Welcome Message

Welcome to Warwick 2016 the 4th in our series of international polymer chemistry meetings and the largest so far with almost 600 delegates

We hope you make many new friends and meet fellow polymer chemists from around the world.

The program is designed for you all to spend social time as well as scientific time and for you all to get out of the meeting what you want.

Please ask us or any of the Warwick people for any help you require and we will do our best to make your stay pleasant and successful.

Most of all enjoy yourselves and make the most of our Campus and surrounding areas.

Dave

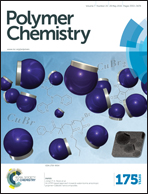
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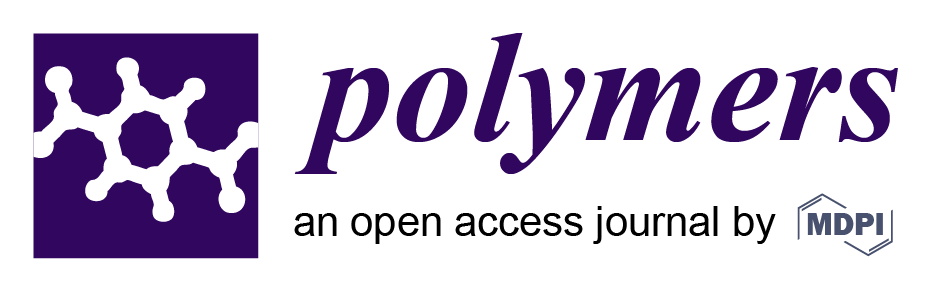
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MACRO GROUP UK

We would like to thank the following for sponsoring or supporting the conference;

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Social Program

All Free of charge (except Admission Charges)

Monday Evening

Welcome Buffet Dinner and “International Quiz Night” Prizes, Prizes, Prizes! Teams of 10/12 required don’t worry we will fix you up in a team – Rootes Social Building

Tuesday Evening

1. 7.30- 8.00 PM Coaches to Royal Leamington Spa “English pub night” Experience the delights of English pubs with your student guides,

Coaches return at 10.30 and 11.15 pm to the University.

*Please sign up but all are invited*

2. INVITED GUESTS ONLY. 7.30 PM Coaches to Kenilworth, Walk around Kenilworth Castle with guide and “English Pimms and Beer Evening” at The Queen and Castle pub opposite Kenilworth Castle (walk around the castle weather permitting), Coaches return to the University at 10.30-11.30 PM

Wednesday Afternoon

2.00 PM

Coaches to Stratford upon Avon, home of William Shakespeare

Coaches to Warwick Castle – Entrance tickets available price approx. £15

Coaches to Leamington Spa (Shopping) and Kenilworth Castle

Please sign up for preferred trip on the web page, see next page

The 4th Polymer 5 a side World Cup on the Sports Field – sign up as teams or individuals

Wednesday Evening

Banquet – with dancing until the early hours. (Bar shuts at 12.30)

Guest appearance – Steve Howdle’s Polymer Rock Band (if you wish to Jam see desk)

*Sign up for tables at the conference desk and on the web page*

Kenilworth Castle - Grandeur, Glory, Royalty & Romance!

'This lordly place, where princes feasted and heroes fought' Sir Walter Scott

England’s finest and most extensive castle ruin.

Kenilworth Castle Millennium Trail - a 1.5 mile walk revealing a glorious and beautiful landscape for you to enjoy.

Royal Leamington Spa:  perfect mix of Georgian & Victorian architecture, tree-lined avenues, terraces & squares. Visit the Royal Pump Rooms Art Gallery, Museum & Gardens (sample the Spa water!) or sample the excellent number and range of small and large shops.

Warwick  a delightful town steeped in history best known for its magnificent castle - the finest mediaeval castle in England.

Stratford-Upon -Avon - beautifully situated on the River Avon, rich in culture and history but most famous for its literary connections relating to the life & works of William Shakespeare.

Posters

Poster presenters need to be at their posters at poster sessions.

Posters 1-150 from Monday morning to Tuesday Lunchtime

Posters 151 – 304 from Tuesday Lunchtime to Wednesday Lunchtime

There will be 10 CASH poster prizes which will be presented at the banquet. 4 runners up and 1 first Prize for a) 1-150 and 2) 151-305

Thanks to

* MDPI publications
* ACS Publications
* RSC Publications
* Nature Publications
* Agilent

**Featured Symposium**

Tuesday in the Conference Room (Woods-Scarwen) Industry Session

Tuesday in S0.21 Nanomedicine

**Macro Group UK award lectures**

Theatre Monday 2.00 pm Dave Adams

Theatre Monday 2.00 pm Paul Topham

Theatre Tuesday 12.00 pm Mike Shaver

Theatre Tuesday 12.30 pm Athina Anastasaki

**RSC Polymer Chemistry Award Lectures**

Theatre Monday 12.00 pm Richard Hoogenboom

Cinema Monday 2.30 pm Feihe Huang

**Congratulations!!**

**Monday**



**Tuesday**



**Wednesday**



**Thursday**



**PLENARY LECTURES**

**PL1**

**Directing Macromolecular Chemistry with Light**

**Professor Christopher Barner-Kowollik**

*Karlsruhe Institute of Technology*

Installing chemical functionality at precise locations within complex macromolecules as well as onto three dimensional direct laser written constructs in the mildest possible fashion (visible light) and without any catalyst becomes possible with powerful light driven, quantitative ligation protocols. Advanced light induced processes enable the parallel encoding of multiple molecules onto predefined locations on surfaces as well as the wavelength dependent addressing of specific parts of a macromolecule for its highly orthogonal functionalization (lambda-orthogonal photochemistry). In addition to exploring the above technologies, the lecture will highlight how polymer functionalization can be directed in its selectivity with light by exploiting light controlled reaction manifolds as well as explore if diffraction unlimited laser lithography is possible based on photo-click chemistry concepts.

**PL2**

**Multicellular cancer spheroids as a tool to understand the toxicity of nanoparticles**

**Professor Martina Stenzel**

*UNSW*

Micelles and vesicles have long been proposed as carriers for low molecular weight molecules including drugs. Polymer chemist have designed a variety of different micelles and tested their ability to deliver drugs using a tradition assay of cell in 2D. However, the uptake of nanoparticles in vitro does not take the actual structure of tumors into account, which requires the movement of particles into the tissue. Multicellular tumor spheroids (MCTS) can act as a 3D tumor model to investigate the biological responses to polymeric micelles as nanocarriers for therapeutic applications. Therefore, a range of nanoparticles were prepared to study the correlation between nanoparticle type and spheroid penetration. It was found that stable micelles, which were stabilized by crosslinking, penetrated deeper and delivered more drugs into MCTS than the diffusion of the free drug.

**PL3**

**TBC**

**Professor Molly Stevens**

*Imperial College London*

TBC

**PL4**

**Rejuvenation of poly(2-oxazoline)s**

**Professor Richard Hoogenboom**

*Ghent University*

The living cationic ring-opening polymerization of 2-oxazolines has been studied in great detail since its discovery in 1966. The versatility of this polymerization method allows copolymerization of a variety of 2-oxazoline monomers to give a range of tunable polymer properties that enable, for example, hydrophilic, hydrophobic, fluorophilic, as well as hard and soft materials. However, this class of polymers was almost forgotten in the 1980s and 1990s because of the long reaction times and limited application possibilities. In the new millennium, a revival of poly(2-oxazoline)s has arisen because of their potential use as biomaterials and thermoresponsive materials, as well as the easy access to defined amphiphilic structures for (hierarchical) self-assembly. Recent developments from our research that illustrate the potential of poly(2-oxazoline)s will be discussed in this lecture, including the preparation of defined high-molar mass polymers as well as functional biomaterials.

**PL5**

**Macromolecular Engineering by ATRP**

**Professor Krzysztof Matyjaszewski**

*CMU*

Macromolecular engineering is based on precise design, synthesis, processing and characterization of targeted materials for specific applications. Many advanced nanostructured functional materials were recently designed and prepared by controlled/ living atom transfer radical polymerization (ATRP). ATRP of acrylates, methacrylates, styrenes, acrylamides, acrylonitrile and other vinyl monomers was employed for macromolecular engineering of polymers with precisely controlled molecular weights, low dispersities, designed shape, composition and functionality. Examples of block, graft, star, hyperbranched, gradient and periodic copolymers, molecular brushes and various hybrid materials and bioconjugates prepared with high precision will be presented.

**PL6**

**Making molecules with the tiniest machines**

**Professor Dave Leigh**

*University of Manchester*

Over the past few years some of the first examples of synthetic molecular level machines and motors—all be they primitive by biological standards—have been developed. These molecules respond to light, chemical and electrical stimuli, controlling the motion of the components. Nature achieves the sequence-specific synthesis of information-rich oligomers and polymers through the operation of complex molecular machines that transcribe information from the genetic code (e.g. the ribosome, DNA polymerases etc). We will discuss the first steps towards doing this at a very basic level with artificial molecular machines.

**PL7**

**Controllable Supramolecular Polymerization**

**Professor Xi Zhang**

*Tsinghua University*

Supramolecular polymers are of great interest because the nature of noncovalent interactions holding them together imparts dynamic, reversible and degradable characteristics to these materials. Although the study of supramolecular polymers has made considerable progress, it remains a big challenge to realize control over supramolecular polymerization. In this presentation, I will introduce two strategies to fabricate supramolecular polymers, leading to advancement of controllable supramolecular polymerization. One is supramolecular polymerization promoted and controlled by molecular self-sorting. The other method involves noncovalent preparation of supramonomers and covalent polymerization of the supramonomers. It is highly anticipated that these studies will enrich the methodology of fabricating supramolecular polymers with molecular weight and structure control.

**PL8**

**Professor Virgil Percec**

*University of Pennsylvania*

*A Material Genome Approch to Complex Systems*

A materials genome approach to complex systems that involves the discovery and the prediction of the structure responsible for function will be discussed. Examples will range from protocells via sequence defined building blocks to Ni-precatalysts for quantitative organic transformations and to helical assemblies that disregard the stereochemical information of their building blocks.

**PL9**

**Nanostructure recipes using block polymers as key ingredients**

**Professor Marc Hillmyer**

*UMN*

Block polymers are remarkable hybrid materials that can self-assemble on nanoscopic length scales. By controlling the composition, architecture, chemical nature, end groups, and molar mass, synthetic chemists can precisely tune the morphologies adopted by these materials. The morphology in turn dictates ultimate properties. In this talk, I will discuss the design, synthesis, self-assembly and applications of block polymers for use in nanopatterning at very small length scales and for use in high-performance membrane materials. Emphasis will be placed on modern synthetic techniques for the facile generation of nanostructures in both thin films and the bulk state. In-situ generation of bicontinuous nanostructures will be highlighted as a particularly practical route to advanced nanostructured materials.

**PL10**

**Peptide-containing conjugates for triggered assembly and controlled delivery from collagen matrices**

**Professor Kristi Kiick**

*University of Delaware*

Temperature-triggered formation of nanostructures with distinct biological activity offers opportunities in selective modification of matrices and in drug delivery. Toward these ends, motifs from structural proteins, such as collagen and resilin, have been conjugated to polymers including poly(ethylene) glycol, poly(ethyleneimine), or thermally responsive poly(acrylate)-based polymers. Analysis via dynamic light scattering and electron microscopy suggests that the thermally responsive conjugates are able to form a range of nanostructures depending on temperature. Collagen-peptide-modified nanoparticles have enabled the retention and sustained release of cargo from collagen-based materials, offering substantial improvement in cargo activity over that achieved by free nanoparticles. These results suggest the utility of these techniques for designing tunable, collagen-based delivery systems.

**PL11**

**First Initiator-Driven Chain-Growth Supramolecular Polymerization**

**Professor Takuzo Aida**

*Tokyo University*

Over the last decade, significant progress in supramolecular polymerization has had a substantial impact on the design of soft materials (1). However, most studies are still based on a preconceived notion that supramolecular polymerization mechanistically follows step-growth polymerization, which does not, in principle, permit the chain-length, sequential, and stereochemical structural control of polymers. Here we report the first noncovalent chain-growth polymerization by designing metastable monomers with an intramolecular hydrogen-bonding network (2). The monomers are disabled for spontaneous polymerization at ambient temperatures, but begin to polymerize with a typical character of living polymerization upon mixing with tailored initiators. The chain growth occurs stereoselectively and therefore enables optical resolution of a racemic monomer: (1) T. Aida, E. W. Meijer, and S. I. Stupp, Science 2012, 335, 813. (2) J. Kang, D. Miyajima et al., Science 2015, 347, 646.

**PL12**

**Professor Steve Armes**

*University of Sheffield*

Occlusion of organic nanoparticles within inorganic crystal offers a unique model to examine biomineralization while providing a versatile route to new nanocomposite materials. Herein, a series of poly(ammonium 2-sulfatoethyl methacrylate)-based diblock copolymer nanoparticles are prepared via RAFT-mediated polymerization-induced self-assembly (PISA). Their anionic charge character and size distributions are evaluated by aqueous electrophoresis, dynamic light scattering and transmission electron microscopy. XPS studies confirm that the stabiliser density of these nanoparticles can be tuned by varying the PISA synthesis conditions, e.g. using either aqueous emulsion polymerisation or dispersion polymerisation in ethanol/water mixtures. Some of these anionic nanoparticles can be efficiently incorporated within calcite crystals, with thermogravimetric analysis indicating up to 7.5 wt% (14.8 vol %) occlusion.

**PL13**

**Precision Functional Polymers by Precision Polymerizations**

**Professor Mitsuo Sawamoto**

*Kyoto University*

Taking metal-catalyzed living radical and living cationic polymerizations that the author's group have been developing as examples, the lecture will overview the current status of catalyst developments and precision synthesis of functional polymers and oligomers. Special attention will be focused on the principles for reaction control, polymer topology, and sequence-control, among others.

**PL14**

**Organocatalytic Polymerization of Ylides: A powerful tool towards well-defined polyethylene-based polymers**

**Professor Nikos Hadjichistidis**

*KAUST*

Access to well-defined (high degree of structural, molecular weight and compositional homogeneity) polyethylenes (PEs) and PE-based copolymers is necessary in order to elucidate the structure-properties relationships and evaluate potential applications. Polyhomologation, first discovered by Shea, is a borane-initiated living polymerization of ylides leading to well-defined polymethylene (C1 polymerization). Our group is developing both novel borane catalysts/initiators and ylide monomers and combines polyhomologation with other living polymerizations to synthesize model polymethylene (equivalent to polyethylene, PE)-based polymeric materials.

**INVITED LECTURES**

**30 Minutes**

**IL1**

**Macro Group UK Award Lecture**

**Professor Dave Adams**, Emily R. Draper, C. Colquhoun, J. Raeburn, L. Chen

Liverpool University

*Controlling the Assembly in Multicomponent Supramolecular Hydrogels*

Supramolecular polymers can be formed by self-assembly and have many applications , from sensing, cell culturing, and electronics. We have been investigating the formation of gels using small molecule gelators, the assembly of which into long fibrous structures forms the gel matrix. Mixing building blocks can be used to make a range of interesting new materials. Here, we will describe a range of mixed systems. We will show how fibrous structures form in these systems and show how we can control how different types of fibrous networks are built up in multicomponent systems. We describe both self-sorted and co-assembled networks and the effect of these different networks on the gel properties.

**IL2**

**Macro Group UK Award Lecture**

**Dr Paul D Topham**,

Aston University

*A strategy to use block copolymer technology to modify surface properties of thin films*

A strategy to use block copolymer technology to modify surface properties of thin films is presented. Focus is paid on external physical stimuli, such as temperature, to trigger changes in surface character of polymer films. In contrast to chemical modification, external physical triggers render the processes more amenable to industrially-relevant roll-to-roll printing processes. The specific materials discussed are targeted for use in organic photovoltaics, however, the strategy should be amenable to a variety of surface technologies/applications. The use of x-ray scattering to probe the nanomorphology of the thin films is also explained and discussed in reference to controlling the film properties through manipulation of the molecular composition of the block copolymers.

**IL3**

**Professor Daniel Savin**, Greg Strange, Ian Smith, Craig Machado, Jacob Ray

University of Florida

*Morphology Transitions in Polypeptide-based Block Polymer Assemblies*

This study involves the bottom-up design and tunability of responsive, peptide-based block polymers. The self-assembly of amphiphilic block polymers is dictated primarily by the balance between the hydrophobic core volume and the hydrophilic corona. In these studies, amphiphilic diblock, triblock and star polymers containing poly(lysine) (PK) and poly(glutamic acid) (PE) were synthesized and their solution properties studied using dynamic light scattering, circular dichroism spectroscopy and transmission electron microscopy. This talk will present some recent studies in solution morphology transitions that occur in these materials as a result of the helix-coil transition and associated charge-charge interactions. We exploit the responsiveness of these materials to encapsulate and release therapeutics such as doxorubicin and demonstrate the potential to achieve triggered release as a function of pH due to morphology transitions.

**IL4**

**Professor Feihe Huang**,

**RSC Polymer Chemistry Award Lecture**

Zhejiang University

*Supramolecular Polymers Based on Host-Guest Molecular Recognition Motifs*

We are interested in the fabrication of supramolecular polymers based on host-guest molecular recognition motifs. Self-sorting organization of two AB–type heteroditopic monomers led to the formation of linear supramolecular alternating copolymers. By utilization of host-guest and metal-ligand noncovalent recognitions motifs, different topologies of supramolecular polymers, such as linear and crosslinked species, can be reversibly interconverted by external stimuli. Based on the dibenzo-24-crown-8/1,2-bis(pyridinium)ethane recognition motif, a hyperbranched mechanically interlocked polymer was prepared by polyesterification of an easily available dynamic trifunctional AB2 pseudorotaxane monomer. By utilization of a crown ether-based host-guest recognitions motif, a supramolecular polymer gel constructed from a low molecular weight A-B monomer shows thermo- and pH-induced reversible gel-sol transitions.

**IL5**

**Professor Filip Du Prez**, Wim Denissen, Johan Winne

Gent University

*Tailor-made vitrimer chemistry for reprocessable networks*

Crosslinked polymers and their corresponding composites offer a cost-effective replacement for classical materials, with an intrinsically low ecological impact, because of their light weight and simple production process. However, processing and 'end-of-life' applications of fully cured resins remains an issue as these polymer networks cannot be reshaped, repaired or recycled.

In this presentation, a new chemical class of crosslinked polymers obtained from upscalable raw chemicals, using a spontaneous reaction, will be reported. Although the formed chemical bonds are permanent ones, they can very rapidly exchange positions at higher temperatures. This chemical feature allows for fast reprocessing upon heating without damaging the structural integrity of the material.

The reported material is a quite promising example of a recently discovered new class of polymers, coined 'vitrimers', a name that refers to their ability to be processed and recycled like vitreous glass.

**IL6**

**Professor Jan van Hest**, Ruud Peters, Bastiaan Buddingh', Loai Abdelmohsen, Marleis Nijemeisland, Fei Peng, Wilhelm Huck, Daniela Wilson

Radboud University

*Adaptive and bio-inspired nanocompartments*

In nature many biological processes are compartmentalized to ensure their integrity and efficiency. Inspired by this phenomenon, we explore hybrid capsules based on a combination of proteins and amphiphilic block copolymers to construct bioactive compartments. In this lecture we will give a number of examples to highlight the versatility of this approach.

Intrinsically porous enzyme-loaded polymersomes have been explored as artificial organelles. We have investigated the encapsulation of multiple polymersome nanoreactors in a larger polymersome, to mimic the structural build-up of a eukaryotic cell.

Catalysis can also be used to turn chemical energy in movement. We have applied this concept to bowl-shaped indented vesicles, known as stomatocytes, in which enzymes can be effectively encapsulated. Due to their anisotropic shape, catalytic activity allows the particles to move. By employing a chemical gradient chemotaxis in biological fluids with high level of efficiency was observed.

**IL7**

**Professor Thomas Epps, III**,

University of Delaware

*Tapered block copolymers: Controlling segment sequence to improve materials properties*

Block copolymers (BCPs) are an exciting class of soft materials that enable controlled phase separation and nanoscale self-assembly of designer macromolecules for applications ranging from thermoplastic elastomers and membranes to nanocapsules for drug delivery. One subclass of block copolymers, tapered block copolymers (TBCs), offers a unique opportunity for optimizing thermal, mechanical, and transport properties in BCPs through control of the monomer distribution near the junction between the copolymer blocks. We have synthesized various TBCs containing normal and inverse tapers, of various lengths and compositions, by using semi-batch feeds in combination with 'living' anionic and/or controlled radical polymerizations. Through this approach, we are able to generate a diverse array of well-organized and self-assembled nanostructures. Additionally, we recently have reported ion-conducting systems with reduced barriers to ion-transport and enhanced conductivity.

**IL8**

**Professor Greg Qiao**,

Melbourne University

*Biocompatible polymeric biomaterials for targeted applications*

Biomaterials have increased uses in the development of medical applications. Biomaterials with purposed designed architecture, precursor choice, and specific functionality are the keys to be successful in vivo applications.

This presentation will overview our recent work on biomaterial design, architecture formation as well as target applications. They will include a hydrogel design used to as substrates for endothelial layer formation for a synthetic corneal transplant. The second area will describe a recently developed nano-engineered surface modification method, e.g. the continuous assembly of polymers (CAP), which can be applied to create nano-capsules with controlled mechanical stiffness and show different behaviors in cell internalization. The final area will introduce our latest developments on nano-engineered polypeptide architectures and their potential applications as drug carriers and antimicrobial agents for killing super-bacteria.

**IL9**

**Dr Paul Wilson**

Warwick University

*Organic Arsenicals as Novel Linkers for Petide/Protein-Polymer Conjugation*

(In)organic arsenic exists as a dichotomous enigma between toxicity and therapy in (bio)chemistry and medicine. The biochemistry of arsenic is dominated by trivalent arsenic (As(III)) due to its high affinity for thiols which are present in variable concentrations in the intra- and extracellular milieu. The affinity of As(III) for thiols is enhanced for chelating vicinal or neighbours-through-space dithiols, such as those presented by naturally occurring disulfide bonds in biological (macro)molecules. This has been investigated using organic and polymeric arsenicals derived from p-arsanilic acid (As(V)). Highly efficient and site-specific conjugation has been demonstrated using BSA as a model protein. This novel conjugation chemistry has also been exploited for the preparation of peptide-polymer conjugates of functional and therapeutic peptides salmon calcitonin and octreotide. Long term, the aim is to translate this conjugation technology to antibody-polymer/drug conjugates.

**IL11**

**Professor Hong Chen**,

A novel biomaterial with thrombin-responsive fibrinolytic activity: breaking down the clot as it forms

*A novel biomaterial with thrombin-responsive fibrinolytic activity: breaking down the clot as it forms*

Incorporation of anticoagulants to prevent coagulation has been widely practiced as an approach to solving the problem of foreign surface-induced clotting/thrombosis. Alternatively, we have designed the surface that could lyse fibrin as it forms. However, in either strategy, inherent antithrombotic activity may cause unfavorable effects. Herein, a novel concept of a thrombolytic material whose activity is triggered by the generation of clot/thrombus is developed. The concept is realized using a tissue plasminogen activator (t-PA)-loaded hydrogel crosslinked by a thrombin-cleavable peptide. The hydrogel is shown to release t-PA in serum and dissolve fibrin clots only when thrombin (generated in clot formation) is present. The rate of release of t-PA depends on the degree of crosslinking of the hydrogel and on the thrombin concentration. Moreover, the release of t-PA is switched “on” and “off” in the presence and absence, respectively of thrombin.

**IL12**

**Professor Eva Harth**,

Vanderbilt University

*Techniques to access tailored polymeric networks*

Polymeric networks are on of the most versatile and fundamental structures in polymer science, finding applications in hydrogels, membranes, surface coatings, energy materials, thermosets and virtrimers. We have dedicated our recent work to access novel materials that give a higher network control, a range of morphologies and different size dimensions for a defined application. To address the demand of biocompatible, hydrophilic networks for biomedical applications, we have created one-pot nanogels using liposome templates, injectable hydrogels with extraordinary mechanical properties, printed technologies for precise miron-sized particles with the common goal to advance current treatment regimes. An introduction of the specific developed technique to make these networks, integrated synthesized polymeric building blocks with examples for the field of application will be subjects of the lecture.

**IL13**

**Professor Harm-Anton Klok**

EPFL

*Engineering cell surfaces with synthetic polymers*

Cells provide attractive opportunities to develop innovative drug delivery systems. Red blood cells e.g. are designed to circulate in the bloodstream for long periods of time. Immune cells are able to home in to disease sites in a highly selective manner. Modifying the surfaces of these cells with synthetic polymers or polymer nanoparticles provides manifold opportunities to further enhance their functionality. Successful polymer cell surface engineering requires conjugation chemistries that proceed under biological conditions and in high yields and without compromising cell viability and function. This presentation will discuss various polymer cell surface modification strategies and compare these terms of the possibilities they offer to modify cell surfaces as well as their impact on cell viability and function. It will be shown that under appropriate conditions live cells can be surface modified with synthetic polymers while retaining their viability and functional properties.

**IL14**

**Professor Brent Sumerlin**, Megan R. Hill, C. Adrian Figg, Bryan S. Tucker, Hao Sun, Christopher P. Kabb, R. Nicholas Carmean

University of Florida

*Structurally Dynamic Assemblies of Stimuli-Responsive Polymers*

This presentation will focus on our recent advances in the areas of dynamic-covalent materials and responsive nanoparticles. By relying on a variety of reversible covalent reactions that lead to readily cleaved bonds, we have prepared materials that combine the physical integrity of covalent materials and the structural dynamics of supramolecular complexes. Oximes, boronic esters, boronate esters, and Diels-Alder linkages have all been employed to prepare these responsive and dynamic materials, with particular attention having been dedicated to the preparation of hydrogels, elastomers, and nanoparticles. We seek to exploit the reversible nature of these bonds to prepare responsive and self-healing materials.

**IL15**

**Professor Bin Liu**

National University of Singapore

*Conjugated Polymer Nanoparticles for Biomedical Applications*

There is an increasing trend of using organic nanoparticles and especially light-harvesting conjugated polymer nanoparticles as active materials for sensing, imaging and therapy applications. The recent results show that conjugated polymer nanoparticles could be fabricated to have tunable sizes and emission, with over 10-fold brightness as compared to inorganic quantum dots with a similar dimension. In addition, their large absorption cross-sections have also enabled them to be used as photoacoustic contrast agents and for photothermal and photo dynamic therapy. In this talk, I will discuss different strategies to form water-dispersible conjugated polymer nanoparticles and their applications as signal reporters or signal amplifiers for chemical and biological sensing/imaging and therapy. In addition, I will also briefly introduce our recent progress in organic nanoparticles with aggregation-induced emission features as replacement for quantum dots in various applications.

**IL16**

**Professor Emily Pentzer**, Yuanhui Xiang, Riki Drout, John McCaffrey, Tyler Densmore

Case Western

*Silyl Ketenes as Monomers*

Polymers are an important class of materials that impact nearly every facet of life- from the packaging food is transported and stored in, to the piping used to transport clean water and waste, to the tools and implants used in medicine. To some degree, the applications of a polymer are defined by how it is processed, yet more important are the properties of the polymer, such as how hard or malleable the polymer is. These properties are derived from the chemical structure of the polymer, as well as the molecular weight and the dispersity of the polymer sample; the structure of the polymer dictates the properties. To access properties not achievable with current systems and to improve properties for current applications, new polymer structures are required. We will report on the preparation of novel polymer backbones using silyl ketenes as monomers.

**IL17**

**Professor Amanda Ellis**,

Flinders University

*Strategies for decreasing biofouling of polymeric materials*

This talk reports on current strategies to modify polymer surfaces with anti-biofouling agents. The talk will focus on the polymerisation of various antimicrobial agents, namely sulfobetaine methacrylate (SBMA), 2-(methacryloyloxy)ethyl]trimethylammonium chloride (MTAC) and eugenyl methacrylate (EgMA). Applications of these modifications are in polyamide reverse osmosis desalination membranes and polydimethylsiloxane for catheters. Various techniques for modifying these surfaces including, surface initiated activators regeneration by electron transfer (ARGET) atom transfer radical polymerisation (ATRP), interfacial co-polymerisation and simple co-polymerisation will be discussed.

**IL18**

**Dr Graeme Moad**, John Chiefari, Almar Postma, Ezio Rizzardo, Julien Rosselgong, San Thang, Xiaohu Wei

CSIRO

*Stars and RAFT*

This paper will discuss various approaches to the synthesis of functional star polymers by RAFT polymerization pointing out their scope, advantages and limitations and will be illustrated by examples from recent CSIRO research. These approaches include the arm-first method based on RAFT cross-linking (co)polymerization of a divinyl monomer using macroRAFT agents1,2, which has recently been applied in the synthesis of Mikto-arm polymers. The other approaches considered are core-first methods where the core may be a precisely defined multi-RAFT agent, a hyperbranched copolymer prepared by RAFT crosslinking (co)polymerization of divinyl monomer using a (small) RAFT agent or RAFT copolymerization mediated by a “RAFT inimer” (a molecule comprising both RAFT agent and monomer functionality). The factors that determine whether RAFT crosslinking (co)polymerization yields a polymer monolith or a well-defined star will also be considered.

**IL19**

**Professor Ulrich S. Schubert**,

University of Jena

*Polymer based redox-flow batteries*

For renewable energy sources such as solar, wind, and hydroelectric to be effectively used in the grid of the future, flexible and scalable energy-storage solutions are necessary to mitigate output fluctuations. For systems that are intended for both domestic and large-scale use, safety and cost must be taken into account as well as energy density and capacity, particularly regarding long-term access to metal resources, which places limits on the lithium-ion-based and vanadium-based RFB development. Here we describe an affordable, safe, and scalable battery system, which uses organic polymers as the charge-storage material in combination with inexpensive dialysis membranes, which separate the anode and the cathode by the retention of the non-metallic, active (macro-molecular) species, and an aqueous sodium chloride solution as the electrolyte. In parallel, printable solid state polymer batteries were developed allowing a new generation of metal-free batteries.

**IL20**

**Professor Ben Zhong Tang**,

HKUST

*AIEgen-Based Polymers: Synthesis and Functions*

Polymers with aggregation-induced emission (AIE) are widely studied recently because of their good solubility, processability, and high emission efficiency in the aggregated states. A large variety of advanced polymers with AIE activity have been developed. In this talk, the research efforts directed to advanced polymers with AIE activity including the designs and syntheses, structures and topologies, as well as functionalities and applications will be introduced with an emphasis on the most up to date progress. The synthetic approaches for the construction of AIE polymers include chain polymerizations such as free-radical polymerization and metathesis polymerizations, step polymerizations such as transition-metal catalyzed carbon-carbon coupling reactions and polycycloadditions, as well as post-modification of polymers. Through such versatile polymerization approaches, a vast array of AIE polymers with various chemical and topological structures can be easily accessed such as linear or zigzag shaped oligomers and polymers, star-shaped oligomers, dendrimers and hyperbranched polymers, conjugated microporous polymers, as well as crystalline supramolecular polymers. Combining the AIE characteristics with the desired traits of the polymeric materials will endow the resulting macromolecules with fascinating functionalities and they have found applications in fluorescent sensors, stimuli-responsive materials, biological probes, cell imaging, electroluminescence devices, optical nonlinearities, circular polarized luminescence, photopatterning, light refractive materials, liquid crystalline, gas adsorption, etc. Advanced polymers with AIE activity is still a young research area with numerous possibilities and it is a fast-growing promising field.[1],[2]

[1] Rongrong Hu, Nelson L. C. Leung and Ben Zhong Tang. *Chem. Soc. Rev*. **2014**, *43*, 4494-4562.

[2] Anjun Qin, Jacky W. Y. Lam and Ben Zhong Tang. *Prog. Polym. Sci*. 2012, *37*, 182-209.

**IL21**

**Dr Michael Shaver,**

**MacroGroup UK Young Researcher Medal Talk**,

University of Edinburgh

*Designing Catalysts and Monomers for Controlled Radical and Ring Opening Polymerizations*

This presentation will cover a series of vignettes from our contributions to ring opening polymerisations (ROP) and metal mediated controlled radical polymerisations (CRP). Specifically, the talk will focus on the development of new monomers and polymers in ROP to make functional biodegradable materials and alternative catalysts for atom transfer radical polymerisation that are helped by an important organometallic pathway.

**IL22**

**Dr. Athina Anastasaki**

**MGUK Thesis Prize lecture**,

UCSB

*Sequence controlled multiblock copolymers via copper mediated and emulsion polymerization techniques.*

An ambitious target is to develop synthetic procedures capable of replicating, or approaching, the precision over monomer sequence exhibited by natural polymers such as nucleic acids, carbohydrates, peptides and proteins. These remarkable and complicated structures which are capable of storing an abundance of information are efficiently constructed by cellular organelles such as the nucleus and ribosome. Towards this direction, the synthesis of sequence-controlled multiblock copolymers has received considerable attention. Herein, a versatile, simple and inexpensive method that allows for the synthesis of sequence-controlled multiblock copolymers in a one pot polymerization reaction at ambient temperature is reported. This approach offers a versatile and inexpensive platform for the preparation of high-order multiblock functional materials with additional applications arising from the precise spatiotemporal “on/off” control and resolution when desired.

**IL23**

**Professor Darinka Christova**,

Institute of Polymers - Bulgarian Academy of Sciences

*FUNCTIONALISED STIMULI-RESPONSIVE COPOLYMER ARCHITECTURES DESIGNED FOR BIOMEDICAL APPLICATIONS*

**IL24**

**Dr Kristian Kempe**,

Monash Institute of Pharmaceutical Sciences

*Functional comb/brush polymers from 2-oxazoline based macromonomers - from synthesis to biomedical applications*

2-Oxazolines are highly functional compounds which have been proven to be potent monomers in cationic ring-opening polymerisations (CROP) to yield poly(2-oxazoline)s. An alternative approach to prepare 2-oxazoline based degradable polymer systems is the spontaneous zwitterionic copolymerisation (SZCP).[1] The synthesis and post-polymerisation modification of comb/brush polymers based on oligo(2-oxazoline) and alternating N-acylated poly(aminoester) macromonomers is presented. By combining reversible-deactivation radical polymerisations and CROP or SZCP, polymers responsive to external and biological stimuli such as pH, temperature and redox are obtained. Their potential for the design of responsive targeted layer-by-layer films and capsules is demonstrated.[2]

**IL25**

**Professor Shiyong Liu**, Guhuan Liu, Yanyan Jiang

University of Science and Technology of China

*Facile Construction and in situ Fluorescent Quantification of the Coupling Efficiency of Functional Protein/Antibody Conjugates*

Upon stimuli-triggered single cleavage of capping moieties at the focal point and chain terminal, self-immolative dendrimers (SIDs) and linear self-immolative polymers (l-SIPs) undergo spontaneous domino-like radial fragmenta-tion and cascade head-to-tail depolymerization, respectively. The nature of response selectivity and signal amplifica-tion has rendered them an unique type of stimuli-responsive materials. Moreover, novel design principles are required for further advancement in the field of self-immolative polymers (SIPs). Herein, we report the facile fabrication of wa-ter-dispersible SIPs with a new chain topology, hyperbranched self-immolative polymers (hSIPs), by utilizing one-pot AB2 polycondensation methodology and sequential post-functionalization.

**IL26**

**Professor Jean-François Gohy**, Julien Rolland, Bruno Ernould, Alexandru Vlad

IMCN-BSMA Place L. Pasteur 1

*New redox polymer hybrids: bridging the gap between Li-ion batteries and super capacitors*

This presentation is centered on the development of novel energy storage systems with enhanced performances through original organic electroactive material chemistry and engineering approaches. We will focus on distinct directions: (i) improve and develop new organic radical materials for pseudo-capacitive energy storage by engineering high energy density nitroxide radical containing polymer architectures; (ii) design and synthesize hybrid macromolecular architectures displaying both, electroactive and electron conductive properties; (iii) develop novel block copolymer architectures for high performance solid polymer electrolytes and (iv) develop hybrid organic-inorganic electrochemical energy storage materials and technologies that combine best-of-both worlds characteristics. Accordingly, this research aims the design and development of novel electroactive organic materials and architectures and develop faster, safer & longer-lasting organic batteries, capacitors and their hybrids.

**IL27**

**Dr Jason Harcup**, Vice President, Personal Care R&D

Unilever Research and Development, Port Sunlight, Quarry Road East, Bebington, CH63 3JW

*"Next Generation Personal Care Through the Fast Moving Consumer Goods Industry"*

Advancement in material science and the use of advanced materials and specially polymers in Personal Care has increased the quality of life for millions of people across the world. Unilever is one of the world’s leading producers of fast moving consumer goods, with a long history of successful innovation and focus on sustainable growth. Every day, an estimated two billion consumers, in 190 countries, use our products including household names such as Dove, Sunsilk, Signal, Axe, Rexona and Lux.

Personal Care products represent a very large market for products that provide a range of unique benefits to the consumers worldwide. These products are used for a variety of applications, including, cleansing aid at the same time delivering additional attributes such as sensory, antifungal, antibacterial and moisturisation and conditioning benefits that could survive and last well after cleansing. They can also provide protection in antiperspirant/deodorant products as well as enhancing the appearance of an individual’s skin, hair, teeth and nails.

One of the key classes of ingredient in Personal Care products is polymers. Indeed, polymers play such a key role that most modern products will not function in their absence. The majority of polymers used in current Personal Care products have a linear architecture and are derived from natural and synthetic sources. However, in recent years, novel polymers with block, hyperbranched and dendritic architectures explored by the industry. This paper will outline areas in which Unilever has been exploiting polymers with novel architecture in a range of Personal Care products. In particular, several examples of novel polymers with controlled architecture investigated by Unilever will be discussed highlighting the complexities involved in the various stages of design, synthesis, production, formulation and application of such polymers.

**IL28**

**Graham Cleaver**,

Agilent Technologies

*Miniaturization in GPC*

**IL29**

**Dr Mike Schellekens**,

DSM

**IL30**

**Dr Katherine Locock**,

CSIRO

*Bioinspired Polymers: The Antimicrobial Polymethacrylates*

Naturally occurring antimicrobial peptides (AMPs) have been honed by evolution over millions of years to give highly safe and efficacious antimicrobials. By studying AMPs to identify key aspects of structure and composition (e.g small and highly cationic), suitable synthetic polymer mimics can be designed that hold potential as anti-infective agents.

Our work takes this mimicry one step further by developing new monomers as analogues of amino acids such as arginine and tryptophan, key to the activity of AMPs. Using RAFT, we have produced a range of polymethacrylate copolymers that exhibit potent antimicrobial effects against bacteria, fungi and low toxicity towards human cells. Further, these polymers have shown a biofilm busting capability, eradicating 94% of S. aureus bacteria and 80% of C. albicans fungi present in a mixed biofilm. This was not only achieved by the use of a single antimicrobial agent, but outperformed any clinical combination of antibiotic and antifungal tested.

**IL31**

**Dr Seb Spain**,

University of Sheffield

*Oxidation-responsive polymers for the detection of inflammation*

Inflammation is a normal response to invasion of a host by a pathogen and are characterised by a high concentration of reactive-oxygen species (ROS) that are responsible for pathogen destruction. In immune disorders the misregulation of the normal immune response can result in the production of high levels of ROS in absence of a pathogen, instead resulting in tissue damage. We are currently developing a range of oxidation-responsive materials that combine a morphological change and a detectable output for the detection and treatment of inflammatory disease.

**IL32**

**Professor Markus Retsch**,

University of Bayreuth

*Thermal Transport in Polymer Colloidal Crystals*

The transport of thermal energy on sub-micrometre length scales is becoming increasingly important in modern technologies. We introduce colloidal crystals based on polymer latex particles as an excellent platform to investigate and understand thermal transport on small length scales. In particular, we characterize their potential as thermal insulation materials. Varying the polymer composition we can specifically tune the temperature-dependent thermal conductivity behavior and use the time dependent change in thermal diffusivity to determine the film formation kinetics.

**IL33**

**Professor Mike Turner**,

University of Manchester

*Fluorescent Conjugated Polymer Nanoparticles of Controlled Shape, Size and Surface Functionality*

**IL34**

**Dr Peter Roth**,

University of Surrey

*Doubly Smart Materials: Synthesis of Polymers with LCST and UCST in Water*

**IL35**

**Professor Eva Malmström**, Assya Boujemaoui, Carmen Cobo Sanchez, Joakim Engström, Linda Fogelström, Anna Carlmark

KTH Royal Institute of Technology

*Covalent or non-covalent surface modification of nanocellulose for phase compatibilization in nanocomposites - what is most efficient?*

Surface modification of cellulose has attracted interest and has often significant influence on the material properties of a cellulose-reinforced composite. During the last decades, different nanocelluloses have enticed considerable interest and have further fueled the interest for surface modification. Surface properties can be modified by polymers, by either covalent or non-covalent approaches. For covalent modification, preformed polymers can be linked to cellulose, or initiators for reversible deactivation radical polymerization can be attached, where after grafting-from can be conducted. The non-covalent approach is based on adsorption of surfactants to the cellulose surface and can be accomplished via ionic or non-ionic interactions. This contribution aims at comparing three different surface modifications of cellulose nanocrystals; covalent (grafting-from) and non-covalent (using diblock copolymers or nanoparticles) and their effect on the properties of cellulose nanocomposites.

**IL36**

**Dr Giuseppe Mantovani**, Francesca Mastrotto, Luisa Martinez-Pomares, Alan Salama

Nottingham university, School of Pharmacy

*Sweet Immunomodulation*

Glycans mediate a range of key events in nature, which include parasitisation, fecondation, and immunity. Synthetic analogues of naturally occurring oligomeric glycans - glycopolymers - are emerging as very valuable molecular probes to dissect and elucidate glycan-mediated processes in vitro. However, their use in vivo can be hampered by substantial overlapping of sugar binding modalities, where the same sugar ligand(s) can be recognised by a number of different carbohydrate-binding protein receptors (lectins). In this work we show that synthetic glycopolymers can be designed that selectively bind specific macrophage receptors, and investigate the mechanisms by which they can modulate the activity of these key immune cells. Finally effect of glycopolymers on clearance of biological macromolecules by macrophages in vivo as well as implications in inflammatory processes in murine models are discussed.

**IL37**

**Dr Kristofer Thurecht**, Zachary Houston, Nicholas Fletcher, Aditya Ardana, Amanda Pearce, Adrian Fuchs, Chris Howard, Stephen Mahler

AIBN

*Optimising targeting strategies for nanomedicines*

Polymer nanomedicines show enormous potential as future therapeutics for cancer. There is now significant evidence that incorporation of cytotoxic drugs into polymeric structures can increase the concentration of drug that accumulates in a tumour and, as such, improve the therapeutic efficacy of the drug. In spite of this, a number of key challenges remain, foremost of which surround the delivery of nanomedicines specifically to the tumour and there is considerable debate around how best to achieve this goal. Importantly, targeted therapeutics have been widely claimed to enhance therapeutic uptake in tumour tissue. In this presentation we report on new strategies for targeting polymeric nanomedicines to tumour tissue using a variety of ligands. We discuss the implication on polymer biodistribution (using molecular imaging) and how this would ultimately affect the efficacy of polymer therapeutics.

**IL38**

**Professor J. D. Tovar**,

John Hopkins University

*Energy migration and transient electric field generation within peptide-based supreamolecular nanostructures*

This lecture will describe recent work to incorporate pi-conjugated molecules of interest for organic electronics into self-assembling oligopeptides of interest for biomaterial applications. The assembly process leads to the formation of supramolecular polymers fashioned into 1-D nanomaterials ca. 10 nm in diameter. Using this general platform, a series of energy transport examples will be discussed, spanning transistor-based gating for carrier mobility, photonic activation for exciton transport, and the photonic creation of static electric fields. Prospects for using these hybrid electronic biomaterials to elicit biological adhesion or other specific responses in an externally tunable manner will be addressed.

1. Sanders, Magnanelli, Bragg and Tovar. JACS, in press. (DOI: 10.1021/jacs.5b12001)

Besar, Ardoña, Tovar and Katz. ACS Nano 2015 (9) 12401-12409.

Ardoña and Tovar. Chem Sci, 2015 (6) 1474-1484.

**IL39**

**Professor J Gooding**

Elizabeth Hindea,b,c, Kitiphume Thammasiraphopa,b,c, Hien T. T. Duongc, Jonathan Yeowc,d, Bunyamin Karagozc,e, Cyrille Boyerc,d, J. Justin Goodingc,e,f\*, Katharina Gausa,b,c\*.

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*Using pair-correlation analysis of fluorescence microscopy data to reveal how the shape of polymeric nanoparticles impacts on intracellular translocation and the site of drug release*

The potency of chemotherapeutics depends on their ability to selectively deliver a drug to the nucleus. Here, we investigated whether nanoparticle shape influences the intracellular route and site of doxorubicin release. This is achieved using a fluorescence microscopy method that can measure the number and rate of differently shaped nanoparticles (5-100 nm in diameter) with pair correlation analysis. By cross correlating the fluctuations in fluorescence intensity separated by a distance along a line, pair correlation analysis measures the mobility into, within and out of a given cellular compartment for all possible delay times. The method shows that only nanoparticles with high aspect ratios (rods and worms), but not spherical nanoparticles (micelles and vesicles), were retained in late endosomes and entered the nucleus by passive diffusion. Enhanced nuclear accessibility of the worm- and rod-shaped drug carrier resulted in more doxorubicin release directly into the nucleus which correlated with greater cytotoxicity. Thus the major cellular barrier, the nuclear envelope, plays a pivotal role in determining the site of drug release and, consequently, doxorubicin efficacy. In conclusion, we present an experimental framework for testing nanoparticles as organelle-targeting drug carriers and identified shape as a promising design criteria for polymeric chemotherapeutics carriers.

**IL40**

**Professor Nicolas Voelcker**,

University of South Australia

*Nanomedicine: Targeted drug delivery from porous silicon nanoparticles*

**IL41**

**Professor Chris Porter**,

Monash Institute of Pharmaceutical Sciences

*Dendrimers as Enhanced Drug Delivery Vectors*

Dendrimers are dendritic or branched polymers that can be synthesised to provide macromolecular constructs with hydrodynamic radii in the low nanometer size range and with good control over size and surface properties. As such dendrimers show increasing promise as drug delivery vectors, and have particular application in cancer therapy. Here, the impact of modification of the dendrimer surface on dendrimer absorption, clearance and tumour targeting is described and the implications of these findings for delivery system design discussed. Examples of PEGylated and drug conjugated dendrimers as enhanced anti-cancer nanomedicines will be described and in particular recent data suggesting utility in the targeted treatment of lymph-resident and lung-resident cancer metastases.

**IL42**

**Professor Maria Vicent**,

*Polyglutamate-based nanoconjugates as versatile Therapeutics*

Principe Felipe Research Center

Polyglutamates are highly biocompatible, biodegradable and multifunctional polymers, which have been effectively used as building blocks in polymer drug conjugates and polymeric micelles for various medical applications ranging from cancer to regenerative medicine. Control on polymer chain length and stereochemistry have been one of the major challenges in synthetic approaches over the past years. We have demonstrated how to overcome those limitations with precise controlled reactions followed by an adequate characterization yielding to well-defined polypeptidic architectures by NCA polymerization techniques. In addition, a variety of functionalities such as alkyne, azides, reactive disulphides, protected amines.. can be easily introduced by post-polymerization modification reactions yielding a set of orthogonal reactive attachment sides suitable for further bioconjugations yielding single as well as polymer-based combination therapeutics.

**IL43**

**Professor Steve Howdle**,

University of Nottingham

*Using Supercritical Carbon Dioxide for Green Synthesis of Renewable Polymers*

We have utilized the low viscosity and high diffusivity of supercritical CO2 to plasticise polymers. High pressure rheology techniques have been applied to quantify the decrease in melt viscosities in the presence of scCO2. We have exploited this drop in viscosity to effect polycondensation and ring opening polymerisations at much lower temperatures than is possible under conventional operating conditions. In some cases, these lower temperature operating conditions have opened up the opportunity to use enzymatic catalysts to yield valuable new polymeric materials.

Using these techniques we have created new “green” surfactants and also materials that self-assemble with potential for utility in drug delivery. In addition, we will report new approaches to creating polymers with a wide range of physical properties from waste materials such as tree bark extracts and terpenes.

**IL44**

**Professor Wei You**,

UNC

*Photoinitiated, Living, Cationic Polymerization of 4-Methoxystyrene*

We have carried out initial studies into the methanol-controlled visible light photoinitiated polymerization of 4-methoxystyrene using pyrylium salts. First order kinetic behavior, linear Mn growth with respect to monomer consumption, narrow Ð, and continued polymerization upon monomer addition all indicate the controlled/living nature of the polymerization. The accumulated data suggest methanol plays a role as a reversible chain transfer agent, analogous to that of dithiocarbamates in RAFT polymerization. The polymerization does not require the use of strong Lewis or Brønsted acids or the prior synthesis or formation of small molecule co-initiators. Poly(4-methoxystyrene) of low Ð can be prepared, with Mn controlled by the concentration of methanol.

**IL45**

**Dr Remzi Becer**,

Queen Mary University

*Precision Macromolecular Synthesis and the GlycoCode*

Glycopolymers are of great interest because of their multivalent interactions with lectins. The glycoside cluster effect results in a great binding avidity towards these carbohydrate binding proteins. Over recent years several complex mannose-based glycopolymer architectures have been established, each one of them improving the binding affinity towards the animal lectin DC-SIGN (which takes part of the immune system and plays an important role during HIV infection). However, this binding affinity is not yet selective. We believe that multi-arm glycopolymers with a controlled carbohydrate sequence should not only improve the binding avidity towards these lectins, but we also believe controlling the sequence will enable the desired specificity which will result in a reduction of possible side-effects connected to other lectins. Furthermore, a cyclodextrin core should provide us a tool for drug encapsulation and possible further supramolecular interactions.

**IL46**

**Professor Andreas Heise**, Cristina Lavilla Aguilar

Royal College of Surgeons in Ireland

*Synthetic polypeptides with well-defined sequences*

A strategy towards sequence control in the synthesis of polypeptides is introduced, based on the sequential addition of &#945;-amino acid-N-carboxyanhydrides (NCAs). This method yields polypeptides with a specific sequence and controlled molecular weights. A series of copolypeptides from benzyl-L-glutamate and tert.-butyl glutamate with identical overall composition yet varying block sequences (8, 4, 2 and random) was synthesized. All synthetic polypeptides were able to adopt a helical secondary structure irrespective of their block structure. Quantitative selective deprotection of the tert.-butyl glutamate and subsequent PEGylation of the glutamic acid blocks yielded polypeptides with sequence controlled PEG and benzyl side groups. Notable differences in the secondary structures and the solution behavior as a function of the sequential composition were recorded demonstrating an example of the structure-property relationship in synthetic polypeptides as peptidomimetic materials.

**IL47**

**Dr Paul Findlay**,

Revolymer (UK) Ltd

*Protection and delivery of actives for use in consumer products*

**IL48**

**Dr Andrew T Slark**,

Henkle

*Solving Sticky Problems with Polymer Chemistry*

A range of polymers are used to join substrates for a wide variety of applications and the main innovation drivers for industrial adhesives will be highlighted. Specific examples will be shown of how polymer chemistry & science are used to develop new products which satisfy key application requirements.

**IL49**

**Professor Thomas Junkers**, Joke Vandenbergh

Universiteit Hasselt

*Precision polymers towards biological precision: Monodisperse sequence-controlled oligomers*

Despite all advances that were made in the field of synthetic polymer chemistry, still a significant gap exists between artificial macromolecules and biopolymers, the ability to control the specific sequence within a polymer chain and hence the ability to design a primary structure that may result in specific functionality. Various approaches based on CRP techniques towards sequence-controlled acrylate and acrylamide oligomers are discussed and intrinsic limitations put in perspective. Relatively long sequences can for both cases be achieved if the underpinning polymerization protocols are tuned to maximum efficiency, whereby reversible addition fragmentation transfer and photo-initiated copper-mediated polymerization have the highest potential.

Concomitantly, the use of continuous flow microreactors will be highlighted. Due to their unmatched operation stability and excellent heat transfer capabilities, flow reactors allow for an increased efficiency of the oligomerizations.

**IL50**

**Dr Daniel Keddie**,

University of Wolverhampton

*Functional polymers via RAFT-based synthetic protocols*

Reversible addition-fragmentation chain transfer (RAFT) polymerization, arguably the most versatile of the various reversible deactivation radical polymerization techniques, allows for the synthesis of functional polymers of low dispersity, complex architecture and defined molar mass. Most monomers that can be polymerized by radical polymerization are able to be controlled via the RAFT process simply by the addition of a RAFT agent.

Recently we have used RAFT based protocols for the synthesis of block copolymers incorporating electron rich and electron poor monomer units through the use of “switchable” RAFT agents, the synthesis of steric stabilisers for lyotropic liquid crystals and functional polymeric libraries through one-pot high throughput processes.

In this presentation some aspects of our recent work will be discussed.

**IL51**

**Professor S Lecommandoux**,

*Bioactive glycopolypeptide self-assembled biohybrid nanomaterials*

The field of synthetic polypeptides has seen many significant advances in recent years, including studies on block and hybrid copolypeptides that form vesicles, fibrils, and other structures with potential applications in medicine and materials chemistry. However, the development of glycosylated polypeptides has not kept pace, primarily due to the inability to readily synthesize glycopolypeptides in a controlled manner. In this context, we developed over the last years synthetic strategies for the design of glycosylated polypeptides and polysaccharide-polypeptide biohybrids with controlled placement of sugar functionality. We were especially interested in designing amphiphilic copolymers able to self-assemble into well- defined micelles and vesicles that can advantageously be loaded with drugs and present a surface with multivalent presentation of bioactive saccharides or oligosaccharides.

**IL52**

**Professor Brian Hawkett**, Nirmesh Jain, Hadi Sabori, Kurt Terhune and Brad King

Sydney University

*Ionic liquid ferrofluids for space propulsion*

Current designs for electrospray propulsion of small spacecraft use very fine needles to present tips of fluid that are expelled into space by the application of an electric field. Such designs are problematic in that the needles are very easily blocked or damaged and, if this happens, there is no means of rectifying the problem is a mini satellite in space.

In a project funded by the US Air force and run by Brad King of Michigan Tech. we are investigating the possibility of forming self-repairing liquid tips by positioning an ionic liquid ferrofluid (ILFF) in a magnetic field. In the magnetic field the ferrofluid will form spikes, the tips of which can be caused to emit material by the further application of an electric field.

The KCPC role in the project is to design and prepare (ILFFs) with appropriate properties. The basis for the ferrofluid design is the stabilization of superparamagnetic iron oxide nanoparticles in the ionic liquid using diblock copolymers prepared by RAFT.

**IL53**

**Professor Maria Kavallaris**,

Children's Cancer Institute, UNSW

*Nanomedicine: Targeting microtubules: Potential of RNAi delivery for the treatment of aggressive cancers*

Cancer is one of the major causes of morbidity and mortality in the world, with 8.2 million cancer related deaths in 2012 alone. A major cause of cancer treatment failure is poor access of chemotherapeutic drugs to tumour sites and resistance to therapy. The ability to deliver a higher drug load to tumours or to switch-off cancer-associated genes (RNA interference) using nanotechnology, offer great hope as effective, and potentially, less toxic cancer therapies. Microtubules and other mitotic proteins are often deregulated in cancer and are responsible for diverse effects including drug resistance, tumour formation and metastasis. We have been investigating nanoparticle delivery vehicles for the delivery of RNAi against cancer-associated microtubule and mitotic genes in aggressive epithelial-derived cancers. Recent data on these delivery systems and their effects on delivery and release of their payload to cancer cells and complex tumour systems will be presented.

**IL54**

**Professor Cameron Alexander**,

School of Pharmacy, Nottingham University

*Nanomedicine: Polymers for Exploring Pharmaceutical Biology*

Functional polymers can be used for detecting disease and for delivering therapeutic agents to disease sites. The ability to synthesise very precise macromolecules is enabling polymer chemists to explore previously inaccessible aspects of pharmaceutical biology, such as trafficking of exogenous materials in cells in real time. In turn, these advances are allowing biologists to develop new understanding in the ways that healthy and diseased cells process drugs and macromolecular therapeutics. This talk will feature our latest results using polymers and polymer-bioconjugates to probe cellular mechanisms and exploit biological responses for therapy.

**IL55**

**Dr Markus Muellner**,

The University of Sydney

*Pharmacokinetics and Biodistribution of Cylindrical Polymer Brushes*

The ability to tune nanoparticle composition, nanostructural shape and particle behavior has the potential to provide new materials to address challenges in in vivo drug delivery and imaging applications, where the prospect for tailoring distribution patterns is particularly attractive.

To date, only a small number of in vitro reports have described potential biomedical applications of cylindrical polymer brushes (CPBs); showing composition-dependent cellular interactions and strategies to release drugs to kill cancer cells.

In order to access the usefulness of CPBs further, we initiated studies to investigate the in vivo behaviour of PEGMA-based CPBs. Control over particle properties enabled an investigation of the impact of size, aspect ratio and stiffness on pharmacokinetics and biodistribution in animal models.

**IL56**

**Professor Cyrille Boyer**, Sivaprakash Shanmugam, Jiangtao Xu,

UNSW

*Selective Photoregulated Reversible Addition Fragmentation Chain Transfer (PET-RAFT) using Photocatalysts*

In this talk, photoenergy/electron transfer - reversible addition fragmentation chain transfer (PET-RAFT) polymerization will be discussed. We will present the recent progress in this technique. First, we were able to regulate the polymerization by varying the wavelengths (from blue light to near-infrared light) using various types of catalysts. More recently, we were able to selectively activate polymerization and generate complex macromolecular architectures, such as graft copolymers, in one-pot synthesis by changing the wavelengths. Finally, we will present potential application of this process for the synthesis of sequence control polymers.

**IL57**

**Mr Paul Clarke**,

Postnova Analytics

*Poly(lactic-co-glycolic acid) Nanoparticles in Cell Media used as Biodegradable Substrates in Pharmaceutical Applications: Comprehensive Characterization with Centrifugal Field-Flow Fractionation (CF3) coupled with Online Dynamic Light Scattering (DLS)*

**IL58**

**Dr Tara Schiller**,

Warwick University

*Synthesis of polymeric microcapsules by interfacial-emulsion cationic photopolymerization of divinyl ether monomer in aqueous suspension*

We have synthesised microcapusles using cationic photopolymerisation with a less hydrophobic monomer than previously used. In our study we proposed a modification of the classical emulsion polymerization since we polymerized triethylene glycol divinyl ether (DVE3). Since the DVE3 was not hydrophobic, n-hexadecane was used to generate an oil-water interface, where the monomer can polymerize. The triarylsulphonium salt, used as cationic photoinitiator, possess aryl groups which impart sufficient lipophobic character allowing the photoinitiator to be readily soluble in the oil phase, remaining insoluble in the water suspending medium. The work presented will show the study of these materials through SEM, TEM and SAXS.

**IL59**

**Professor Zhengbiao Zhang**, Yanyan Zhou, Junfei Zhao, Nianchen Zhou, Xiulin Zhu

Soochow University

*Tansformation of living chain terminals for the construction of topological polymers*

TBC

**IL60**

**Professor Andrew Whittaker**, Cheng Zhang, Shebbrin Moonshi, Kewei Wang, Hui Peng,Simon Puttick

AIBN

*19F MRI agents for detection of diseased tissue and tracking of cells*

Recently there has been intense interest in fluorinated molecules to allow tracking of therapeutic particles and cells in vivo. The motivation for this is the very high selectivity of the 19F imaging experiment, since unlike in 1H MRI, the body does not contain a confounding fluorine background signal. In principle therefore, highly-selective 19F images can be superimposed on high-resolution anatomical 1H images, allowing tracking of suitably-labelled cells or biomarker molecules. Here I describe the motivation for the development of new partly-fluorinated copolymers with outstanding potential as 19F MRI imaging agents, and in particular as agents sensitive to the biological environment. The discussion will focus on macromolecules incorporating the monomers DMAEMA and/or OEGMA which respond to external stimuli, for example local temperature, pH or ionic strength. I will also describe our programs in imaging and delivery to small animal models of glioma, prostate and skin cancer.

**IL61**

**Professor Mark H. Schoenfisch**,

UNC

*Nanomedicine: Nitric oxide-releasing macromolecular therapeutics*

Nitric oxide (NO) is a reactive free radical that exhibits broad-spectrum antibacterial properties due to multiple modes of action. Recent work has focused on the development of NO-releasing macromolecular scaffolds (e.g., dendrimers) as antibacterial agents. Developing an understanding of how a dendrimer's physicochemical properties influence antibacterial activity is essential in designing new therapeutics. This presentation will describe the effects of dendrimer composition, size, and exterior chemical modification on bacterial killing and cytotoxicity.

**IL62**

**Professor Doo Sung Lee**,

Sungkyunkwan University

*Stimuli sensitive block copolymer for biomedical applications*

The design concept of the injectable block copolymer hydrogels responding to pH and temperature, and their potential biomedical applications will be discussed. These copolymers usually contain tertiary amine and sulfone amide groups as pH-sensitive moieties and many different chemical groups, such as ester, amide, urethane, urea… to control the hydrogel properties. These copolymer aqueous solutions existed in the sol states at low pH and low temperature with low viscosity, which are suitable for formulation with proteins or bioactive molecules, and exhibited a sol-gel transition to be the gel states with high viscosity by changing to physiological conditions (37 °C, pH 7.4). Or after being injected into the body, it could let them serve as proteins/bioactive molecules depots for long term sustained release. The potential applications of these hydrogels as drugs/proteins carriers will also be suggested.

**IL63**

**Professor Steve Brocchini**,

*Covalency or not?*

Polymers are widely used to alter the biodistribution and to extend the duration of action of drugs. Polymers in orally administered dosage forms readily clear the gastrointestinal track without uptake in the the body. Oral dosage forms often exploit non-covalent polymer properties (e.g. coating, wettability, dispersibility, etc). There are greater challenges for polymers used to develop injectable drugs (e.g. haemolytic toxicity, propensity for accumulation). Covalent approaches tend to focus on drug conjugation to the polymer while non-covalent properties are used to form colloids. We are examining both non-covalent and covalent approaches to utilise polymers in injectable medicines. This talk will describe (i) a conjugation strategy to make protein mimetics that cannot be easily made by recombinant means alone and (ii) a liposome replacement strategy based on the non-covalent complexation of poorly soluble and toxic drugs to a water-soluble polymer.

**IL64**

**Professor Timothy E. Long**,

Virginia Tech

*The Magic is in the Morphology: Designing Multiphase Polymers*

Tailoring morphology requires the design of sequenced polymers using a complement of synthetic strategies, ranging from living anionic polymerization and controlled radical polymerization to segmented copolymers with step-growth polymerization. This lecture will focus on the structure-property-processing relationships of novel multiphase polymer systems with a focus on the formation of block copolymers in concert with intermolecular interactions. Particular attention is devoted to the roles of hydrogen bonding and ionic interactions on phase separation at the nanoscale with implications on thermomechanical properties. Recent efforts have involved the role of multiphase architecture in 3D printing, and ionic liquids and block copolymers offer exciting opportunities to tune performance of 3D printed objects. This lecture will also describe our efforts in mask projection microstereolithography to prepare diverse micron-scale objects with topological and geometric control.

**IL65**

**Professor Neil Cameron**, Australia

Monash University and the University of Warwick

*Emulsion-templated Porous Polymers as Scaffolds for 3D Cell Culture and Tissue Engineering*

There are several routes described in the literature for the production of highly porous and permeable polymer materials for use as tissue engineering scaffolds. However, many of these methods result in poorly defined materials with void sizes that are difficult to control and limited connectivity. One method that has the ability to create well-defined porous polymers (foams) is the so-called emulsion templating process, whereby a high internal phase emulsion (HIPE) is used as a precursor to a porous material. The presentation will describe the preparation of HIPEs

and the resulting porous polymers (polyHIPEs) together with methods by which the morphology, properties and surface chemistry can be varied. In particular, the use of photopolymerization as a means to prepare porous

materials from relatively unstable HIPEs will be presented. Subsequently, the application of these materials as matrices for tissue engineering and in vitro 3D cell culture will be discussed.

**IL65**

**Professor Neil Cameron**,

Monash University, Dept of Materials Science & Engineering

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**IL66**

**Dr Jean-Francois Lutz**,

Institut Charles Sadron

*About Codes, Sequences and Polymers*

Information-containing macromolecules are polymers that contain a message encrypted in their comonomer sequences. The archetypal example of such a polymer is DNA, which is used in biology to store genetic information. However, DNA is not the only polymer that can store molecular information. In principle, a string of information can be created in any copolymer using two comonomers defined intentionally as 0- and 1-bits. However, such polymers have to be monodisperse and perfectly sequence-defined. In addition, the message encoded in their chains should be easily read. In this lecture, I will present recent achievements obtained in my laboratory for the synthesis of information-containing macromolecules. For instance, monodisperse sequence-defined polymers were prepared using chemoselective iterative solid-phase strategies. Furthermore, the sequencing of these polymers by tandem mass spectrometry will be discussed.

**IL67**

**Professor Gaojian Chen**, Jiawei Lu, Wei Lu, Lulu Xue, Qi Liu, Hong Chen

Soochow University

*Synthesis of glycopolymer-based ‘signal antenna’: targeting cancer cell and regulating stem cell*

Sugar chain is widely recognized as the signal antenna localized on cell surface. All living cells are coated with glycan polymers on their cell walls. They play diverse roles, including critical functions in the areas of cell signaling, molecular recognition, immunity, and so on. It is also noted that non-sugar moities such as sulfonic acid or proteins are found to be important elements to complex with sugar for the proper function of glycans. Herein, by picking the important elements, we rebuild them to form synthetic complex glycopolymers. We designed and synthesized functional glycopolymers that can recognize cancer cells, or used as the ‘antenna’ on stem cell surface for cell fate regulation.

**IL68**

**Dr Hans Heuts**, Olessya Loiko, Mohammad Amin Moradi, Jan Meuldijk, Alex van Herk

Chemical Engineering & Chemistry, TU Eindhoven

*Nanocapsules and Nanocomposites via Reversible Deactivation Emulsion Polymerization*

In this contribution we will present our recent efforts in the preparation of nanocapsules and polymer-Gibbsite nanocomposites via reversible deactivation emulsion polymerization. The former structures are prepared by chain extension of anionic cooligomers of butyl acrylate and acrylic acid containing a trithiocarbonate group, adsorbed onto cationic DODAB vesicles, using a starved-feed emulsion polymerization. Different nanocapsule morphologies are obtained in this process and in the current presentation we will highlight our recent efforts in controlling these morphologies. Furthermore we will present our recent results on the extension of this RAFT-based approach to ATRP in the preparation of polymer-Gibbsite nanocomposites. Unlike the RAFT approach, which leads to fully encapsulated Gibbsite platelets, the ATRP approach results in very different morphologies and here we present our efforts in controlling these morphologies.

**IL69**

**Professor Michael Meier**,

Karlsruhe Institute of Technology (KIT)

*Multicomponent reactions in polymer science: from versatile tuning of structure and properties to sequence defined macromolecules*

Multicomponent reactions are an established tool in organic chemistry. They offer high atom-economy, straightforward practical procedures and most importantly structural diversity can easily be achieved by variation of the used components. Only recently, the benefit of these one-pot reactions was realized for macromolecular engineering. Especially the Passerini three-component and Ugi four-component reactions demonstrate attractive tools for polymer synthesis. Here, two different approaches to form polymers can be followed: either synthesizing the monomer first via an isocyanide-based MCR (IMCR) or forming the polymer directly by the use of IMCR-reactive

bifunctional components. Both approaches will be discussed in detail and led to a large variety of different polymer architectures offering a variety of tunable properties. Moreover, multicomponent reactions are an excellent tool for the design of highly defined polymer architectures, including dendrimers and sequence defined polymers.

**IL70**

**Professor Ben Boyd**, Kristian Tangso, Patrick T. Spicer

Monash University

*Formation of nano-structured interfaces using oppositely-charged polymer-surfactant systems*

The interface between oppositely-charged surfactant and polymer solutions can generate self-assembled structures with thermodynamically stable and reversible stimuli responsive order not achievable in coacervated polymer-polymer systems. We have been using spatially-resolved X-ray scattering approaches to understand the structures formed at these interfaces. The structures formed can be used to form capsules, and can be manipulated through changes in variables such as temperature or pH to yield stimuli responsive materials. Industrially relevant systems as well as biocompatible and biological surfactants and polymer pairs have demonstrated such behaviour, yielding new opportunities for controlled release applications in a wide range of fields.

**IL71**

**Professor Beppe Battaglia**,

UCL

*Active drug delivery: from synthesis to supramolecular engineering to applications*

Getting through the biological barrier that limits access to all the different parts of our body is paramount for enhancing and enabling both drug delivery and diagnostic development. This requires a level of engineering that requires both synthetic and supramolecular design. In the last year, we approached this problem using systems that mimic natural carriers such as vesicles and viruses and yet implement their design with new features such as responsiveness, active diffusion, and moreover using materials that guarantee easy clinical translation. We synthesise amphiphilic copolymers that comprise all the necessary requisites such as immune compatibility, molecular recognition and responsiveness, we then combined this into supramolecular structures that fulfil all the requirements imposed by the different barrier, tissue penetration, selectivity, intracellular delivery and more. The result is a technology platform that we are now applying to several clinical settings.

**IL72**

**Dr Pu Chun Ke**, Bo Wang, Aleksandr Kakinen, Emily H Pilkington, Thomas Blin, Feng Ding, Angela Ivask, Nicolas Voelcker and Thomas P Davis

Monash University

*Inhibition of Protein Aggregation and Adsorption by Polymeric Materials*

Protein aggregation is a ubiquitous phenomenon occurring in neurological disorders and type-2 diabetes (T2D). Aggregation of human islet amyloid polypeptide (hIAPP), specifically, is associated with the loss of pancreatic cells and, consequently, insulin resistance and deficiency in T2D. Here we show the use of OH-terminated dendrimers and polyphenols for effective inhibition of hIAPP aggregation and cytotoxicity in vitro, ex vivo and in silico.

Protein adsorption determines the biological identity of the nanoparticle core. We have devised a synthesis scheme by grafting phosphorylcholine (PC) brushes onto iron oxide nanoparticles (IONPs). PC displayed a comparable or better performance over PEG in affording the IONPs stability and biocompatibility while computer simulations further examined the capacities of PC and PEG brushes in albumin avoidance. Towards application the transcytosis of the IONPs across a model blood brain barrier is briefly discussed.

**IL73**

**Professor Matthew Becker**,

The University of Akron

*Translationally Relevant Strategies for Enhancing Function in Degradable Polymers*

Chemical approaches to functionalize polymers with bioactive groups are evolving rapidly to enhance interactions at the biotic-synthetic interface. Further advances in both synthetic methodology and scaffold fabrication are needed to drive these efforts forward. Many strategies have involved doping polymers with proteins or peptides or decorating the substrates bioactive groups. While these approached have been demonstrated to aid the biochemical signaling and integration into host tissues, they generally reduce the mechanical properties of the material. This presentation will describe the use of several translationally relevant functionalization strategies to functionalize polymeric materials in nanofiber, scaffold and hydrogel technologies

**IL74**

**Professor Per Zetterlund**, Frank Lucien, Jerome Claverie, Jiming Dong, Jean-Christophe Daigle, Noor Hadzuin Nik Hadzir

UNSW

*Synthesis of polymeric nano-objects using CO2-based heterogeneous polymerization approaches*

Polymeric nano-objects find a wide variety of applications in areas as diverse as material science, health care products and nanomedicine. We have been exploring the use of low pressure CO2 as an environmentally friendly and versatile tool to exert influence on heterogeneous polymerization systems. Examples include the synthesis of hollow particles via CO2-assisted photoinitiated polymerization using vesicles templates, tuning of particle morphology via CO2-pressure in polymerization-induced self-assembly (PISA), as well as synthesis of aqueous polyethylene latexes using CO2-induced miniemulsions.

**IL75**

**Bela Ivan**

Hungarian Academy of Sciences

*Nanostructured bicontinuous amphiphilic conetworks as a new material platform for intelligent gels and nanohybrids*

Amphiphilic conetworks (APCNs) composed of covalently bonded, otherwise immiscible hydrophilic and hydrophobic polymer chains belong to a new group of rapidly emerging nanostructured materials. Such macromolecular assemblies are prepared by utilizing telechelic polymers obtained by living polymerization techniques. Due to the strong chemical bonds between the immiscible chains, unique bicontinuous nanophase separated morphology exists in APCNs in a broad composition window. This is the basis for the preparation of various specialty new intelligent (responsive) gels and unique organic-inorganic nanohybrids by applying one of the nanophases as nanoreactor. The resulting novel materials have a variety of high added-value potential applications from nanocatalysis and photonics to biomaterials etc.

**Acknowledgements.** Support of this research by the National Research, Development and Innovation Office (K112094, NN116252) and the National Development Agency (KTIA-AIK-12-1-2012-0014) is acknowledged.

**IL76**

**Professor Charles E. Diesendruck**,

Technion City, Haifa

*Intramolecular cross-links and mechanics*

The demand for new, better materials increasingly directs materials science towards a profound understanding of the relation between the nanoscopic and macroscopic worlds. The mechanical properties of materials, as well as the mechanical response to stress are a direct consequence of molecular friction (non-covalent bonds) and polymer architecture. The mechanical response of linear and cross-linked polymers is well described and understood. In this talk, I’ll describe the effect of intramolecular cross-links on the mechanical response of polymer chains. Intramolecular cross-links influence the mechanochemical stability of the chains, the mechanical properties of the chain as well as of the material, since these physical barriers affect the entanglement between chains. Importantly, since these cross-links are intramolecular, the polymer remains a thermoplastic material, with easy processability.

**IL77**

**Professor Fawaz Aldabbagh**,

School of Chemistry, National University of Ireland Galway,

*Synthesis of Heterocycle-Containing Polyacrylamide Block Copolymers and Formation of pH-Responsive Vesicles*

**IL8**

**Professor Michael S. Silverstein**, Maya Ovadia, Inbar Shreiber Livne, Liraz Avraham, Sebastijan Kova

Technion, Materials Science and Engineering

*Responsive, high porosity hydrogels through emulsion templating*

PolyHIPEs are porous, emulsion-templated polymers that are usually synthesized within surfactant-stabilized, water-in-oil, high internal phase emulsions (HIPEs). Here, highly porous hydrogel polyHIPEs (HG-PHs), ionic and non-ionic, were synthesized within oil-in-water HIPEs. Many HG-PHs proved to be superabsorbent, with the extraordinary, pH-responsive water uptake ascribed to hydrogel-swelling-driven void expansion. Self-crosslinking through the formation of methylene radicals, as opposed to crosslinking using a comonomer, was shown to enhance the water uptake. In addition, poly(urethane urea) polyHIPEs incorporating renewable resource materials, such polysaccharides, were synthesized for tissue engineering applications.

**IL79**

**Professor D Gigmes**,

Aix-Marseille University

*Organic Electron Donnors and alkoxyamines as alternatives to conventional polymerization initiators*

Radical initiators are belonging to a class of chemical species finding a broad range of applications in organic chemistry and material science. Among various possibilities the generation of these species is mainly obtained from the thermolysis or photolysis of peroxy or azo derivatives. In material science these compounds are particularly useful as polymerization initiators, crosslinking agents or chemical modification of the polymer backbone. Despite peroxy and azo derivatives are routinely applied in radical polymerization, it has to be mentioned that some drawbacks are associated to their use. Indeed due to their inherent reactivity, their preparation, storage, handling and shipping is often challenging and raise severe safety issues. In this lecture, we will present our latest results on the use of organic electron donors and alkoxyamines as efficient alternative to peroxy and azo compounds used in material science.

**IL80**

**Dr Julien Nicolas**,

Univ Paris-Sud

*Vinyl polymers for biomedical applications*

This lecture will present our recent achievements in the field of controlled radical polymerization (CRP) as a tool for the design of (i) functional polymers for polymer-protein bioconjugation; (ii) well-defined degradable materials by radical ring-opening polymerization (rROP) using cyclic ketene acetal (CKA) monomers and (iii) polymer prodrug nanomedicines by the 'drug-initiated' method for anticancer therapy.

**IL81**

**Dr Kohji Ohno**,

Institute for Chemical Research, Kyoto University

*Well-Defined Hairy Particles: Precision Synthesis and Self-Assembly*

Surface-initiated living radical polymerizations were carried out to densely graft polymer chains on particles of various shapes including spheres, rods, and plates. Depending on their shapes, the hybrid particles grafted with polymer brushes formed colloidal crystals or liquid-crystals in their suspension. Particle assemblies with external-field-responsiveness were also achieved using functional hybrid particles. Ordered structures of hybrid particles were also fabricated in their thin films. Some of the films exhibited an iridescent color arising from the periodicity of refractive index. A thin film composed of rod-shaped particles showed optical anisotropy.

**IL82**

**Dr Olivier Colombani**, Sylvain Catrouillet, Laurent Bouteiller, Cédric Lorthioir, Erwan Nicol, Taco Nicolai, Sandrine Pensec

University du Maine

*1D solution self-assembly of urea-functionalized polymers into homogeneous or patchy nanocylinders*

Supramolecular chemistry has become a very efficient way to design complex nanostructures in a rather straightforward way by self-assembly. Here, we focused on molecules consisting of polymer-decorated hydrogen bonding bis(ureas) and tris(ureas). Scattering techniques revealed that these molecules may self-assemble in solution into highly anisotropic supramolecular bottle-brushes with persistence lengths of hundreds of nanometers. The extent of self-assembly moreover critically depends on a subtle balance between the strength of the hydrogen bonds and the steric hindrance of the polymer arms, allowing tuning of the length of the nanostructures. Moreover, two incompatible polymer arms could be attached onto the urea-based units with the prospect of preparing Janus nanocylinders. 1H transverse relaxation measurements and NOESY NMR experiments conducted directly in solution were used to characterize the local organization of the polymer chains within these nanocylinders.

**IL83**

**Dr Roberto Milani**, Y. Liu, K. Kempe, P. Wilson, L. Gazzera, C. Pigliacelli, A. Paananen, F. Baldelli Bombelli, M. Linder, D.M. Haddleton, P. Metrangolo

Biologinkuja 7, Espoo

*Functional surfaces from proteins and protein/polymer hybrid layers*

Surface modification allows control over important features of materials such as wettability, dispersibility, susceptibility to fouling and many others without affecting the bulk properties of the underlying substrates. However, poorly reactive surfaces such as those of hydrophobic polymers often require previous activation through aggressive or energy-intensive methods.

We used hydrophobins, i.e. exceptionally amphiphilic proteins produced by fungi, as intermediates for the surface modification of such substrates. Thanks to their Janus-like amphiphilic structure, hydrophobins spontaneously and quickly assemble onto poorly reactive hydrophobic surfaces and form strong, elastic films which expose a reactive hydrophilic surface.

We show here how these proteins offer a simple and environmentally friendly solution to prepare aqueous dispersions of hydrophobic polymer particles, and how hybrid hydrophobin/polymer layers can be used to prepare functional coatings.

**IL84**

**Dr Nghia Truong**, Michael Whittaker

Thomas Davis

Faculty of Pharmacy and Pharmaceutical Sciences, Monash University

*Nanoparticles with tunable properties via emulsion polymerizations*

In this talk, our state-of-the-art emulsion polymerization techniques that allows control over the size, shape, surface, and core of nanoparticles will be presented. These synthetic techniques have many advantages: (i) rapid polymerization; (ii) nearly complete conversion; (iii) minimal side reactions; (iv) ultra-high molecular weight; (v) narrow distributions of molecular weights and particle sizes; (vi) high solids content; (vii) excellent stability; (viii) precise control over both molecular weight and particle size; (ix) various and uniform morphologies; (x) modifiable surfaces; and (xi) tunable cores. Although challenges still remain, the emulsion polymerization techniques presented in this talk mark significant steps forward in the synthesis of polymeric nanoparticles with tunable size, shape, surface, and core, opening the doors to a variety of potential applications.

**IL85**

**Dr Muriel Lansalot**, E. Velasquez, J. Lesage De La Haye, J. Rieger, F. Stoffelbach, B. Charleux, P.E. Dufils, J. Vinas, I. Martin-Fabiani, M. Schulz, J.L. Keddie, F. D'Agosto

University of Lyon

*One-pot synthesis of surfactant-free latexes by RAFT-mediated emulsion polymerization*

Organic latexes are most of the time stabilized by low molar mass surfactants, which are however known to have detrimental effects on the latex stability when frozen or subjected to high shear. They can also diminish the properties of the resulting films when exposed to water or high humidity. Besides, the use of surfactants raises environmental concerns. Recently, an original strategy combining emulsion polymerization and controlled radical polymerization (CRP) has been developed to produce surfactant-free latexes. The process requires the synthesis by CRP of hydrophilic polymer chains followed by their chain extension with a hydrophobic monomer in water leading to the in situ formation of amphiphilic block copolymers playing the role of a macromolecular stabilizer covalently anchored at the particle surface. The present paper describes the successful implementation of this strategy using water-soluble polymers obtained by RAFT.

**IL86**

**Professor Stephen Rimmer**, Richard Plenderleith

Bradford University

*Preparation of branched semi-interpenetrating networks*

Interpenetrating networks (IPN) are useful materials for the production of products with combined properties. For example one of the components can provide mechanical properties while the other provides some other functionality. IPNs are composed of two crosslinked polymers that are intertwined and useful materials must be phase seperated only at the nano/sub-micron lenghth scale. Semi-IPNs (S-IPN) are prepared when only one component is crosslinked. S-IPNs can be more easily manufactured and processed but the linear component is easly extracted by solvnets. In this work we show hwo highly branched polymers can be incorportaed into S-IPNs (gicing BS-IPNs). We describe BS-IPNs that are useful as supports for cell culture: composed of highly-branched poly(N-isopropyl acrylamide) in a poly(N-vinyl pyrolidinone), polyurethane or poly(ethylene glycol) networks. Extraction did not remove the soluble component and in some cases these BS-IPNs were fabricated into foams or tubes.

**IL87**

**Dr Vincent Ladmiral**, Bruno Améduri

Marc Guerre

ICGM, UMR 5253 (CNRS, UM, ENSCM)

*MADIX polymerization of VDF: Easy to learn, Hard to master*

Polyvinylidene Fluoride (PVDF) and its copolymers are very valuable materials for their excellent weatherability, chemical and thermal stability, and outstanding electroactive properties. Ironically, although VDF was the first monomer to be polymerized using controlled radical polymerization technique; PVDF-based well-defined architectures are still very much underdeveloped. This is most probably due to the peculiar polymerization behaviour of VDF which impairs perfect control. Here, we will present the results of our research aiming at controlling the polymerization of VDF using MADIX polymerization. Our contribution provides a much better understanding of the various reactions at work during the solution MADIX polymerization of VDF, allows the preparation of unprecedented PVDF-containing architectures (macromonomers, block copolymers, star-polymers…), and thus expands the scope of both MADIX polymerization and PVDF-based materials.

**IL88**

**Professor Bert Klumperman**, Rueben Pfukwa, Siyasanga Mbizana, Johnel Giliomee, Ingrid Heyns

Stellenbosch University

*New polymers for biomedical applications*

The field of Nanomedicine covers a broad range of applications from drug delivery systems to materials for tissue engineering. For many of these applications it is necessary to develop new materials that possess specific properties. In this contribution a number of new developments will be discussed that comprise the use of a newly developed monomer, the synthesis of a new thermoresponsive block copolymer and a statistical terpolymerisation for the synthesis of a cell adhesive material.

**IL89**

**Professor Aline Miller**,

Manchester Institute of Biotechnology

*Engineering Multifunctional and Responsive Peptide Based Soft Materials*

Self-assembling peptides have been highlighted as one of the most promising building blocks for future material design where individual molecules are held together via strong, yet irreversible bonds. Consequently design rules for the self-assembly route of the different peptide systems and final material structure and properties are emerging, but these typically provide bare materials that lack the ability to adapt to their environment. Here several different strategies will be outlined for the fabrication of functional, responsive and active materials based on ionic-complementary self-assembling octa-peptides. Several examples of the different types of functionalities that can be incorporated will be outlined, thus covering a wide range of application areas including controlling cell culture, targeted and temporal release of therapeutics, biosensors and biocatalysis for fine chemical manufacturing.

**IL90**

**Professor Laurent Billon**,

University de Pau

*Soft micro-objects for Bio-inspired Functional Materials*

Polymerization in aqueous dispersed media was used to synthesize both corona@shell@core particles and multi-responsive biocompatible microgels as soft micro-objects. These building blocks were then self-assembled by extrusion/compression or simple water evaporation to create bio-inspired functional materials for self-supported flexible colloidal crystal or cohesive/adhesive films, respectively.

**IL91**

**Professor Jinming Hu**,

Monash University

*The Synthesis and Functional Application of Nitric Oxide (NO)-Responsive Polymers*

TBC

**IL92**

**Dr Helen Willcock**,

Loughbrough University

*Towards new applications for stimuli responsive polymers*

Controlled radical polymerisation (CRP) techniques have, in recent years, allowed the synthesis of increasing complex architectures including linear and branched block copolymers, polymer particles and higher order structures such as micelles. Control over the architecture of polymers gives us exquisite control over their solution properties, and can be achieved using commercially available starting materials. In addition to this, research into stimuli responsive polymers has become increasingly more prolific, with an ever increasing number of studies on polymers responsive to pH, light and temperature, amongst others. Here examples in which the properties of polymers are controlled by their chemical composition, molecular weight and architecture will be discussed, focusing on potential bio-applications including Magnetic Resonance Imaging (MRI).

**IL93**

**Dr Theoni Georgiou**, Nicole Pamme Bingyuan Lu, Mark D. Tarn, Negar Ghasdian, Mark A. Ward, Dean Carroll, Anna P Constantinou

Imperial College, Department of Materials

*Amphiphilic Microgels and Macrogels*

Amphiphilic gels either in the micro- or in the macro-scale can exhibit interesting properties like phase separation and be used in drug delivery and in tissue engineering. We have reported the synthesis of both, micro- and macro-gels with an amphiphilic nature of different compositions and architecture. The amphiphilic microgels were fabricated using a lab-on-a-chip device where the size and composition of the microgels can easily be tailored. The amphiphilicity of the microgels was demonstrated by their ability to deliver both hydrophobic and hydrophilic moieties. Finally, amphiphilic macrogels were prepared via Group Transfer Polymerization (GTP). Several design criteria were systematically alerted to investigate how these affect the end properties and applications of the gels that were in both cases block based. It was demonstrated that the molar mass and the composition as well as the topology, i.e. position of the blocks had an effect on their ability to swell or form a gel

**IL94**

**Professor Philippe Guégan**, Zahra Eskandani ; Ibrahima Faye ; Véronique Bennevault ; Nicolas Illy ; Cécile Huin

IPMC équipe polymères UPMC/Sorbonne Université , 4 place Jussieu

*Cyclodextrin-based Amphiphilic Star Polymers : a Gate in Lipid Bilayer*

We investigated the synthesis of a new library of star polymers. The anionic ring-opening polymerization of oxirames (ethylene oxide, butylene oxide and ethoxyethylglycidylether), using DPMK or phosphazene base as deprotonating agents, allowed for the synthesis of well defined amphiphilic star polymers with a cyclodextrin core. The polymers were characterized by NMR (1H, 13C, DOSY), SEC and MALDI ToF for a precise determination of the architecture. Interactions of the amphiphilic star polymers with a lipid bilayer was then investigated, showing their insertion propensity. Those polymers were then used to provide the evidence of the translocation of active biological compounds through a lipid bilayer, at the unimolecular level.

**IL95**

**Dr Sagrario Pascual**, Maël Le Bohec, Sandie Piogé, Laurent Fontaine

Université du Maine

*Reactive stimuli-responsive polymers: synthesis and reactivity towards biological entities*

Advances in polymer synthetic approaches including polymerization techniques as well as chemoselective coupling reactions creates the opportunity for polymer chemists to prepare new polymers with a high degree of control over topology, composition, and functionality. Radical-based controlled polymerizations, including RAFT polymerization, have shown a high tolerance towards functional groups allowing the preparation of functional polymers under relatively facile conditions. Therefore, functional polymers with well-defined molecular characteristics including the incorporation of desirable functionality in a site-specific manner have been emerged. In this context, our contribution is based on the development of original heterofunctional monomers and their use in RAFT polymerization to access to reactive stimuli-responsive polymers towards biological entities such as proteins and DNA. The development of new reactive polymers for bioconjugation and for gene delivery will be presented.

**IL96**

**Dr Franck D'Agosto**, Sébastien Norsic, Christophe Boisson, Cédric Dommanget, Bastian Ebeling, Vincent Monteil, Yasuyuki Nakamura, Shigeru Yamago

Univ Lyon

*Controlled radical polymerization of ethylene*

Controlling the growth of the chains during a polymerization process gives access to the fine-tuning of the properties of the final material. In addition, being able to efficiently and selectively introduce reactive groups into a very apolar polyolefin such as polyethylene may open the way to use this segment as a building block. Coordinative chain transfer polymerization (CCTP or Catalyzed Chain Growth (CCG)) system is conceptually analogue to the well-known reversible addition-fragmentation chain transfer (RAFT) process in free radical polymerization. Our team, involved in both catalytic and controlled radical polymerizations, identified efficient and original ways of designing well-defined and reactive polyethylene chains. This paper will show how CCG, RAFT and organotellurium-mediated radical polymerization have been used to design, starting from ethylene, telechelic polyethylenes and to control the free-radical polymerization of ethylene.

**IL97**

**Professor Guosong Chen**,

Fudan University

*Carbohydrate-based Macromolecular Self-Assembly*

Carbohydrates are one of most important biological macromolecules. The self-assembly of DNA and proteins make a significant contribution to our lives and they have been employed to make functional self-assembled materials. Compared to the development of DNA and proteins, our knowledge and manipulation to the self-assembly of carbohydrates as well as their functionality are quite limited. In this talk, three different strategies will be presented: 1) developement of crystalline protein array and protein microtube controlled by protein-carbohydrate interaction; 2) construction of polymeric vesicles mimicking glycocalyx, structure, self-assembly and biological functions; 3) control of macromolecular self-assembly by chemical reactions related to sugars.

**IL98**

**Dr Frederik Wurm**

Max Plank Institute for Polymer Research

*Poly(phosphoester)s and -amidates: Novel biodegradable polymers*

Modern needs in materials science and bioapplications are manifold: From hydrophobic matrices for tissue engineering to water-soluble protein therapeutics demand special materials. The incorporation of uncharged phosphates or phosphonates within the polymer backbone is a unique handle to tune the materials properties both along the main chain but also at the side chains.

The materials range from very hydrophobic to highly water soluble PPEs: With the natural phosphate building block a reliable access to biodegradable, biomimetic PPEs is possible. We have developed a reliable protocol based on olefin metathesis for the synthesis of several PPEs with tunable hydrophilicity and degradation rate, high reactivity or adhesion properties. Further, we develop the anionic ring-opening polymerization of five-membered cyclic phosphoesters to novel water-soluble polymers with stealth properties similar to polyethylene glycol, however having the great benefit of being biodegradable.

**IL99**

**Professor Andre H. Gröschel**, Tina I. Löbling, Jani-Markus Malho, Panu Heikkataipale, Olli Ikkala

University of Duisberg

*Block Copolymer Hexosomes*

Hexosomes are polymorphs of lipid self-assemblies featuring a hexagonal lattice of inverse curved cylinders (channels) mostly observed for a particular family of liquid-crystalline molecules, e.g., oleates and its derivatives. The molecular nature of the building blocks however, limits variation of structural parameters such as size, lattice, chemistry and mechanical properties of these otherwise very intriguing particles. Here, we describe the self-assembly of block copolymer hexosomes with a monocrystalline lattice of open channels and flat exterior interfaces untypical for all-amorphous polymers. We characterize the internal order and the hollow interior of the channel system in-situ with cryo-TEM and tomography. The mechanically robust particles further allows transfer to the dry state to analyze their aspect ratio and surface texture with AFM and SEM. Disturbances during the self-assembly process cause coiling of growing channels into higher-order spinning-top structures.

**IL100**

**Professor Jianzhong Du**,

Tongji University

*Polymer vesicles for antibacterial and theranostic applications*

Multifunctional polymers have been designed for self-assembling into vesicles, showing excellent antibacterial activity and ultra-sensitive MRI contrast effect.

**IL101**

**Professor Mathias Destarac**, Ihor Kulai, Stéphane Mazières, Simon Harrisson, Zoia Voitenko

Université Paul Sabatier

*RAFT polymerization monitoring by 31P and 119Sn NMR*

Two novel ranges of triarylphenylstannylcarbodithioate (Sn-RAFT) and phosphinoylcarbodithioate (P-RAFT) reversible addition-fragmentation chain-transfer (RAFT) agents are described and evaluated for the polymerization of acrylamides, acrylates and styrene. 119Sn and 31P NMR are shown to be informative instruments for the monitoring of these polymerizations.

**IL102**

**Dr Lei Tao**,

Tsinghua University

*Biginelli reaction, a 120 years old click reaction?*

Recently, our group reassessed multicomponent reactions (MCRs) from the angle of click reaction, and developed a new type click reaction: multicomponent click (MCC) reaction, i.e. some highly efficient and atom economy MCRs can also be considered as click reaction. Same as traditional two components click reactions, MCC reactions can also be used as efficient coupling tools. Moreover, it is easy to introduce new functional groups through MCC reactions due to their multicomponent nature. In current research, the Biginelli reaction has been employed as a click reaction to synthesize multifunctional polymers, link dye on cell membrane under a catalyst-free condition, modify the carbon based nanomaterials with polymers, demonstrating the unique superiority of MCC reactions.

**IL103**

**Professor Vitaliy Khutoryanskiy**

Reading School of Pharmacy, University of Reading

*Polymer-mediated diffusion of nanoparticles through biological membranes*

Penetration of nanomaterials through biological membranes is an important area for developing nanomedicines. The factors affecting the penetration of nanoparticles through biological membranes include their dimensions, shape and surface functionality. This communication will discuss our recent studies on the diffusion of sub-100 nm functionalised silica nanoparticles through ocular tissues, mucosal lining of stomach and skin. Thiolated silica nanoparticles were synthesised by self-condensation of 3-mercaptopropyltrimethoxysilane (Langmuir 2011, 27, 9551); these were then subsequently functionalised by reactions with 5 kDa alkyne terminated poly(2-ethyl-2-oxazoline) or maleimide-terminated poly(ethylene glycol) (Nanoscale, 2015, 7, 13671). It was established that nanoparticles functionalised with poly(ethylene glycol) and poly(2-ethyl-2-oxazoline) show greater penetration through biological membranes (Molecular Pharmaceutics 2014, 11, 3556; Nanoscale, 2015, 7, 13671).

**IL104**

**Qiang Zhang**

Nanjing University of Science & Technology

*Well-Defined Protein/Peptide–Polymer Conjugates by Aqueous Cu-LRP: Synthesis and Controlled Self-Assembly*

The synthesis of well-defined protein/peptide–polymer conjugates with interesting self-assembly behavior via single electron transfer living radical polymerization in water is described. A range of protein/peptides with different physical and chemical properties have been modified to macroinitiators and optimized polymerization conditions ensure successful polymerization from soluble, insoluble, and dispersed protein/peptide molecules or protein aggregates. This powerful strategy tolerates a range of functional monomers and mediates efficient homo or block copolymerization to generate hydrophilic polymers with controlled molecular weight (MW) and narrow MW distribution. The polymerizations from bovine insulin macroinitiators follow surface-initiated “grafting from” polymerization mechanism and may involve a series of self-assembly and disassembly processes.

**IL105**

**Professor Theodora Krasia-Christoforou**

University of Cyprus

*Structurally-Defined Magnetoactive Amphiphilic Conetworks: Synthesis, Characterization and Evaluation in Icon Restoration*

A novel synthetic approach towards structurally-defined magnetoactive nanocomposite (co)networks is presented, involving the 1,2-bis-(2-iodoethoxy)ethane (BIEE)-crosslinking of well-defined homopolymers and amphiphilic block copolymers based on 2-(dimethylamino)ethyl methacrylate prepared by RAFT in the presence of oleic acid-coated Fe3O4 nanoparticles. The obtained materials were characterized in regards to their swelling behavior, thermal and magnetic properties. Concerning the latter, they were found to exhibit superparamagnetic behavior at 300K. Their well-defined structural characteristics enabled the prediction of their mechanical response via mathematical modelling. The applicability of these materials in icon restoration processes is presented and discussed.

**CONTRIBUTED LECTURES (15 MINS)**

**CL1**

**Dr Anja Goldmann**

Karlsruhe Institute of Technology

*Elucidating the Structure of Poly(Ionic Liquid)s by In-Depth Mass Spectrometric Analysis*

Mass spectrometry provides the synthetic polymer chemist with a powerful tool to investigate the molecular structure of macromolecules. In the current presentation, we demonstrate the in-depth mass spectrometric characterization of complex poly(ionic liquid)s (PILs) bearing different core structures, counter ions and end groups. The characterization of this attractive class of polymers is performed via matrix-assisted laser desorption ionization as well as – for the first time for PILs – electrospray ionization mass spectrometry and Q-TOF quadrupole mass spectrometry. To access the PILs, RAFT polymerization is carried out in a highly controlled fashion resulting in polymers with relatively narrow molecular weight distribution (2000 g/mol;Mn;10000 g/mol). In addition, PILs were encoded in a spatially-resolved fashion onto silicon wafers via a photolithographic process and evidenced via X-ray photoelectron spectroscopy and time-of-flight secondary ion mass spectrometry.

**CL2**

**Dr Robert Chapman**

University of NSW

*Combinatorial low-volume synthesis of well-defined polymers by enzyme degassing*

My research is focused on the generation of combinatorial polymer libraries in very low volumes for the design of therapeutic polymers and polymer conjugates. By using small amounts of the oxygen scrubbing enzyme glucose oxidase (GOx) we have been able to prepare a wide range of highly controlled homo and block co-polymers by RAFT polymerization, in microtiter plates open to the atmosphere. Almost complete conversion is possible in volumes less than 40 µL and low radical and monomer concentrations. Because of this, polymers can be screened for desired properties without purification, without any highly specialized synthesizers but by the non-expert on the benchtop. We are applying this technique to explore structure-property relationships, and the interaction of polymers with biological molecules.

**CL3**

**Professor Dongsheng Liu**

Tsinghua University

*The Frame Guided Assembly*

How to precisely control the shape and size of final assemblies, especially using same amphiphilic molecules and under the same environmental conditions, is always a challenge in molecular assembly. Inspired by the cytoskeletal/membrane protein/lipid bilayer system that determines the shape of eukaryotic cells, we proposed and ‘the Frame Guided Assembly’ (FGA) strategy to prepare heterovesicles with programmed geometry and dimensions. This method offers greater control over self-assembly: with same molecular system, the size of final assemblies could be tuned at 1 nm level and their shape could vary from spherical to cubic, and even given sized two dimensional sheets. Most importantly, the principle of the FGA could be applied to various materials such as bock copolymers, small molecules including surfactants and lipids, which is a general rule in self-assembly.

**CL4**

**Professor Patrice Woisel**

ENSCL, University of Lille

*Supramolecular chemistry: a powerful tool to create "colourful" multi-stimuli responsive polymeric materials*

Complexes fabricated from the electron deficient cyclobis(paraquat-p-phenylene) (CBPQT4+) and electron rich guests have become an important building blocks for the synthesis of functional coloured pseudorotaxanes. Here, we report the successful engineering of new multi-stimuli responsive macromolecular assemblies based on well-defined functionalized polymer building blocks incorporating both CBPQT4+ and electron-rich units (tetrathiafulvalene, naphthalene) moieties. More particularly, we have exploited such pseudorotaxane architectures to create novel “smart” micelles and (re)programmable supramolecular temperature and pH sensors with memory function. An important practical aspect of these multifunctional materials is that all relevant phenomenon (self-assembly and deassembly processes, reading/reprogramming of temperature, memory function) have an associated visible readout thereby affording convenient systems with applications spanning the physical and biological sciences.

**CL5**

**Dr Craig Bell**

The University of Warwick

*Controlling the Synthesis of Amphiphilic, Functional, Degradable Vinyl copolymers by Xanthate-Mediated Polymerization*

Degradable polymers from cyclic ketene acetals (CKAs) are a facile alternative for the synthesis of aliphatic poly(ester)s. The 7-membered CKA, 2-methylene-1,3-dioxepane (MDO), has been the most widely studied due to the structural similarity of the resulting polymer to poly(&#1297;-caprolactone) (PCL). In this work we have functionalised commercially available MeO-PEG-OH with an acid functional p-methoxyphenyl xanthate. This xanthate macro chain transfer agent (MacroCTA) was able to terpolymerize vinyl acetate (VAc), vinyl 4-bromobutanoate (VBr) and MDO to form functional amphiphilic block copolymers with controlled incorporation of functionality and high chain end retention. Furthermore, the functional bromine is able to undergo azidation and ‘click’ type reactions with alkyne functional molecules, the hydrophilic block enables self-assemble of these polymers into amphiphilic core-shell micelles, and the incorporation of MDO allows for slow hydrolytic degradation of these constructs.

**CL6**

**Dr Derek Irvine**

University of Nottingham

*Continuous, In-flow Manufacture via Electromagnetically Heated Catalytic Chain Transfer Polymerisation of Functional Oligomers for use as Functional Chain Transfer Agents and Vaccine Adjuvants*

Star polymers of rac-poly(lactic acid) (s-PLA) were prepared for use as dispersants for hydroxyapatite nanoparticles in a polymer matrix. Better control of the stars’ molecular weight and dispersity was achieved in all polymerisations relative to similarly prepared linear PLA. This was attributed to the degenerative chain transfer process between the star polymer’s arms causing a greater probability of transfer relative to propagation during polymerisation. The reaction temperature was optimized to allow for the shortest reaction times while keeping the catalyst concentration below the limits for biomedical materials and minimizing the rates of degradation reactions to below detectable levels. All reactions were carried out to over 90% conversion. The residual lactide was efficiently removed by vacuum distillation. The poor thermal diffusivity of PLA coupled to an exothermic enthalpy of polymerisation may result in a thermal runaway for larger scale polymerisations.

**CL7**

**Professor Zhongqiang Yang**

Tsinghua University

*DNA modified liquid crystal droplets*

Liquid crystal (LC) droplets have shown for transducing interfacial interaction to optical signals and allowing label-free in-situ monitor. Amphiphilic molecules, e.g., surfactants, lipids, amphiphilic polymers, have been studied to assemble at the LC-aqueous interface. However, these molecules lack of specific interactions with target molecules, here, we combined LC droplets with DNA nanotechnology and decorated the surface of LC droplets with DNA-amphiphiles. Take the advantage of DNA such as sequence programmability and binding fidelity, we are able to design the DNA sequence and direct the assembly of LC droplets, which can be specifically designed such that respond to external stimuli, e.g., temperature, Hg2+, ATP, enzyme. This work would provide a general strategy of design and modification of LC droplets, open a new platform for self-assembly, construction functional structures, and potentially for sensing and diagnosis applications.

**CL8**

**Dr Duc Nguyen**

KCPC, The University of Sydney

*Synthesis of Polymer/SPION Janus Nanorattles and Nanorattles*

This work is designed to showcase the versatility of RAFT mediated emulsion polymerization in creating complex composite nanostructures. We take superparamagnetic iron oxide nanoparticles (SPIONs), encapsulate them inside hollow polymer particles to form polymer/SPION nanorattles. The process is based on our established polymer encapsulation technology using macro-RAFT copolymers as stabilizers. Furthermore, we will explore the ability to grow hydrophobic polymer bulges onto the nanorattle surface to produce complex Janus polymer/SPION nanorattles. Both nanorattles and Janus nanorattles are hollow structures and therefore ideal candidates for cell labelling and drug delivery.

**CL9**

**Dr Maarten Danial**

CSIRO Manufacturing

*Polymers with triple activity against HIV*

Here we present a novel library of polymers that exhibits activity against HIV via three independent mechanisms. The polymers were synthesized via RAFT polymerization and comprise sulfonate side chains as well as pendent self-immolative linkers that permits glutathione mediated release of 3TC, a reverse transcriptase inhibitor. We demonstrate that the polymers can act as (i) an entry inhibitor, (ii) a kinase-independent reverse transcriptase inhibitor mediated by the anionic character of the polymers, as well as (iii) a kinase-dependent reverse transcriptase inhibitor mediated by the release of 3TC. The polymer therapeutics described are envisioned to counter the emergence of resistant HIV strains by providing simultaneous pressures against viral proliferation. The polymers exhibit no cytotoxicity against human T-lymphocytes and epithelial cells and can easily be formulated as a gel and therefore make excellent candidates as virustats that prevent mucosal transmission of HIV.

**CL10**

**Dr Siti Fairus**

Universiti Kebangsaan Malaysia

*Properties and Potential Applications of Modified Liquid Natural Rubber*

Natural rubber (NR) has been widely used in industries, owing to its superior tensile strength, excellent elasticity and waterproof nature. However, due to the large amount of double bonds in its chain structure, NR is susceptible to oxidative and thermal degradation thus limiting its applicability. Low-MW NR can be easily modified into various useful products. For example, liquid natural rubber (LNR), short polymeric chains and molecular weight lower than 105. LNR is more advantageous than NR because it makes chemical modifications possible. In order to improve the thermal stability of LNR, chemical modification can be performed to produce highly saturated LNR. In this research, we have carried out number of modification including hydrogenation, oxidation, hydroxylation and fluorination. The desired product of the modification reaction should withstand high temperature conditions and therefore could be used in various applications, such as in rubber blending and hydrophobic surfaces.

**CL11**

**Dr Olivier Bertrand**

Université catholique de Louvain

*Polymers bearing TEMPO radicals: synthesis and redox controlled stimuli-responsive behavior*

Here, we show the thermo-responsive upper critical solution temperature (UCST) behaviour of a nitroxide containing polymer based on TEMPO. The polymer is synthesised via the single electron transfer-living radical polymerization (SET-LRP) of a precursor monomer 2,2,6,6-tetramethylpiperidin-4-yl methacrylate (TMPM). The control behaviour of the polymerisation is demonstrated and the synthesis of functional block copolymers is investigated with 3-azidopropyl methacrylate (AzPMA). The TMPM containing (co)polymers are oxidised to produce electro-active poly(TEMPO methacrylate) (PTMA). It is demonstrated that PTMA exhibits a UCST-type cloud point temperature in alcohol-water mixtures that can be tuned by an external electrical stimuli. The reversible redox response of PTMA is used to tune the thermo-responsive behaviour of the polymer. The effect of the oxidation extent in PTMA on UCST is demonstrated and a correlation between the chemical and electrochemical oxidation is presented.

**CL12**

**Dr Florence Gayet**

Laboratoire de Chimie de Coordination

*Tailor-made core-shell nanoreactor for biphasic catalytic application*

In this work latexes synthetized by a straightforward RAFT emulsion polymerization technology have been studied. These tailor-made hydrosoluble nanoreactors consist of an hydrophilic shell and a reticulated hydrophobic core containing covalently bound tris(aryl)phosphines.

Those nanoreactors have been used to perform the Rh-catalyzed biphasic hydroformylation of 1-octene as they offer the possibility of ligand immobilization for catalyst recovery and recycling.

After the presentation of the synthesis of various latex architectures, we will also illustrate the effect of the polymer architecture (ligand nature, core size, nature of crosslinking) and of the stirring rate on the catalytic performance and catalyst leaching. We will also present NMR and DLS investigations of precatalyst coordination and interparticle metal migration, after core swelling with toluene, at both natural (ca. 5) and strongly basic pH (13.6)

**CL13**

**Dr Laetitia Mespouille**

University of Mons (UMONS)

*From reactive microgels to injectable materials : the potential of click chemistry*

Injectable polymer networks are gaining increasing attention as scaffolds for drug release or tissue engineering owing to their ability to fill ill-defined locations upon injection. In that context, doubly crosslinked microgels (DX gels) appear as a highly interesting candidate as primarily crosslinked microbeads can be injected with a reactive crosslinker to generate in situ macroscopic networks filling and fitting cavities at perfection to optimize their action. Compared to other injectable networks, this new class of injectable hydrogels offers a better tuning of hydrogel hierarchisation, swelling and mechanical properties. However, these DX gels are mainly obtained by radical coupling of vinyl functionalized particles, making this gelation mechanism inconvenient for in vivo applications. Herein, we describe a new approach towards DX gels synthesis by using the ultrafast triazolinedione (TAD)-based click reaction to promote the formation of DX microgel networks.

**CL14**

**Dr Tom Wilks**

University of Warwick

*New methods for the creation of DNA-polymer conjugates using RAFT polymerisation*

DNA-polymer conjugates were synthesised using copper catalysed azide-alkyne cycloaddition (CuAAC) and a variety of hydrophilic and –phobic polymers, including poly(styrene), in yields ranging from 75-95 %. The optimised conditions were effective in slightly hydrated organic solvents and at low DNA concentrations. We used this system to create DNA-polymer conjugates that could form higher order structures using either segment. The DNA strand was designed such that it could form part of a DNA tetrahedron, and poly(N-isopropylacrylamide) was used as a responsive polymer that aggregates at high temperatures. We showed that the DNA strand attached to the polymer was still able to form the tetrahedron, and that when heated these tetrahedron-polymer conjugates were able to act like ‘giant’ surfactant molecules to stabilise the formation of large, well-defined nanoparticles, which were studied by DLS, AFM and cryoTEM.

**CL15**

**Dr Ana Sousa-Herves**

Instituto de Investigaciones Químicas (IIQ).

*Polymeric Glyconanogels as Inhibitors of Lectin-Mediated Viral Infections*

Carbohydrate-protein interactions mediate many biological processes including tumour progression, inflammation, and viral infection. These interactions are typically characterized by a high selectivity and a low affinity, which is compensated in Nature by multivalency.

In this communication, we will report the synthesis and characterization of multivalent glyconanogels prepared from FDA-approved Poly(ethylene glycol) (PEG). The nanogels display multiple mannose moieties and have been designed to interact with the cellular receptor DC-SIGN by mimicking viral structures. DC-SIGN is a lectin that recognizes highly mannosylated glycoproteins, and is known to play a key role in the initial stages of many viral infections, including HIV and Ebola virus. Finally, infection assays performed with an artificial Ebola virus demonstrated the potent antiviral activity through specific DC-SIGN recognition of the glyconanogels.

**CL16**

**Dr Vien Huynh**

KCPC, The University of Sydney

*Polymer Coating of Hybrid Magnetic Nanoparticle-Reduced Graphene Oxide Composite via RAFT-mediated Emulsion Polymerization*

Magnetic nanoparticle (MNPs)/reduced graphene oxide (rGO) composites were prepared when iron salts were used to reduce GO. This process led to high loadings of chemically anchored MNPs on the rGO sheets. MNP loadings could be varied by changing the amount of ion salts added. Successful polymer coating of the composites via RAFT-mediated emulsion polymerization was achieved. Poly(allylamine hydrochloride) was initially used to alter the charge on the surface of the composites and enhance the adsorption of negatively charged macro-RAFT copolymers onto the surface. Macro-RAFT copolymers of acrylic acid, butyl acrylate and sulfonated monomer stabilized MNP/rGO was coated by starve feeding a mixture of methyl methacrylate and butyl acrylate. The process yielded uniform polymer-coated MNP/rGO with a shell thickness that could be tailored by varying the amount of monomer fed. The polymer coated MNP/rGO maintained their magnetic character and formed stable dispersions in a range of solvents.

**CL17**

**Professor Peter Wich**

University of Mainz

*Biopolymer-based Nanoparticles: Dynamic Materials for Drug Delivery*

Biopolymers, such as polysaccharides and proteins show a remarkable versatility as multifunctional materials for therapeutic applications. They can be easily modified with the toolkit of bioorganic chemistry and are particularly attractive because of their degradability and biocompatibility.

We present a chemical modified polysaccharide (acetal-modified dextran) that can be formulated into nano- und microparticles using a variety of common emulsion-based techniques. It is possible to encapsulate and deliver proteins, DNA and RNA, as well as small hydrophobic drugs.

We also present a new universal approach for the preparation of protein-based nanoparticles. The technique allows the use of solvent evaporation techniques for the formation of nanoparticles without denaturation or crosslinking of the proteins. The material has low toxicity at high concentrations and successfully delivers drugs, for example chemotherapeutics to cancer cells.

**CL18**

**Dr Tushar Borase**

Monash University

*Polypeptide nanoparticles for ocular drug delivery*

Polypeptides are ideal materials for ocular drug delivery vehicles due to their bio-compatibility and biodegradability. Polypeptides of desired molecular weight possessing tunable properties, can be synthesized from amino acid building blocks in a controlled manner using ring-opening polymerization (ROP) of N-carboxyanhydride (NCA) monomers. In this work, peptide-based nanostructures for ocular drug delivery have been prepared from polypeptides which were synthesized by controlled ROP of NCAs, using modified previously described procedures.

**CL19**

**Dr Haritz Sardon**

University of Basque Country UPV/EHU

*Towards more sustainable synthesis of polyurethanes*

Polyurethanes (PUs) constitute one of the most important classes of polymeric materials with applications ranging from high-performance structural applications to foam padding. Due to their extreme utility and relatively low cost, these materials account for nearly 5 wt % of total worldwide polymer production and are expected to exceed 18 kilotons annually by 2016. From a green and sustainable chemistry standpoint, the current challenge in the polyurethane’s industry is to switch to more greener approaches for the polyurethane production. Critically, important highlights for the future of polyurethanes will be the utilization of more benign organocatalysis instead of conventionally used tin-based catalyst, the move from toxic isocyanates to isocyanate free approaches, to replace petroleum-based reagents with biobased and/or to make the transition from organic solvent-based to water-based PUs.

**CL20**

**Dr Nicolas Barry**

University of Warwick

*From (medicinal) inorganic chemistry to materials chemistry*

The ability to control single-atom dynamics on surface could revolutionize the design of the next generation of electronic and functional nanodevices. Currently, capturing the dynamics of single-atoms on graphenic materials is an experimental frontier because of their fast motion on such surfaces, and the formation of nanocrystals cannot be controlled at the level of individual atoms. In this presentation, we will show how, starting from the design of metallated particles for biological applications (by combining unusual ligands, precious metals and polymers), we developed a synthetic strategy for assembling, atom-by-atom, metal nanocrystals of defined size. Experimental insight into the dynamics of nanocrystals and pathways for their assembly from single atoms will be described, and the extent to which this technology can be generalised to a wide variety of metals and dopants will be discussed.

**CL21**

**Dr James A. Wilson**

University of Akron

*N-carboxyanhydrides for bone growth repair*

The ring-opening terpolymerisation of the N-carboxyanhydrides (NCAs) alanine-NCA, tyrosine-NCA and phenylalanine-NCA has been investigated as an alternative to poly(1-PHE-6) polyester ureas for use in bone growth repair. Whilst modified poly(1-PHE-6) has been demonstrated to assist in bone growth repair, degradation by-products contain carboxylic acid groups known to cause inflammation on the surrounding tissue. Hence, the use of a controlled molecular weight polypeptide material analogous to poly(1-PHE-6) is studied in order to avoid inflammation as well as optimise mechanical properties. The use of functionalised NCAs for post-polymerisation modification is also investigated as a means to incorporate bone growth peptides on the active surface of the implant.

**CL22**

**Dr Mona Semsarilar**

Institut Européen des Membranes

*Functional Membranes from Block Copolymers*

Smart membranes, able to perform with high efficiency while minimizing energy consumption or respond to their environment, to avoid fouling for example, are in high demands to answer the needs of a growing global population. One of the most recent preparation methods of such smart membranes is the assembly of copolymer micelles.

Here we report a novel strategy to assemble nanostructured membranes from block copolymer assemblies, so that the free volume between the micelles arrays form nano-pores. Di- and triblock copolymers of different compositions were synthesized using controlled radical polymerization techniques and then self-assembled at high concentration via solvent evaporation. The progressive decrease of the intermicellar distance results in the in-situ formation of a porous membrane able to respond to external stimuli. This work highlights an original strategy to control membrane pore size and provides new insights towards the design of smart membrane systems.

**CL23**

**Dr Efrosyni Themistou**

Queen's University Belfast

*Functionalised Poly[oligo(ethylene glycol) methacrylate]-based Nanostructures for Biomedical Applications*

PEG-based nanostructures are commonly used for various biomedical applications, ranging from intracellular delivery of therapeutic agents to tissue engineering. Herein, we explore the preparation of various PEG-based nanostructures, such as amphiphilic block polymer vesicles, polymer networks, and star polymers. Biocompatible water soluble poly[oligo(ethylene glycol) methacrylate] macro-molecular chain transfer agents are utilized in RAFT polymerisations. Hydrophobic monomers are used for chain extension of POEGMA by RAFT or ROP, leading to the formation of amphiphilic block copolymers that can self-assemble to polymer vesicles in water. For the synthesis of star polymers and polymer networks, degradable cross-linkers are used to connect the linear POEGMA chains. Biologically important molecules are chemically attached to nanostructures containing functional groups. The polymers were characterised by NMR and GPC. The formation of the nanostructures was confirmed by microscopy and DLS.

**CL24**

**Dr Elisabeth Garanger**

Laboratoire de Chimie des Polymères Organiques (LCPO)

*Side-chain modification and self-assembly of recombinant elastin-like polypeptides (ELPs)*

While structure-property relationships are tricky to establish with polydisperse natural or synthetic polymers, such studies are more reliable with recombinant polymers that are strictly monodisperse in terms of chain length and monomer sequence. An extensive physico-chemical study achieved on a series of recombinant ELPs allowed us to better understand their temperature-triggered self-assembly and to correlate characteristic dimensions of ELP chains with micelles. Because tuning ELP’s LCST has usually been achieved by the design of different protein sequence, involving tedious molecular cloning steps, our group also explores orthogonal ligation strategies to chemoselectively modify the guest residue X of ELP’s pentapeptide repeat units (VPGXG) in order to introduce various chemical groups and modify the solubility/hydrophobicity of the ELP backbone. Such strategy can also be used to conjugate biologically relevant motifs conferring specific bioactive properties to ELPs.

**CL25**

**Dr Benjamin Chalmers**

National University of Ireland

*Synthesis of N-[(cycloamino)methyl]prop-2-enamides and Aqueous RAFT-Polymerization of this New Monomer Class and their Heterocyclic Salts*

Reports of polymerization of N-[(cycloamino)methyl]prop-2-enamides are scarce in the literature, presumably due to the absence of reliable methods of monomer preparation. The acrylamide and methacrylamide analogues contain N-methyl nitrogen heterocyclic groups, which are sensitive to pH. The following presentation details the first reliable synthesis of this monomer class, and subsequent aqueous conventional radical polymerization. RAFT in water has allowed the synthesis of multi-block copolymers in one-pot from several different types of acrylamide monomer featuring different heterocyclic groups. Hydrophilic polymers are converted to amphiphilic block copolymers using chain extension with hydrophobic acrylamide monomer. Acid-sensitive micelles are harvested.

**CL26**

**Dr Chaoying Wan**

International Institute for Nanocomposites Manufacturing, WMG, University of Warwick

*A facile core-shell strategy towards high performance energy storage devices*

The facile synthesis of cyclomatrix organophosphazenes (OPZs) has triggered the production of core-shell materials, suitable for a wide range of applications. Under optimized conditions, the crosslinking of hexachlorocyclotriphosphazene with a diphenol, such as 4,4’-sulphonyldiphenol can produce a highly cross-linked hybrid shell on the surface of various nano- and micro-sized particles. A further carbonisation treatment leads to a transition from OPZ-shell to mesoporous carbon shell with highly intrinsically heteroatom-doping. In addition, the abundant surface hydroxyl groups of OPZ-shell can be further functionalized with initiators for a second polymer functionalisation through surface-initiated controlled free-radical polymerisation techniques, e.g., RAFT or ATRP. Some recent research results are presented here to demonstrate the versatility of the OPZs chemistry as a facile and scalable core-shell technology for energy storage applications

**CL27**

**Dr Fiona Hatton**

University of Sheffield

*Grafting-from cellulose via photoinduced Cu-mediated reversible-deactivation radical polymerisation*

The modification of cellulose through polymer grafting is highly desirable. Whilst cellulose is renewable and exhibits excellent mechanical properties, disadvantages mainly stem from its hydrophilic nature, resulting in limited barrier properties and poor miscibility with hydrophobic polymer matrices.

Here, the modification of cellulose has been accomplished by covalent grafting via a grafting-from method. We demonstrate the surface initiated polymerisation of methyl acrylate (MA) from filter paper (FP) and cellulose nanocrystals (CNC) applying the recently reported photoinduced Cu-mediated RDRP technique, first described by Anastasaki et al. in 2014. Initial experiments with FP proved successful, and the polymerisation of diethylene glycol acrylate inferred thermoresponsive behaviour to the FP. Utilising the same technique with CNCs resulted in high grafting amounts in short reaction times. Polymer-grafted CNCs may have potential in nanocomposite and emulsion applications.

**CL28**

**Dr I Martín-Fabiani**

University of Surrey

*Water Barrier Properties of Films Made from Particles Using a Modified Polymerisation-Induced Self-Assembly (PISA) Process*

The presence of surfactants in latex films causes detrimental effects on water permeability and adhesion. Here, we report the synthesis of surfactant-free latex particles, using hydrophilic macromolecular RAFT agents (macroRAFTs) in water. In a Polymerization-Induced Self-Assembly (PISA) process, macroRAFTs can act as stabilizers during emulsion of acrylic monomers to obtain self-stabilized particles. Our results show that films made from these particles have lower water vapour sorption and liquid water uptake than conventional latex films made via conventional emulsion polymerization. NMR relaxometry allowed us to determine the degree of water confinement within soaked coatings. Notably, both the use of a less hydrophilic macroRAFT and a slight reduction in its content have a strong and positive impact on the barrier properties. The results presented here provide evidence for the potential of self-stabilized latex particles for the development of new waterborne protective coatings.

**CL29**

**Dr Julien Poly**

Institut de Science des Matériaux de Mulhouse (IS2M)

*Recent developments in the field of light-controlled radical polymerizations*

The introduction of light as an external stimulus in controlled radical polymerizations has been extensively studied in recent years, due to the supplementary advantages that it can bring, such as temporal and spatial controls. Two mechanisms recently developed in our group will be presented.

The first one is a photocatalyzed ATRP involving a Cu-based complex with phenanthroline ligands. The mechanism involves the excited state derived from the activator form of the complex, which is original for a photocatalyzed Cu-based ATRP.

The second one is based on a RAFT mechanism. Before being considered as RAFT agents, several compounds were already commonly used as photoiniferters. We report the use a RAFT agent designed to exploit this dual reactivity, leading to an efficient photoRAFT.

Narrow polydispersities were reached in both cases for methacrylates or acrylates using soft LED. Additionally, an efficient temporal control was achieved by simply switching on/off the light source.

**CL30**

**Dr Johannes C. Brendel**

University of Warwick

*Efficient Polymer Coupling Based on a Click-Addition Cascade*

Controlled radical polymerisation methods and click chemistry uniquely complement one another to create a versatile toolbox for creating exceptional and demanding polymer architectures. However, the incompatibility of the often reactive groups with the conditions in radical polymerisation techniques still remains a challenge. Instead of a direct polymerisation, we demonstrate that the combination of RAFT and isocyanate-amine chemistry enables the introduction of active groups such as azides and strained alkynes without the need of purification of the polymers. Subsequently these polymers can be used for modification of peptides or to create block copolymers in high yield. The orthogonality of the applied addition reactions, especially towards residual monomer and the RAFT end group, offers access to functional and challenging polymer architectures without need for stringent reaction conditions or laborious intermediate purifications.

**CL31**

**Dr Vinh Truong**

Monash University

*Light responsive hydrogels for bioengineering applications*

In this talk, our state-of-the-art emulsion polymerization techniques that allows control over the size, shape, surface, and core of nanoparticles will be presented. These synthetic techniques have many advantages: (i) rapid polymerization; (ii) nearly complete conversion; (iii) minimal side reactions; (iv) ultra-high molecular weight; (v) narrow distributions of molecular weights and particle sizes; (vi) high solids content; (vii) excellent stability; (viii) precise control over both molecular weight and particle size; (ix) various and uniform morphologies; (x) modifiable surfaces; and (xi) tunable cores. Although challenges still remain, the emulsion polymerization techniques presented in this talk mark significant steps forward in the synthesis of polymeric nanoparticles with tunable size, shape, surface, and core, opening the doors to a variety of potential applications.

**CL32**

**Dr Dosu Malomo**

Federal University Oye-Ekiti, Nigeria

*Preparation and properties of NR based Ebonite Rubber suitable for use as Engineering material*

The preparation of various samples of ebonite vulcanizates and their physic of mechanical properties have been investigated using standard methods. This work explores the production of ebonite dust, production of ebonite vulcanizates and investigation of the characterisation of the ebonite. Five different ebonite materials - labelled A,B,C,D and E with sulphur content in parts per hundred grams if rubber (Phr) of 32,34,36,38 and 40 respectively were produced. The physico- mechanical properties carried out were tensile strength, hardness and abrasion resistance. The tensile strength (MPa) for sample A, B, C, D and E were 5,6,3,5,4.7,1.7 and 2.0 respectively and the hardness (IRHD) being 63,64,65,70 and 82. The results show that the preparation of ebonite from natural rubber as a base polymer is feasible considering the results of characterisation obtained.

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**CL33**

**Dr Simon Bassett**

The University of Nottingham

*Solvent-Free, Low-Temperature Synthesis of Poly(lactic acid): Stereocontrolled Ring-Opening Polymerisation of DL-Lactide in Supercritical Carbon Dioxide*

Poly(lactic acid) (PLA) has received significant attention due to its tuneable physical properties, biodegradability and derivation from renewable resources. However, a major barrier to commercialising PLA are the high temperatures (>130 °C) required for melt polymerisations. By using CO2 (240 bar) as a processing medium, we have shown the viscosity of PLA can be significantly lowered, allowing the melt polymerisations to take place at only 80 °C. This has advantages in reducing energy costs and minimising transesterification. Furthermore, novel stereoselective zirconium alkoxide initiators,(1) often deactivated at high temperatures, can be implemented in a solvent-free synthesis. Control over the PLA microstructure has been demonstrated, producing highly heterotactic PLA (Pr>0.8) from a racemic mixture of L and D lactide. This lower temperature, solvent-free route opens up the possibility of using other novel catalysts under industrially relevant conditions.

**CL34**

**Dr Anaïs Pitto-Barry**

University of Warwick

*Semi-crystalline polymeric cylindrical nanoparticles and their core functionalisation by photo-initiated thiol-ene radical reactions*

There is great interest in the preparation of functional nanomaterials, which often requires chemical modification. This can be achieved by modification of the precursor amphiphilic polymers followed by self-assembly or by direct functionalisation of the self-assembled nanostructures.

We report the crystallisation-driven self-assembly of a triblock copolymer of tetrahydropyran acrylate, 5-methyl-5-allyloxycarbonyl-1,3-dioxan-2-one and L-lactide synthesised by sequential ring-opening and reversible addition-fragmentation chain transfer polymerisation. These cylindrical micelles bearing an acrylic acid corona-forming block are further functionalised by thiol-ene reaction without morphology disruption, thus allowing the addition of a small hydrophobic molecule to the hydrophobic core. The combination of the CDSA process and the post-self-assembly loading opens up new pathways for the delivery of hydrophobic drugs via robust micellar carrier.

**CL36**

**Dr Karin Odelius**

KTH Royal Institute of Technology

*Precision Synthesis and Architectural Design of Functional Degradable Polymers*

Advances in the precision synthesis of aliphatic polyesters and polycarbonates have led to an array of available materials with specific properties, some which carry pendant functionality. Focus here is on the synthesis and use of functional and biobased monomers followed by their controlled ring-opening polymerization using organic catalysts to predefined architectures. One example is the facile and benign monomer synthesis of an allyloxy-functional 6-membered carbonate via ring-closing depolymerization. The monomer was subsequently used as a model for the temperature-dependent ring-opening polymerization of carbonates and lactones to a well-defined and functional multiblock copolymer in a short time span. Another example is the use of 5-membered and functional lactones that depending on the nature of their functionality can be copolymerized with other lactones to statistically branched structures or to linear polymers with active sites for e.g. controlled radical polymerization.

**CL37**

**Dr Dr Tim Dargaville**

Queensland University of Technology

*Hydrogels Containing Hierarchical Structures Based on Poly(2-oxazoline)s and Related Polymers*

Biomaterials based on hydrogels are ideal substrates for extra-cellular matrices due to their high water content. However, one of the great challenges hindering the use of hydrogels is reproducing the transport properties found in natural tissue with hierarchical features such as vascularisation. To address this, we have used a process of melt electrospinning writing using polycaprolactone to create 3-dimensional layers of sacrificial fibres and encapsulated these within hydrogel networks. Subsequent dissolution of the fibres results in a network of porous channels in the image of a negative copy of the sacrificial template and not achievable using other methods for introducing porosity. The hydrogels used for this study are based on poly(2-alkyl-2-oxazoline) synthesized from copolymerization of methyl-2-oxazoline and unsaturated alkyl-2-oxazolines followed by thiol-ene photocrosslinking under aqueous conditions.

**CL38**

**Mr Pietro Buono**

Luxembourg Institute of Science and Technology (LIST)

*Synthesis of novel silylated lignin and its incorporation in low density polyethylene matrix*

Among biomass components, lignin is one of the most promising biopolymers suitable for the conversion of biomass into renewable added-value chemicals and materials. However, only a small amount (e.g. 2%), is exploited in the polymers industry, beacause the presence of sulphur moieties, large molecular diversity and poor compatibility with polymer matrices. In this context, by taking advantage of a sulphur free and low molecular weight soda lignin, for the first time a silylated lignin (Si-L) was synthesized. It was characterized by 1HNMR, 31PNMR, FTIR, SEC, DSC, TGA and its hydrophobicity evaluated through contact angle and solubility tests in organic solvents. Si-L were then blended with polyethylene (PE), and injection molded materials were analyzed with tensile tests, DMA, DSC and Scanning Electron Microscopy. This study reveals the higher compatibility of Si-L with PE and hence the great potential of the silylated lignin for a use as additive in apolar polymer matrices.

**CL39**

**Mr Vincent Tan**

University of New South Wales

*Polymeric hydrogels used as an extracellular matrix mimic for 3D cell culturing*

In this body of work two possible routes of forming ECM mimics via hydrogels are provided. In one body of work a block copolymer of oligo(ethylene glycol) and allylacrylamide is crosslinked with bisthiol oligo(ethylene glycol) in the presence of eosin-Y (photocatalysis), under the presence of visible light (515 nm). Another body of work uses simple “off the shelf” chemicals are used to make form consistent hydrogels with similar mechanical properties, while allowing the incorporation of biomolecules and motifs. By using borax as a crosslinking agent the hydrogel provides a self-healing property which allows the formation of multi-layer hydrogels, consisting of different properties

**CL40**

**Mr Daniel Crisan**

University of Birmingham, University of Santiago de Compostela

*Poly(acryloylhydrazide) as a scaffold for modulated siRNA Delivery*

Platforms for the rapid screening of polymers with biological purpose are required to speed up the discovery process. At the current time, it is still difficult to synthesise libraries of polymers with different chemical compositions but with consistent polymer backbone and chain length. To address these issues we have synthesised poly(acryloyl hydrazide) as a scaffold for its straightforward functionalization with aldehydes to afford amphiphilic polymers that could be in situ screened for the modulated transport of nucleotides across lipid membranes. Optimisation of these modulated amphiphilic polymers can be performed in aqueous conditions and without purification, minimising the synthetic effort and time required to identify novel candidates for polynucleotide delivery. This versatile technology allowed the rapid identification of a single component formulation for the delivery of siRNA with performances comparable to one of the best commercial reagents (lipofectamine RNAiMAX).

**CL41**

**Dr Dr.ir. Henk Huinink**

Eindhoven University of Technology

*Water and ion diffusion in nylon-6; the impact of plasticization*

Nylon-6 is semi crystalline polymer that due to its amide-bond strongly interacts with water. Water only enters the amorphous phase. At low relative humidity (RH), single water molecules bind to the amide moiety. Above a certain RH clusters of water form. Due to water binding, the H-bonds between the polymers are disrupted leading to a softening of the amorphous phase. With GARField NMR depth profiling we have studied the combined process of diffusion and plasticization of the nylon matrix. It is shown that plasticization lags behind the water diffusion front in the matrix. Relaxation experiments on samples completely saturated with water demonstrate that the amorphous phase is heterogeneous and only a small fraction is plasticized significantly. Experiments with MnCl2 solutions show that ion diffusion in the matrix is facilitated by the presence of water.

**CL42**

**Dr Gerald Lopez**

Institut Charles Gerhardt Montpellier (ICGM)

*From Telechelic Perfluoropolyethers to High-End Materials*

Perfluoropolyethers (PFPEs) are a unique class of polymers endowed with atypical properties such as high chemical inertness, good oxidative and thermal stability. PFPEs are also known to exhibit a very low glass transition temperature (generally lower than -60 °C) because of the high mobility of the C-O-C ether bonds present along the backbone. This feature allows them to exhibit a liquid-phase behavior over a wide range of temperature. Due to this outstanding physicochemical behavior, PFPEs are likely to play a key role in high technology applications (e.g. flexible dielectric substrates exposed to harsh environments in the aircraft industry). This talk aims at presenting the synthesis and the physico-chemical characterizations of new PFPE-based fluoropolymers obtained by thermally activated alkyne-azide polymerizations. The physico-chemical properties of the obtained materials are easily tunable depending on the nature and the ratio of the initial components of the formulations.

**CL43**

**Dr Claudia Conte**

University of Nottingham

*Novel bioresponsive polymeric nanoparticles for the combined therapy of lung cancer*

Redox-responsive polymeric nanoparticles (NPs), based on biodegradable polyethylene glycol-poly(lactic-co-glycolic acid) block copolymers, have been developed and their potential for the combined therapy of lung cancer has been investigated.

Bioreducible block copolymers were synthesized by Ring Opening Polymerization and Michael Addition and finally employed to prepare NPs.

Spherical NPs of around 100 nm able to entrap both lipophilic and hydrophilic drug models were obtained. In particular, docetaxel (DTX) was selected as anticancer drug and loaded into NPs. NPs showed a long term stability in the most relevant biological fluids, thus disassembling and completely releasing the drug cargo at simulated reductive intracellular environment. DTX-loaded NPs were rapidly uptaken by lung cancer cells, thus inducing a dose- and time- dependent cytotoxicity.

For a synergic anticancer therapy, the co-delivery of DTX with different anticancer molecules is currently being explored.

**CL44**

**Dr Garbiñe Aguirre**

Université de Pau & Pays Adour

*Smart microgels and films as cosmetic active molecules carriers*

Nowadays, the design of innovative delivery systems (DSs) is driving the new product development in the field of cosmetic. Among different DSs, dual stimuli-sensitive microgels have emerged as well-received ones. Thanks to their sensitivity to two external stimuli, small size, high porosity and capability to be functionalized, they offer more controllable DSs. In this sense, the most studied and applied microgels are those that are pH- and thermo-sensitive. Herein, using dual-responsive oligo(ethylene glycol)-based microgels recently developed,1 the encapsulation of different cosmetic active molecules (hydrophobic/hydrophilic) has been studied at different conditions (pH/temperature). Since these novel microgels are able to spontaneously form self-assembled microgel films, the encapsulation into them has been also studied. The in vitro release profiles of the microgels and films in response to pH and temperature changes have been analyzed.

1 Macromol. Rapid Commun. 2015, 36, 79.

**CL45**

**Dr Fabien Dutertre**

University of Bristol

*Structure and dynamics of dendronized polymer solutions: Gaussian coil or macromolecular rod?*

We investigate the conformation of well-defined dendronized polymers (denpols) based on poly(norbornene) (PNB) and poly(endo-tricycle[4.2.2.0]deca-3,9-diene) (PTD) backbones employing static and dynamic light scattering. Their synthesis by ring-opening metathesis polymerization (ROMP) led to fully grafted and high molecular weight denpols with narrow polydispersity. In dilute solutions, the persistence lengths were estimated by static (radius of gyration) and dynamic (translational diffusion) chain conformational properties of the denpols and were compared to their homologue precursor PNB. The conformation of denpols with a 3rd generation side dendron conforms to a semiflexible chain with a persistence length of about 6-8 nm, virtually independent of the contour length. The assumption of extremely high chain rigidity for this class of polymers is clearly not supported, at least for a 3rd generation dendron.

**CL46**

**Dr Stephanie Schubert**

Jena Center for Soft Matter

*Preparation and application of functional polymeric nanoparticles*

The development of functional polymeric nanoparticles is essential for breakthroughs in nanomedicine. By tuning the polymer characteristics and subsequently applying optimized formulations for the procedure of nanoparticles, tailored nanoparticles with varying release properties, degradation behavior, targeting groups and size distributions can be developed. For the preparation of polymeric nanoparticles, nanoprecipitation is a good choice since it is a facile, mild, and low energy input process. In combination with high-throughput devices such as microfluidics, pipetting robots, inkjet printers, and automated analytical instrumentation, the abilities of nanoprecipitation can broaden tremendously with significant effects on new applications. Selected examples in the field of gene- and drug delivery vehicles will be presented, e.g. dual pH-value and redox responsive nanoparticles based on a methacrylate copolymer library.

**CJ47**

**Simon Saubern**

CSIRO

*Forced gradient polymers in continuous flow reactors*

The preparation of forced gradient polymers has received considerable attention using batch reactors, while the preparation of usable quantities of forced gradient co-polymers using continuous flow reactors has been hampered by the need to vary the composition of the monomer feedstock continuously during the reaction.

A reactor that allows for addition of a monomer feedstock continuously at all points along the length of the reactor tubing would allow for the preparation of forced gradient co-polymers in continuous flow reactors, allowing for the scale-up and bulk preparation of these polymers.

We report here our initial investigation of preparing forced gradient co-polymers using the RAFT methodology in continuous flow reactors.

**CL48**

**Miss Elrika Harmzen**

Stellenbosch University

*Self-assembly of poly (styrene-co-divinyl benzene-co-maleic anhydride) nanoparticles for encapsulation mechanism and capsule formation*

Micro-scale compartments prepared using inverse Pickering emulsions as templates have a number of interesting uses, including the encapsulation of viable microbial cells within the membrane-bound water micro-droplets. Several novel applications for such systems are targeted in the pharmaceutical and food industries.

**CL49**

**Dr Lucy Weaver**

CSIRO

*Block versus statistical copolymers: solution properties and trends of stimuli-responsive polymers*

Elucidation of structure-function relationships is important for the rational design of advanced thermo-responsive materials. To determine this interplay between structure and function, the stimuli-responsive properties of two sets of polymers were studied. Using RAFT polymerisation, DEGMA was copolymerised with either MAA or DMAEMA to generate polymer pairs that consisted of a random copolymer and a di-block copolymer that contained very similar ratios of DEGMA to either MAA or DMAEMA. The stimuli-responsive properties of each copolymer were determined, and solution structures as a function of temperature were visualised via electron microscopy. Through a direct comparison of polymer structures with different chain composition (statistical vs. block) and side chain functionality (acidic vs. basic) with their corresponding temperature-induced solution properties, trends that may be used in the future design of such polymers for specific and targeted applications, were identified.

**CL50**

**Dr Alexandre Simula**

POLYMAT

*A new class of alkoxyamines for the (co)polymerization of methacrylates*

Reversible deactivation radical polymerisation enables the synthesis of well-defined polymers with various monomers and architectures. Among the plethora of polymerisation techniques, Nitroxide mediated polymerisation (NMP) offers a simple setup for the design of tailored copolymers with good tolerance over the monomer functionality. Nevertheless, the precise polymerisation of methacrylic monomers can be arduous depending on the selected alkoxyamine/nitroxide and reaction setup and extensive research has so far led to moderate success, as termination/elimination events usually are predominant. Herein, we present a new class of alkoxyamines which allows for the (co)polymerisation of methacrylates with good control over the chain end fidelity and molecular weight distribution.

**CL51**

**Dr Paco Fernandez-Trillo**

University of Birmingham

*Enzyme-Responsive Polyion Complex Nanoparticles for Antimicrobial Delivery*

Here we present new enzyme-responsive polyion complex (PIC) nanoparticles for the delivery of antimicrobials. Our efforts to optimise degradation kinetics, multivalency and charge density in our enzyme-responsive peptides will be described. Similarly, we will show how these enzyme responsive PIC nanoparticles are selectively degraded in the presence of P. aeruginosa elastase without being affected by other endogenous elastases. Moreover, this enzyme-responsive particles can exert an specific antimicrobial effect against P. aeruginosa without affecting non-pathogenic strains of these bacteria.

**CL52**

**Ms Penny J. Le**

University of Toronto

*Radioimmunoconjugates by Enzymatic Attachment of Metal-chelating Polymers to Antibodies*

Radioimmunoconjugates (RICs) consist of an antibody modified to carry radioisotopes, and are normally prepared by random modification of exposed amino acid side chains. Site-specific modification of an antibody that avoids altering its binding sites has improved targeting and increased tumour uptake. To study this effect in polymer-based RICs, we developed an enzyme reaction to modify antibodies with polymers at a single designated site. Enzyme reactive groups were introduced into both an antibody fragment and a metal-chelating polymer to enable a selective transamidation reaction catalyzed by microbial transglutaminase. Western blots of the reaction mixtures show that only antibodies with the enzyme reactive group reacted. These results suggest that the modification occurs only at the enzyme reactive group on the antibody. Our method allows us to study the effect of controlled antibody modification on tumour targeting, and will aid the development of RICs for cancer theranostics.

**CL53**

**Dr Julien Rosselgong Saint Amans**

LCPO (Laboratoire de Chimie des Polymères Organiques)

*Scaling up hemicelluloses production: a source of xylan-based building-blocks for functional biomaterials*

There is a growing interest in lignocellulosic biomass, which is a sustainable resource to produce fuels, chemicals, and materials. The most abundant hemicellulosic polymers are xylans accounting for 25-35% of the dry biomass of woody tissues.

This work aims at studying chemical modification through acidic hydrolysis of xylan from beechwood. More precisely, the sulfuric acidic hydrolysis leads to well-defined oligomers with an average of six xylose units per chain and with an aldehyde group at the reductive end. Reductive amination was used on the aldehyde functions of xylan derivatives to functionalize them, either with a double bond or with an azide function. Click chemistry will then open the route to macromolecular engineering and thus new opportunities to valorize this high potential bio-resource as functional materials. A scale up of the hydrophilic block will allow a potential large library of amphiphilic block copolymers to be made with different types of applications.

**CL54**

**Dr Maud Save**

CNRS - University of Pau

*Cationic thermoresponsive PVCL nanogels synthesized by emulsion polymerization from a reactive cationic macromolecular chain transfer agent.*

Thermoresponsive nanogels dispersed in water are fascinating cross-linked polymeric colloids which undergo a temperature-induced swelling-to-collapse volume phase transition (VPT). The incorporation of cationic moieties into the biocompatible poly(N-vinylcaprolactam) (PVCL) nanogels is interesting to promote their interaction with anionic bio-surfaces/molecules. In the present work, cationic core-shell PVCL nanogels are designed by surfactant-free emulsion polymerization. It is highlighted that the use of a reactive cationic polymeric stabilizer synthesized by RAFT polymerization allows for the synthesis of stable PVCL nanogels up to 10 wt-% of solid contents. This strategy offers the opportunity to introduce cationic polymer units while maintaining a sharp, reversible and constant VPT of the thermoresponsive nanogels. The cationic polyelectrolytes (SEC, AF4) and the colloidal features of the nanogels (DLS, TEM, NMR) are characterized in relationship with the synthesis parameters.

**CL55**

**Dr Tom Hasell**

University of Liverpool

*Porous inverse vulcanised polymers for mercury capture*

Heavy metal contamination exists in the waste streams of many industries, and mercury is of particular concern for human health. Sulfur is an industrial by-product, removed as an impurity in oil-refining. This has led to vast unwanted stockpiles of sulfur, and resulted in low bulk prices. Sulfur is therefore a promising alternative feedstock to carbon for polymeric materials. Inverse vulcanisation (Chung et al., Nat. Chem., 2013, 5, 518) has made possible the production of sulfur polymers, stabilised against depolymerisation by crosslinking. Supercritical CO2 can be used to foam inverse vulcanised polymers – making them porous (Hasell et al., Chem Commum. 2016, DOI: 10.1039/C6CC00938G). The high sulfur-foams show excellent potential as low cost water filters to remove Hg. Alternative monomers for inverse vulcanisation, and how they can be used to reduce the cost and improve the properties of the resultant polymers, will be discussed.

**CL56**

**Dr Jaroslav Mosnacek**

Slovak Academy of Sciences

*Oxygen tolerance in copper mediated photoATRP*

Atom transfer radical polymerization (ATRP) can proceed in the presence of limited amount of oxygen, when it is performed under ARGET conditions. In such system CuBr/ligand complex, after its oxidation by oxygen, can be continuously regenerated in situ by reducing agents until all oxygen in the system is consumed; polymerization can then proceed under typical ATRP conditions. In this contribution the studies performed in the presence of limited amount of air under conditions of photoATRP without addition of any reducing agent will be presented. The ligands have to be used in excess to copper catalyst in order to significantly shorter the induction period before starting the polymerization. Experiments showed also high livingness of the polymerization during chain extension performed without removing air from solvent and monomer.

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**CL57**

**Dr Yan Xiao**

East China University of Science and Technology

*Functional poly(&#949;-caprolactone) based materials for potentially biomedical application*

Approved by Food and Drug Administration (FDA), PCL has been extensively investigated for biomedical application due to its excellent biodegradability, biocompatibility, mechanical properties, non-cytotoxicity and permeability to a wide range of drugs. However, PCL degrades extremely slow in vitro and in vivo due to its high hydrophobicity and crystallinity. Moreover, the lack of pendant reactive functional groups to which bioactive compounds can be covalently attached has severely limited its biomedical application. In our study, different pendant groups including methyl, carboxyl and amine were successfully introduced onto the PCL backbone with the aim for developing biomaterials with desired properties. Two examples will be illustrated as follows.

**CL58**

**Dr Tara Schiller**

Warwick University

*Synthesis of Polymeric microcapsules by interfacial cationic photopolymerisation of divinyl ether monomer in aqueous suspension.*

We have synthesised microcapusles using cationic photopolymerisation with a less hydrophobic monomer than previously used. In our study we proposed a modification of the classical emulsion polymerization since we polymerized triethylene glycol divinyl ether (DVE3). Since the DVE3 was not hydrophobic, n-hexadecane was used to generate an oil-water interface, where the monomer can polymerize. The triarylsulphonium salt, used as cationic photoinitiator, posses aryl groups which impart sufficient lipophobic character allowing the photoinitiator to be readily soluble in the oil phase, remaining insoluble in the water suspending medium. The work presented will show the study of these materials through SEM, TEM and SAXS.

**CL59**

**Dr Matthias Haussler**

Clariant Produkte GmbH

*RAFT Polymers for Specialty Polymer Applications*

Controlled radical polymerisation protocols such as RAFT and ATRP give access to unprecedented control over the structure of the target polymer material allowing to optimise products and their performances. This talk will give an industry perspective on important factors such as cost and production requirements to be met for a wide industrial implementation. Example of some specialty polymer applications will be given as well.

**CL60**

**Dr Paul D. Thornton**

University of Leeds

*The Creation of Biodegradable Drug Delivery Vehicles by N-Carboxyanhydride Ring-Opening Polymerisation*

N-Carboxyanhydride ring-opening polymerization (NCA ROP) is a synthetically straightforward methodology to generate poly(amino acid)s. We report two examples of NCA ROP being utilised to yield highly-effective controlled release/drug delivery vehicles:

1) The direct grafting of amphiphilic macromolecules by sequential NCA ROP from a therapeutic initiator to enable the formation of monodisperse, enzyme-degradable and drug-containing particles. Post-synthesis drug loading is negated and payload release only occurs upon targeted polymer hydrolysis.[1]

2) The synthesis of a graft copolymer containing hydrolytically susceptible ester bonds that is capable of gelating edible safflower oil. The thermoresponsive organogel formed, which is non-cytotoxic, is a promising candidate for the delivery of hydrophobic agents within acidic environments, such as cancer tumour sites.[2]

1. Khuphe et al. Chem. Commun. 2015, 51, 1520-1523.

2. Khuphe et al. Soft Matter, 2015, 11, 9160-9167.

**CL61**

**Dr S Israel**

Technion - Israel Institute of Technology

*Carbons with Hierarchical Porous Structures through the Pyrolysis of Hypercrosslinked Emulsion-templated Polymers*

Porous carbons with hierarchical porous structures combining microporosity, mesoporosity, and macroporosity, should have highly accessible porous infrastructures that would be advantageous for "green" energy-storage applications. PolyHIPEs are porous polymer monoliths synthesized within high internal phase emulsions (HIPEs), emulsions in which the dispersed phase occupies more than 74% of the volume. In this research, hypercrosslinking was used to introduce microporosity into the polyHIPEs. These microporous polyHIPEs were then used as templates for the generation of carbons with hierarchical porous structures. The polyHIPEs were based on vinylbenzyl chloride, styrene, and divinylbenzene. Hypercrosslinking produced polyHIPEs with specific surface areas (SAs) of up to 1650 m2/g. Pyrolysis of the hypercrosslinked polyHIPEs produced carbon monoliths with SAs of up to 550 m2/g. Porogens were introduced into the polyHIPEs to enhance porosity, producing carbons with SAs of up to 800 m2/g.

**CL62**

**Dr J Burns**

Syngenta

*TBC*

**CL64**

**Dr Anders E. Daugaard**

Technical University of Denmark

*Selective distribution of enzymes in a microfluidic reactor*

Off stoichiometric thiol-ene mixtures are well suited for preparation of microfluidic devices with highly functional surfaces. Here a two stage process employing first thiol-ene chemistry (TEC) to prepare two opposite parts of a microfluidic system with a 30x30 mm reactor and subsequently a thiol-epoxy bonding was used to prepare a fully sealed microfluidic system. The reactor was surface functionalized in-situ with allyl glycidyl ether in different patterns (half-reactor, full-reactor, checkerboard structures) on the surface to provide a controlled distribution of epoxides. The method additionally enables the selective immobilization on either top-side or bottom-side or both sides of the reactor. Thereafter horseradish peroxidase was immobilized on the surface and activity tests illustrated how this distribution of the enzyme on the surface could be used to optimize the activity of the enzyme. The results were corroborated by CFD simulations.

**CL65**

**Dr Adam Blanazs**

BASF

*“We Create Chemistry”: Advanced Materials & Systems Research at BASF, a World beyond Plastics*

BASF was founded over 150 years ago and has grown to become one of the largest chemical companies in the world, with 112,000 employees and sales of €70.5 Billion in 2015. With segments in oil & gas, petrochemicals, crop protection, catalysts, dispersions, coatings, construction, performance materials, care chemicals, nutrition & health and performance chemicals, BASF has also one of the widest and varied product portfolios. This talk will present a general overview of BASF from the eyes of a (young!) researcher, followed by an introduction to the research topics conducted within Advanced Materials and Systems. A more detailed overview of ‘soluble’ polymers will also be given, with a focus on some of the new polymers recently developed for paper making, water treatment, oilfield and mining applications.

**CL66**

**Dr Emmanuel Pouget**

Université de Lyon, INSA-Lyon

*Towards Ionic-based Supramolecular Silicone Materials*

Over the past two decades, supramolecular chemistry applied to polymers has been extensively studied. Among all polymers available nowadays, silicones were modified by the introduction of supramolecular building blocks onto silicone that consequently develop physical interactions such as hydrogen bonding, pi-pi stacking or ionic interaction. In this work, new supramolecular materials based on ionic interactions are simply obtained by combining commercially available amino-functional polysiloxanes with multifunctional acids. Network formation occurred via the strong acid-base interaction. Besides, the rheological properties of these supramolecular materials can be easily modified by tuning the molar ratio of acid to amine groups from 0 to 5. Another interesting feature of these materials is their easy re-processability by use of solvent which opens access to post-modification or recyclability.

**CL67**

**Dr Simon J. Holder**

University of Kent

*Precision control over the melting transition of poly[ethylene oxide]-block-poly[octadecyl methacrylate -co-docosyl methacrylate] bicontinuous micelles.*

Poly[ethylene oxide]-block-poly[octadecyl methacrylate] (PEO-b-PODMA) synthesized by ATRP self-assembles in aqueous solutions to form semi-crystalline bicontinuous micelles. These aggregates display a phase transition temperature (Tm) of 21.8°C corresponding to the melting of the semi-crystalline PODMA block within the aggregates. The controlled release of poorly soluble encapsulants from the core of these aggregates dramatically increases above the Tm of the core. To obtain precise control over Tm the ODMA (C18 carbon chains) was copolymerised with docosyl methacrylate (DOMA, C22 carbon chains) giving block-copolymers with varying weight% ratios of ODMA:DOMA from 100:0 to 0:100. A linear relationship is shown for the Tm of the bicontinuous micelles formed with DOMA content. Such precision control of molecular composition offers opportunities for the thermally controlled release of poorly water-soluble molecules from the hydrophobic cores of self-assembled aggregates.

**CL68**

**Professor Felix Schacher**

Institute of Organic Chemistry and Macromolecular Chemistry

*Interface Design using Block Copolymers: Crosslinking and Interpolyelectrolyte Complexation*

Block copolymers allow creating nanostructured materials in different environments – mainly driven by the inherent immiscibility of unlike building blocks. Together with the use of monomers featuring unreacted functional groups in the side chain, this allows for straightforward modifications reactions or (reversible) crosslinking of nanostructured materials.

Here, our focus is put on polyampholytes and block copolymers featuring polyelectrolyte segments. In terms of synthesis, we demonstrate the controlled radical polymerization of substituted dehydroalanine monomers as well as carboxylation or sultonation of poly(2-vinyl pyridine). We also show that interpolyelectrolyte complexation is one facile driving force to create materials for biomedical applications, either through the use of multicompartment micelles from ABC triblock terpolymers or using co-assembly strategies towards core-shell-corona micelles where charge, charge density, and composition of the shell can be varied.

**CL69**

**Dr Simon Harrisson**

Laboratoire des IMRCP, Université de Toulouse III

*Limits of Precision Monomer Placement in Controlled Radical Polymerization*

Precise control over the location of monomers in a polymer chain has been described as the ‘Holy Grail’ of polymer synthesis. Controlled/living polymerization techniques have brought this goal closer, allowing the preparation of multiblock copolymers with ordered sequences of functional monomers. Such structures may have applications ranging from medicine to materials engineering. Here we show, however, that the statistical nature of chain growth polymerization places strong limits on the control that can be obtained. Our analysis establishes experimental requirements for the design of polymeric chains with controlled sequence of functionalities, which balance precise control of structure with simplicity of synthesis.

**CL70**

**Dr Olga Koshkina**

Radboud University Medical Center

*Perfluorocarbon-loaded Polymeric Nanoparticles for Cell Tracking Using Multimodal In Vivo Imaging*

Cell therapy holds vast promise for the treatment of cancer. Optimizing this therapy requires long-term tracking and in vivo quantification of the cells. Multimodal in vivo imaging has great potential, but suffers from a lack of clinically applicable imaging agents.

We synthesized perfluoro-15-crown-5-ether loaded poly(lactide-co-glycolide) nanoparticles (NPs) of 100 nm radius (light scattering), suitable for 19F MRI and ultrasound. These NPs are highly stable allowing for long-term in vivo imaging.

The acoustic contrast and high stability appear to be linked to the unusual internal structure of NPs. Thus, we characterized our NPs by cryogenic electron microscopy, solution 2D NMR (HOESY, HSQC), solid state NMR, X-ray scattering, and calorimetric methods, and compared this to various NP controls. The structure of our NPs is different from fluorocarbon containing colloids known thus far.

Finally, clinical application of the NPs has started in melanoma patients.

**CL71**

**Dr Christopher D. Spicer**

Imperial College London

*Synthesis of mono-disperse, hetero-bifunctional oligo-EDOT derivatives for tissue engineering applications*

Conjugated polymers are promising materials for tissue engineering. However the mechanisms through which any beneficial effects occur are poorly understood due to the use of highly heterogeneous materials. Here, we demonstrate the combination of a novel end-capping reaction with iterative C-H activation chemistry to produce end-capped oligo-EDOT derivatives (n = 2-7) in a modular manner. This method allows the synthesis of mono-disperse, hetero-bifunctional constructs bearing orthogonal groups for further conjugation, as well as the production of oligomer lengths previously shown to be unstable. Furthermore, the methodology is applicable to other dialkoxy-thiophene monomers allowing the production of mixed-oligomers with potentially interesting properties. Thus, the methodology presented here allows complex tissue engineering scaffold architectures to be readily produced, as well as opening up the possibility of further applications in the fields of polymer and materials science.

**CL72**

**Dr Lucas Montero**

Adolphe Merkle Institute

*Triggering reversible and non-reversible function in supramolecular polymers*

The dynamic nature of supramolecular polymers makes them perfectly suited for the development of materials with stimuli-triggered functions such as healing, chromism or changes in shape and stiffness. Most supramolecular polymers exhibit a low glass transition temperature (Tg), and mechanical coherence is provided by phase segregation and the formation of a hard phase that physically cross-links the material. This approach provides access to elastomeric stimuli-responsive polymers in which the hard phase dominates the thermomechanical properties. We have shown that materials with a completely different set of properties can be created if the monomers are designed to assemble into non-phase segregated, amorphous, high-Tg networks. This contribution will discuss several new supramolecular polymer systems synthesized on the basis of these two approaches, and discuss their stimuli responsiveness regarding in-situ metal nanoparticle formation, debonding on-demand and healability.

**CL73**

**Dr Lee A. Fielding**

The University of Manchester

*Polyacid-functionalised Diblock Copolymer Nano-Objects via Polymerisation-Induced Self-Assembly*

Well-defined diblock copolymer nanoparticles such as spheres, worms and vesicles can readily be prepared via RAFT aqueous dispersion polymerisation. This approach is a powerful and versatile technique for the preparation of a wide range of bespoke organic diblock copolymer nano-objects of controllable size, morphology, and surface functionality at relatively high concentrations. In this presentation, a binary mixture of anionic and non-ionic macromolecular chain transfer agents is used to design novel polyacid-functionalised nanoparticles with controllable anionic character and morphology. The nanoparticles are characterised by electron microscopy, aqueous electrophoresis and small-angle X-ray scattering. Particular attention is paid to rheological properties of the worm-like micelles, which form free-standing gels of varying gel strengths depending on their composition. These gels are used as synthetic model inclusion materials for investigation into biomineralisation processes.

**CL74**

**Dr Ahmed Eissa**

University of Warwick and Monash University

*Designing the Next Generation of PolyHIPE Scaffolds for Enhanced 3D Cell Culture of Mammalian Cells*

Applications of porous polymers from high internal phase emulsions, known as polyHIPEs, are foreseen in 3D cell culture, tissue engineering and regenerative medicine. However, one potential limitation of these polyHIPE materials as 3D cell culture scaffolds is surface chemistry. Cells in-vivo are typically surrounded by a complex extracellular matrix that contributes to cell anchorage and function. This presentation will describe the surface functionalisation of both styrene-based polyHIPE and the recently developed biodegradable thiol-ene polyHIPE materials with biomolecules. Experiments with primary rat hepatocytes show that the galactose-functionalised scaffolds offer enhanced hepatocyte adhesion and functionality compared to the unfunctionalised/glucose-functionalised scaffolds. Initial cell culture experiments with human endometrial stem cells will also be shown. Lithographic 3D printing approaches to create scaffolds with complex architectures and features are currently underway.

**CL75**

**Professor Sophie Guillaume**

Université of Rennes

*TELECHELIC POLYOLEFINS AS PRECURSORS TO NON-ISOCYANATE POLYURETHANES (NIPUS)*

Conventional polyurethanes (PUs) are being synthesized from isocyanates, which require hazardous and toxic phosgene for their manufacture. Current research thus aims at establishing safer and “greener” alternative routes to more environmentally friendly PUs.

In this context, we have been investigating the post-polymerization chemical modification of telechelic precursors, such as a,w-dihydroxy telechelic polycarbonates, polyesters, polyethers or polyolefins, into their corresponding five-membered cyclic carbonate (5CC) end-functionalized polymers, respectively, which upon aminolysis eventually afforded non-isocyanate PUs (NIPUs).

Another route we have been exploring relies on the direct synthesis of 5CC-end functionalized polymers through the ring-opening metathesis polymerization (ROMP) of a cyclic olefin using 5CC-based chain transfer agents (CTAs). The metathesis pathway thus enables to access to well-defined ditelechelic polyolefins.

**CL76**

**Professor Nikhil K. Singha**

Indian Institute of Technology Kharagpur

*ABA triblock copolymers based on poly(furfuryl methacrylate) & PDMS via RAFT polymerization; Their self-healing property and hydrophobicity*

ABA tri-block copolymers (BCPs), poly(furfuryl methacrylate-b-poly(dimethyl siloxane)-b-poly(furfuryl methacrylate) (PFMA-b-PDMS-b-PFMA) (FDF) were prepared via RAFT polymerization using PDMS-CTA as macro-RAFT agent. In this case first PDMS was modified to prepare PDMS-CTA. The formation of FDF triblock copolymer was confirmed by 1H-NMR, GPC and DSC analyses. Later on the BCPs were cross-linked via Diels-Alder (DA) click reaction between the reactive furfuryl group in PFMA unit as diene with different maleimides as dienophile. The DA cross-linked polymers showed self-healing characteristics via the reversible DA and retro-DA click reaction and also showed hydrophobic characteristics due to presence of PDMS unit. The self-healing characteristic was studied by DSC and SEM analyses. The water contact angle (WCA) measurement showed that the cross-linked BCP has good hydrophobicity value. These materials have potential applications in hydrophobic self-healing paints, coatings and adhesives.

**CL77**

**Dr Ruairí Brannigan**

University of Reading

*Synthesis of novel mucoadhesive nanogels via post-polymerisation modification*

Mucoadhesive nanogels have been of great interest in recent times owing to their potential application as dosage forms for trans-mucosal drug delivery. Furthermore, the synthesis of nanogels have been extensively studied offering a unique platform for the facile generation of drug carriers. In this presentation, we discuss current work on the synthesis of a new generation of mucoadhesive microgel materials.

Nanogels were synthesised via free-radical emulsion polymerisation of functional monomers using a bifunctional acrylamide crosslinking agent and modified to yield acrylate and malaimide functional materials.

Size distributions of the microgels were determined by DLS and TEM. The functionality of the microgels were determined by FT-IR and NMR spectroscopy. Microgel mucoadhesion was determined by fluorescence microscopy using ex-vivo animal tissue and an in-house developed technique under simulated physiological conditions.

**CL78**

**Dr Byung Kim**

KCPC, The University of Sydney

*Biodistribution and clearance of stable superparamagnetic maghemite nanoparticles in nude mice*

Our group have synthesised superparamagnetic nanoparticles (SPIONs) that exhibit superb stability in biological settings and are capable of enhancing the penetration of drugs across solid tumour models. This work highlights the biodistribution of these sterically stabilised SPIONs in healthy nude mice following intra-peritoneal injection. After a single injection of 90 mg Fe/kg body weight, SPIONs were found in most of the major organs except for the brain and the kidneys. Despite such a high dose of SPIONs, no onset of fibrosis or macroscopic damage to the tissues was observed, while some earlier studies showed damage to the liver and kidneys. No cytotoxicity was observed in the current study because the SPIONs did not aggregate and were cleared from the mice within 7 days, partly by the action of macrophages. The stability of the maghemite cores in cells was found to be crucial to the ability of the macrophages to remove the SPIONs.

**CL79**

**Dr Ulrich Tritschler**

University of Bristol

*Dimensional Control of Block Copolymer Nanofibers with a Conjugated Core via Crystallization-Driven Self-Assembly*

Functional nanofibers of controlled length and width with optical and conductive properties can be prepared via crystallization-driven self-assembly (CDSA) by using polythiophene-containing block copolymers (BCPs). CDSA is a process involving the use of crystalline-coil BCPs whereby well-defined micellar nanostructures are formed by epitaxial crystallization of copolymer unimers from existing micelles. However, control over length above 300 nm has remained limited with these &#960;-conjugated BCPs possibly due to the formation of defects in the crystalline micelle core. We report studies of CDSA of BCPs for which the &#960;-conjugated core-forming block is optimized giving profound insights into the self-assembly process and present solution strategies to improve dimensional control of these 1D functional nanofibers. These have potential applications for emissive and conductive nanowires.

**CL80**

**Miss Jessica Clough**

Eindhoven University of Technology

*Illuminating the Mechanomemory of a Filled Elastomer*

Filled elastomers are strong, tough, deformable materials but exhibit complex mechanical behaviour arising from the addition of fillers. Most strikingly, they absorb energy when they encounter a “new” strain, so called the Mullins effect or mechanomemory. We inspected the role of chain scission in this effect with a dioxetane-based probe which lights up when bonds break in a material. Applying cyclic uniaxial tensile tests to dioxetane-functionalised silica-filled PDMS, light is seen only when the material experiences a new strain. Light is also only observed at strains >120%: below this threshold, energy is absorbed through non-covalent mechanisms. The relationship between the total light intensity and the energy absorbed indicates that covalent scission becomes increasingly important with strain. Lastly, straining pre-conditioned samples at different orientations relative to the original tensile direction revealed that covalent scission occurs in a highly anisotropic fashion.

**CL81**

**Mr Pengyu Zhuang**

Université Catholique de Louvain

*Temperature Dependence of the Swelling and Wettability of Hydrophilic Polymer Brushes*

Hydrophilic polymer brushes are important systems that may serve as platforms for anchoring biomacromolecules and cell culture. Their swelling degree in water controls most of their properties and their outer surface is also a controlling parameter in specific instances like protein adsorption. Thus it is critical to develop the capability to measure and design it and understand finely the link between the hydrophilicity of the brush volume and surface. Here we present the swelling and wettability of dense polymer brushes including thermoresponsive poly (N-isopropyl acrylamide). In general, the lack of correlation between surface and volume properties provides possibilities to tune independently the two parameters to obtain weakly swollen but highly wettable brushes or highly swollen brushes with lower wettability. The surface hydrophilicity of thermoresponsive brushes does not vary across the collapse transition contrarily to their volume, a fact which is generally ignored.

**CL82**

**Dr Guillaume Delaittre**

Karlsruhe Institute of Technology

*(1\_ORAL) Synthesis, Functionalization, and Immobilization of Single-Enzyme Nanogels (SENs) / (2\_POSTER A) Making the Best of It: Nitroxide-Mediated Polymerization (NMP) of Methacrylates in the Presence of a Small Amount of Functional Styrenics / (3\_POSTE*

Common protocols for enzyme stabilization often lack precision in terms of enzyme surface chemistry and may lead to considerable variations in efficiency, depending on the nature of the enzyme. Single-enzyme encapsulation was shown to stabilize various enzymes in extreme conditions (temperature, pH, solvents). It generally consists in a crosslinking polymerization in the presence of an acryloylated enzyme acting as multifunctional crosslinker, at high dilution. However, precise protocols are scarce and advanced applications have not been pursued. We have recently set out to investigate the synthesis of SENs and the parameters which may affect the formation of well-defined particles with several common proteins. We found new experimental conditions where pre-functionalization of the enzymes is not necessary, making the process more attractive for real applications. In addition, we showed for that SENs could be immobilized onto surfaces without addition of any functional moiety.

**CL83**

**Professor Steve Rannard**

Liverpool University

*Hyperbranched Polydendrons: Synthesis of highly functional, highly branched polymers with efficient self-assembly to form nanoparticles*

Thiol-Michael addition chemistry benefits from mild reaction conditions, minimal by-product formation, high functional group tolerance and high conversion. We have shown previously that xanthates, acting as masked thiols, undergo one-pot deprotection/thiol-acrylate Michael addition to introduce functionality at the surface of dendritic polyesters. Here, we compare the rapid simultaneous and stepwise sequential controlled surface group modification of these materials to selectively introduce desired amounts of surface groups with a range of functionalities. The controlled deprotection and functionalisation of a range of dendritic materials with varying generations and molar ratios of mixed acrylates has allowed the targeting of materials with a range of molar concentrations of functional groups using a small number of starting materials.

**CL84**

**Professor Alexander Zelikin**

Aarhus University

*Macromolecular prodrugs as antiviral agents*

We wish to disclose our progress in the development of macromolecular prodrugs (MP) as antiviral agents. Key to successful design of MP was the development of self-immolative linkers enabling fast release of the drug upon cell entry of MP and the use of RAFT polymerization to obtain polymers with optimized molar mass. We developed MP such that the parent polymer and the drug have antiviral activity. Engineering the two arms of antiviral effect into MP afforded agents with a broad spectrum antiviral activity. The designed polyanionic MP of ribavirin (a nucleoside analogue type antiviral agent) effectively suppressed infectivity of HIV, Influenza, Measles, Ebola, and other viruses. We also developed MP of histone deacetylase inhibitors as agents for reversal of latency of HIV and showed that MP were equi-efficaceous to the parent drug with regards to virus reactivation. This presentation aims to highlight the utility of polymers as unique agents in the fight against viral pathogens.

**CL85**

**Dr Antonio Ruiz-Sanchez**

Newcastle University

*Zwitterionic-Fluoro Hydrogels as Anti-Biofouling Coatings.*

The unwanted fouling of surfaces by organisms presents a huge and largely unsolved problem. From medical implants to the hulls of ships, fouling leads to reduced performance and increased costs. For example, fouling of ship hulls increases fuel consumption up to 40%. Considering there are over 90,000 vessels in the world fleet, with the largest ships consuming over 350 tonnes of fuel per day, the fuel savings and the reduction in greenhouse gas emissions would be considerable if biofouling were eliminated. Fluoropolymers and zwitterionic polymers individually make platforms for achieving fouling deterrence but have never been studied as a conjugate system. We report the copolymerization of fluoropolymers end-terminated with methacrylate functions with methacrylate-based zwitterion monomers to produce polymer coatings in a way which allows control of surface properties. Their antifouling behaviour was assessed and found to relate to coating composition and method of preparation.

**CL86**

**Mr C. Adrian Figg**

University of Florida

*Polymerization-Induced Thermal Self-Assembly (PITSA)*

Polymerization-induced thermal self-assembly is an aqueous chain-extension (co)polymerization of a hydrophilic polymer with a thermoresponsive block above its cloud point. Subsequently, the growing thermoresponsive block induces in situ aggregation upon reaching a critical degree of polymerization. As the chains continue to polymerize, they adopt thermodynamically-favorable confirmations within the aggregates, leading to nanoscopic changes in aggregate morphology (i.e., micelles, worms, and vesicles). We show that thermoresponsive homo- and copolymers can be used to achieve a variety of nanoparticle architectures and are mainly dependent upon degree of polymerization and composition. Thus, specific nanoparticle morphologies may be discretely synthesized in a facile chain-extension polymerization with proper monomer/polymer selection.

**CL87**

**Miss Ghislaine Barouti**

Institut des Sciences Chimiques de Rennes

*Polyhydroxyalkanoate-based diblock and triblock copolymers: Chemical composition and macromolecular architecture, an easy way to tune the nanoparticles properties for drug delivery applications*

Original Poly(hydroxyalkanoate)s (PHAs) based diblock and triblock copolymers, namely poly(&#946;-malic acid)-b-poly(3-hydroxybutyrate) (PMLA-b-PHB) and PMLA-b-PHB-b-PMLA respectively, have been synthesized. The controlled sequential ring-opening polymerization of &#946;-butyrolactone and benzyl &#946;-malolactonate (MLABe) has been achieved through different catalytic approaches depending on the desired block structure. Various self-assembled systems such as polymerzomes and micelles with tunable hydrodynamic radius (16-300 nm), molecular weight and percentage of extension of the hydrophilic block (10-100%) were obtained as investigated by light scattering measurements. Cell viability of these nanoparticles assessed from MTT assays evidenced no cytotoxic effect (up to 88 µg/mL). All these results demonstrated that these PHB-based copolymers are promising candidates as drug-delivery systems.

**CL88**

**Dr Sarah-Jane Richards**

University of Warwick

*Glycosylated gold nanoparticle biosensors: Label-free and high-throughput evaluation of glycan/lectin interactions*

The development of new analytical tools to probe infection processes and as point-of care diagnostics is crucial to combat the spread of infectious diseases or to detect biological warfare agents. There is a growing need for biosensors that are fast, label-free, sensitive and inexpensive. Here we present the rational design and application of polymer-stabilised, glycosylated gold nanoparticles as colour changing sensors in response to lectins (sugar binding proteins), resulting in a powerful tool for investigating protein-carbohydrate interaction. Using a multiplexed assay and linear discriminant analysis, differentiation between lectins such as ricin or the cholera toxin and bacterial phenotypes is demonstrated. Furthermore, we have shown that the colour change in response to the correct glycan-lectin pairing can be determined not only spectrophotometrically but by the simple combination of a mobile phone camera and image analysis freeware, providing an ultra-low cost biosensor.

**CL89**

**Dr Sylvain Catrouillet**

The University of Warwick

*Influence of polymer arms on the the self-assembly of cyclic-peptide polymer conjugates in water*

The use of supramolecular chemistry to assemble small molecules is a powerful and effective approach to the design of complex nanostructures. Our group has shown that, in organic solvent, cyclic peptides polymer conjugates can self-assemble via hydrogen bonds between cyclic peptide to generate tubular nanostructures grafted with polymeric chains. The resulting brush-like structures have promising applications as drug delivery vectors and ion channels in lipid bilayers. However, these applications require a water soluble system, although the strong hydrogen bonding competing properties of water can hinder the hydrogen bond formation of the self-assemblies. We have investigated the influence of different parameters such as the degree of polymerization of the polymer arms, the density of polymer arms and the bulkiness of the monomer on the self-assembly of conjugates. In addition, we have determined an example of precise control over the number of aggregation via variation of pH.

**CL90**

**Dr Giovanna Sicilia**

University of Nottingham

*Self-assembling 19F Nucleic Acid–Polymer Conjugates as Real-Time MRI Probes of Biorecognition*

Polymer-DNA conjugates in which one nucleic acid strand contains fluorine-substituted nucleobases have been prepared and characterised. The efficacy of these novel 19F nucleic acid &#8722; polymer conjugates as sensitive and selective in vitro reporters of DNA binding events is demonstrated through a number of rapid-acquisition MR sequences. The conjugates self-assemble into micellar-like nanoparticles which are stable in solution but which respond readily and in a sequence specific manner to external target oligonucleotide sequences by changes in hybridisation. In turn, these structural changes in polymer-nucleotide conjugates translate into responses which are detectable in fluorine relaxation and diffusion switches, and which can be monitored by in vitro Spin Echo and DOSY NMR spectroscopy.

**CL91**

**Dr Anna Carlmark**

KTH Royal Institute of Technology

*Biomimetic Modification of Cellulose Fibres by Xyloglucan-Functional Latex Particles Prepared via RAFT-Mediated Emulsion Polymerization*

Herein, we report a biomimetic approach to cellulose modification. Xyloglucan (XG), a hemicellulose with an exceptional high affinity for cellulose, was modified at the reducing chain end with a chain-transfer agent well known to mediate RAFT. The resulting XG MacroRAFT was utilized in the surfactant free, RAFT-mediated emulsion polymerization of methyl methacrylate (MMA). During the polymerization, latex particles formed through a Polymer Induced Self-Assembly (PISA) type mechanism, where the core was composed of hydrophobic PMMA and the corona of hydrophilic XG. The molecular weight of the PMMA was altered, resulting in different sizes of the latex particles, which exhibited good colloidal stability despite the absence of charges. The particles were subsequently adsorbed to cellulose model surfaces, monitored by Quartz-Crystal Microbalance with Dissipation. This novel class of latex nanoparticles provides an excellent platform for cellulose modification via physical adsorption.

**CL92**

**Dr James Blinco**

Queensland University of Technology

*Non-Catalysed Visible-Light-Induced Click Chemistry*

A rapid and catalyst-free cycloaddition systems for visible-light-induced "click" polymer ligation will be discussed. Photoreactive moieties based on aryl-tetrazoles and 2H-azirine moieties were designed to absorb light at wavelengths above 400 nm. Irradiation with low-energy visible light sources thus enables efficient polymer endgroup transformation with a diverse range of multiple-bond-containing compounds. Full conversion with irradiation times of only 1 min at ambient conditions was achieved. It was also possible to use the reactants in stoichiometry approaching 1:1, which coupled with the quantitative reaction allowed the formation of block copolymers for the first time triggered by visible light in catalyst free conditions.

[1] J. Mueller, F. Schmidt, J. Blinco,\* C. Barner-Kowollik\* Angew. Chem. Int. Ed. 2015, 54, 10284 –10288. [2] P. Lederhose, C. Barner-Kowollik,\* J. Blinco\* 2016, Submitted

**CL93**

**Professor Annabelle Bertin**

Freie Universität Berlin

*Aggregation Behavior of UCST-Type Poly(Acrylamide-co-Acrylonitrile) Copolymer Across the Phase Transition Temperature*

Thermoresponsive polymers have shown great potential in applications such as bioseparation, drug delivery and diagnostic. Only few thermoresponsive polymers that present an upper critical solution temperature (UCST), i.e. phase separate from solution upon cooling, in a relevant temperature range have been reported so far. Therefore, UCST polymers with sharp and robust phase are highly needed in order to extend the range of applications of this class of polymers.

Herein, a robust UCST-type copolymer of acrylamide (AAm) and acrylonitrile (AN) (poly(AAm-co-AN)) was prepared by reversible addition fragmentation chain transfer (RAFT) polymerization and its thermo-induced aggregation behavior in aqueous media was studied by turbidity and dynamic light scattering measurements. A model is proposed to explain such aggregation-association behavior of the poly(AAm-co-AN) copolymer depending on the AN contents and concentration of the solutions.

**CL94**

**Dr Robert Göstl**

Technische Universiteit Eindhoven

*Highly sensitive detection of mechanical stress in polymers*

In the field of smart materials (macro-)molecules are elevated beyond their bulk properties to adapt to external stimuli thereby initiating chemical reactions, self-healing processes, performing mechanical work, or reporting on their state. Mechanical stress is one of the most interesting stimuli as it is ubiquitous in man-made materials as well as governing various processes in biological tissues. Hence its detection and exploitation to induce function is of importance for materials science.

Here, we implemented Diels-Alder adducts into polymers that generate highly fluorescent pi-extended anthracenes with high quantum yields upon mechanical cleavage thus allowing for the sensitive detection of mechanical stress. Moreover, we could incorporate hexaarylbiimidazole into polymers that generate triphenylimidazolyl radicals enabling the activation of radical reactions. Currently, we are advancing these motifs to hydrogels and nanoparticles for biocompatible mechano-optical sensing.

**CL95**

**Mr Martin Wåhlander**

KTH

*Next-Generation of Graphene Composites: Surface-Modified GO with Tuneable Orientation*

The extraordinary properties of graphene have made graphene-based fillers extremely popular for composites. In this work, we demonstrate a novel and efficient route to synthesize next-generation graphene composites without the need of polymeric matrices. Hydrophobic matrix-free composites of grafted graphene oxide (GO) in isotropic or nematic states are hereby characterized. The matrix-free GO-composites demonstrated enhanced thermo-mechanical properties, promising membrane effects and thermo-responsive shape memory. We performed controlled surface-initiated precipitation polymerization of hydrophobic grafts from the synthesised cationic macroinitiator immobilized on anionic GO. Matrix-free GO-composites were melt-processed directly from the grafted GO in anisotropic state. After processing, birefringence was observed, attributed to a nematic alignment. Permeability models were developed, which predicted the isotropic or nematic states of GO from the oxygen permeability data.

**CL96**

**Dr Angus Johnston**

Monash Pharmacy

Understanding the secrets of polymer cell interactions

**POSTERS**

**P1**

**Mr Aaron Hillier**

University Of Kent

*Smart Polymers For Wireless Medical Sensing Devices*

Candida albicans is a common diploid fungus that results in reduced functionality of vocal prosthetics, and ultimately the prosthetic becoming inoperable (with a large variation in the time until the device is inoperable from patient to patient).

An effective method of invasive monitoring would allow for a time and cost effective means of determining the operational effectiveness of a prosthesis, and reduce the frequency with which invasive surgery was required to be performed. As Candida albicans moderates its environmental pH in the body to acidic conditions, a pH responsive derivative of poly[styrene-alt-(maleic anhydride)] was tested as a pH responsive thin polymer film (applied to a high frequency RFID tag) to determine whether a change in environmental pH caused a change in antenna performance.

**P2**

**Mr Absil Rémi**

UMons

*Ultrafast gelation of injectable reactive microgels: The power of TAD click chemistry*

Injectable polymer networks are gaining increasing attention as scaffolds for drug release or tissue engineering owing to their ability to fill ill-defined locations upon injection. In that context, doubly crosslinked microgels (DX gels), appear as a highly interesting candidate as primarily crosslinked microbeads can be injected with a reactive crosslinker to generate in situ macroscopic networks filling and fitting cavities at perfection to optimize their action. Compared to other injectable networks, this new class of injectable hydrogels offer a better tuning of hydrogel hierarchisation, swelling and mechanical properties.[1] Herein, we describe a new approach towards DX gels synthesis by using the ultrafast triazolinedione[2] (TAD)-based click reaction to promote the formation of DX microgels network.

[1]Liu, R.X., et al., Soft Matter, 2011. 7(19): p. 9297-9306

[2]De Bruycker, K et al., Chemical Reviews, 2016. 116(6) : p 3919-3974

**P3**

**Mr Adam R. Town**

University of Liverpool

*Poly(N-isopropylacrylamide) nanogels for in situ-forming drug delivery depot*

Prolonged repeated administration of drugs for long term medical conditions faces issues such as keeping a drug in a concentration window which avoids toxic side effects and disease resistance, as well patient compliance, e.g. for repeated oral dose. Pre-formed sustained release implants overcome this issue but require invasive surgery. In situ-forming implants (ISFI) are easier to administer, however suffer from issues such as high burst release of drug, toxicity and system stability. We have synthesised PNIPAM nanogels which are able to rapidly aggregate after injection, in response to physiological conditions. The release rate of drug from the aggregate is tuneable by varying the ratio of two nanogels species of varying hydrophilicity in the implant formulation, and increased when drug is used in the form of solid drug nanoparticles. Burst release is minimal despite high drug loading, and sustained release can be maintained for over 100 days for the antiretroviral lopinavir.

**P4**

**Miss Agnes Kuroki**

University of Warwick

*Polymers as an alternative to antibiotics*

As more research focuses on the role of antimicrobial peptides (AMPs) as a way to tackle the development of resistance against antibiotics, synthetic versions of AMPs have recently attracted increasing interest. Polymeric materials have predominantly appeared as the ideal candidates because their properties can be tuned easily and can be much cheaper to produce on industrial scale than peptides. Polyacrylamides have yet to be investigated in terms of antimicrobial potency, as they could offer materials with greater stability towards hydrolysis. The design of these polymers was based on the composition of AMPs, which includes both hydrophobic and cationic amino-acids. A lysine-like acrylamide monomer was synthesised and copolymerised in different ratios with more hydrophobic monomers. Furthermore, polymers bearing guanidine functions appeared to express an increased selectivity against bacteria over red blood cells.

**P5**

**Mr Alex Wright**

University of Kent

*The Correlation of Swelling Performance and Hansen Solubility Parameters in Styrene Based Polyelectrolyte Networks.*

The super-absorbent nature of a series of styrene based polyelectrolyte networks were examined. The electrolytic nature of the networks was introduced through the introduction of a quaternary ammonium ionic monomer at 0, 10, 20, 30, 40 and 100mol%. The resulting net-poly(styrene-co-4-vinylbenzyl trihexylammonium chloride-co-divinylbenzene) systems were studied for their ability to encapsulate a range of solvents with known literature solubility parameters. The Hansen solubility parameters of the polymers were calculated from the experimental swelling results. The subsequent Ra values against each solvent were then determined. The observed trends in swelling performance were correlated with the Hansen solubility parameters of both the polymers and substrates.

**P6**

**Mr Alexander Cook**

University of Warwick

*Thiol–yne polymerisations with slow monomer addition: Hyperbranched structures with improved control of molecular weight and dispersity.*

We propose a versatile approach to the production of hyperbranched polymers with high degrees of branching and low dispersity values, involving slow monomer addition of a thiol/yne monomer to multifunctional core molecules in the presence of photoinitiator and under UV irradiation. Batch polymerisations had high MW and broad MW distributions; introduction of monomer by slow addition to a multifunctional alkyne core or alkene core was found to lower dispersity at monomer concentrations of 0.5 M to 2.0 M. Degrees of branching were determined by 1H NMR spectroscopy to be greater than 0.8 in most cases. Increasing the fraction of core molecule was found to decrease dispersity to values as low as 1.26 and 1.38 for the alkene core and alkyne core respectively. The Kuhn-Mark-Houwink-Sakurada &#945; parameter decreased from 0.35 for the batch process to values as low as 0.16, indicating that the thiol–yne structures became more globular and dense with the slow monomer addition strategy.

**P7**

**Miss Alice Haddleton**

University of Nottingham

*Scale up of Supercritical Carbon Dioxide Dispersion Polymerisation*

Supercritical carbon dioxide (ScCO2) is a promising green solvent for many polymerisations. It is an environmentally viable alternative for organic solvents and water as it is naturally occurring and abundant. Another advantage of using scCO2 as a solvent is that powdered polymer particles can be obtained in situ, removing the need for several energy and time intensive steps common with traditional solvent based polymerisations. However, the high pressures involved with this technique are expected to make transitioning to larger scales a challenging task. This work therefore aims to assess the feasibility of using scCO2 as a medium for the production of polymers on an industrial scale. Specifically, we will describe our first steps to scale up the free radical dispersion polymerisation of poly(methyl methacrylate) from the millilitre to litre scale. A reproducible, controllable reaction is desired that produces well defined polymer particles with narrow size distribution in one step.

**P8**

**Miss Alice Hill**

University of Warwick

*Investigating the Effect of Monomer on Stability of Polymer-Functionalised Chymotrypsin*

Most enzymes are intolerant to small changes in their environment, usually resulting in a detrimental decrease in activity. Various polymers have shown to be effective stabilisers, not only as an additive, but also by grafting to an enzyme’s surface. Due to the steric limitations of grafting a pre-synthesised polymer using a “grafting-to” approach, a “grafting from” method was utilised to enable higher grafting densities to become accessible. Higher grafting densities are more desirable as previous work has indicated that higher degrees of polymer functionalisation enhances stability to a greater extent. Aiming to investigate various monomer functionalities on the enzyme’s activity and stability, we synthesised a series of polymer-protein conjugates using a model protease enzyme, chymotrypsin, and varying the grafting density, polymer type, and molecular weight. The stability of conjugates was found to increase significantly when using comb-like monomers compared with linear monomers.

**P9**

**Miss Amy Cockram**

University of Sheffield

*Effect of monomer solubility on the evolution of copolymer morphology during polymerisation-induced self-assembly in aqueous solution*

A series of amphiphilic AB diblock copolymer nanoparticles has been synthesised via RAFT polymerisation in water at pH 5. A poly(methacrylic acid) chain transfer agent is used as a reactive steric stabiliser in order to polymerise two monomers of differing water solubility: 2-hydroxybutyl methacrylate (HBMA) and benzyl methacrylate (BzMA). HBMA has relatively high water solubility (20 g dm-3) whereas BzMA has relatively low water solubility (0.19 g dm-3). This difference influences the evolution of copolymer morphology during polymerisation-induced self-assembly (PISA) as judged by transmission electron microscopy and dynamic light scattering.

**P10**

**Mr Andrea Venturato**

University of Edinburgh

*An array platform for the high-throughput generation of 3D double-network hydrogels*

Synthetic hydrogels are attractive biomaterials due to their similarities to natural tissues and their chemical tunability, which can impart abilities to respond to environmental cues as temperature, pH, and light. However, their poor mechanical properties can impair their biomedical application. The generation of double-network hydrogels has proven to be an effective strategy to enhance mechanical properties, although it increases system complexity. Here, we report the development of an array platform that allows the macroscopic synthesis of up to 80 single- and double-network hydrogels on a single microscope slide. This new platform allows for the screening of hydrogels in a high-throughput format with the added dimension of significant control over the compressive and tensile properties of the materials, thus widening their potential application. The platform is adaptable, allowing multiple hydrogels to be generated, with the potential to tune and alter the first and second network.

**P11**

**Mr Andrew Hickman**

Univerisity of Warwick

*TBC*

**P12**

**Mr Andrew Kerr**

Univerisity of Warwick

*Synthesis of bottle-brush polymers using a grafting from RAFT polymerisation approach*

Bottle-brush polymers, polymeric architectures made of a linear backbone with densely packed side chains, have unique features in terms of chemical functionality and physical properties. This project aims to employ RAFT polymerisation and develop methodology of the ‘shuttle CTA’ grafting from approach to access these molecular architectures. A linear polymer is functionalised with RAFT chain transfer agents as pendant groups, then further used to mediate polymerisation, resulting in grafted polymeric chains from a single backbone. The addition of free CTA during the polymerisation improves the control of the grafting reaction, and enables the synthesis of well-defined brushes. The properties of the bottle-brush compounds can be tailored in terms of the backbone length, side chain length, grafting density and choice of grafted monomer. Once the synthetic protocol is optimised a number of applications can be envisaged for these materials, such as drug delivery vectors.

**P13**

**Mr Andrew Lunn**

University of Warwick

*Synthesis and Lectin Binding of Well-Defined and Tailored Glycopolymer-Nanoparticles with Mannosylated Shells via RAFT Emulsion Polymerization*

Antibiotic resistance is widely acknowledged as one of the most pressing concerns in modern medicine, potentially threatening to make simple infections fatal. New antibiotics are becoming harder to discover, and are years if not decades away from being in the clinic. For these reasons novel ways of delivering existing antibiotics to increase their activity and or overcome resistance mechanisms are vital. With this motivation, we report a versatile and precise synthesis of glycopolymer coated nano-particles to target bacterial lectins, produced via a RAFT emulsion polymerization technique, the size of which is precisely controlled by varying the amount of monomer used during emulsion polymerization. The simplicity of the technique allows for a wide variety of targeting carbohydrates to be incorporated into the same particle whilst still allowing binding of single or multiple drug molecules both covalently or non-covalently.

**P14**

**Miss Anne Mabire**

University of Warwick

*Responsive nanogels with a built-in fluorescent read-out*

Fluorescent dyes are widely commercialised for imaging and biological applications, however many of them are large molecules containing aromatic rings and have low solubility. The dithiomaleimide (DTM) functionality was used to label proteins, polymers and nanoparticles. However, thiol addition to dibromomaleimide (DBM) is reversible: alkyl thiol substituents can be replaced by aromatic thiols, resulting in an ON-to-OFF emission switch. This reversibility can be prevented by using amines instead of thiols. Here, we present new highly emissive compounds: monoaminomaleimides (MAM) and aminobromomaleimides (ABM). These compounds were developed for applications in materials science through the synthesis of a fluorescent monomer, which can be used to probe polymeric system environments.

**P15**

**Dr Audrey Llevot**

Laboratory of Applied Chemistry, Institute of Organic Chemistry (IOC), Karlsruhe Institute of Technology (KIT), Fritz-Haber-Weg 6, building 30.42, 76131 Karlsruhe, Germany

*Miniemulsion polymerization of new acrylate monomers synthesized via multicomponent reactions*

Miniemulsion polymerization is a versatile technique, which enables the synthesis of polymeric nano objects with controlled size. Its compatibility with most of the polymerization mechanisms as well as the possibility to polymerize both hydrophilic and hydrophobic monomers, by direct or inverse methods, makes it a useful tool in polymer science. Multicomponent reactions combine three or more starting components to form a single product in a one pot reaction. This approach was recently applied to polymer science, in particular for the synthesis of novel acrylate monomers.

The aim of this work is to take advantage of the structural diversity which can be achieved via multicomponent reactions to prepare novel monomers and thereof derived polymeric nanoparticles with different functionalities. The miniemulsion polymerization of acrylates with different side chains synthesized by Passerini-3CR is performed. The polymerization process and the properties of the particles are investigated.

**P16**

**Mr BAKHET AHMAD M ALQURASHY**

University of Sheffield

*Pyrene-Benzothiadiazole Based Copolymers for Application in Photovoltaic Devices*

Glycopolymers are of great interest because of their multivalent interactions with lectins. The glycoside cluster effect results in a great binding avidity towards these carbohydrate binding proteins. Over recent years several complex mannose-based glycopolymer architectures have been established, each one of them improving the binding affinity towards the animal lectin DC-SIGN (which takes part of the immune system and plays an important role during HIV infection). However, this binding affinity is not yet selective. We believe that multi-arm glycopolymers with a controlled carbohydrate sequence should not only improve the binding avidity towards these lectins, but we also believe controlling the sequence will enable the desired specificity which will result in a reduction of possible side-effects connected to other lectins. Furthermore, a cyclodextrin core should provide us a tool for drug encapsulation and possible further supramolecular interactions.

**P17**

**Miss Barbara Ridder**

Karlsruhe Institute of Technology

*Development of a poly(dimethylacrylamide) based matrix material for solid phase peptide array synthesis employing laser based material transfer*

We present polydimethylacrylamide (p(DMAA)) six-arm star polymers as matrix material candidates for the synthesis of high density peptide arrays structured by laser based material transfer, employing chemistry analogous to Merrifield’s Solid Phase Peptide Synthesis. A mixture of matrix material (solid at room temperature) and an orthopentafluorophenyl activated amino acid derivative is transferred from a donor to defined positions on an acceptor surface via a laser pulse. Subsequently, the acceptor is heated above the glass transition temperature (Tg) of the applied polymeric matrix under an argon atmosphere. Thereby, the matrix softens, enabling peptide bond formation between free amine groups on the acceptor and deposited amino acid derivatives. The suitability of the synthesized p(DMAA) polymers as matrix material for our application was evaluated using differential scanning calorimetry, time-of-flight secondary ion spectrometry and fluorescence staining of the synthesized arrays.

**P18**

**Mr Ben Graham**

University of Warwick

*Synthetic Mimics of AFGP, Novel Ice Recrystalisation Inhibitors*

Antifreeze glycoproteins (AFGPs) have been shown in nature to exhibit remarkable effects on various aquatic species, which as a result are capable of surviving in sub-zero temperatures. The ability to apply this methodology to inhibit intracellular ice crystal growth in other biological systems is highly desirable, and would have many beneficial applications in biomedicine, such as in the preservation of blood stocks. However the prohibitive expense and synthetic difficulty associated with accessing AFGPs, in addition to their significant cytotoxicity outlines the need for biocompatible synthetic mimics. Contemporary preservatives such as Glycerol and DMSO also have problems with cytotoxicity. We are currently developing 2nd generation polymeric mimics of antifreeze glycoproteins, which will be discussed.

**P19**

**Mr Benjamin Voogt**

Eindhoven University of Technology

*Film formation of latex blends of hard and soft particles: GARField 1H-NMR studies*

Latex, polymeric particles dispersed in water, is an essential component of waterborne coating materials. During drying polymer chains need to interdiffuse between particles to form a coherent film. Commonly, small amounts of organic solvents are added to promote this by softening the particles. The presence of this organic solvent brings about concerns on health and environmental impact. The development of coatings without volatile organic components (VOC’s) is therefore of high priority in the coating industry.

Here we present a study on drying blends of hard and soft particles using GARField NMR. Besides the water distribution depth profiles of the two different particles are obtained using NMR relaxometry. Depending on the ratio hard and soft particles and film thickness homogenous or heterogeneous films are obtained. We gain insight into film formation of latex in absence of VOC’s, which will provide us with handles on using water itself as the sole promoter for film formation.

**P20**

**Miss Beth Dickens**

International Institute for Nanocomposites Manufacturing (WMG), The University of Warwick

*Incorporation of Synthesised Macromonomers into Tailored Networks*

**P21**

**Miss Birsen Somuncuoglu**

University of Warwick

TBC

**P22**

**Mr Brooke W. Longbottom**

University of Warwick

*Self-Propelling Silica-Based "Matchstick" Colloids with Tuneable Aspect Ratio*

By careful control of reaction conditions and study of kinetics, we have recently shown an effective method of fabricating matchstick-shaped colloidal particles that exhibit anisotropy in both morphology and chemistry - attributes critical in chemical self-propulsion. Initial studies have been performed to experimentally determine the effect of particle aspect ratio on swimming efficiency by implementing a single particle tracking approach.

**P23**

**Dr Caitlin Decker**

Centro de Investigacion, Principe Felipe

*Prevention of Myocardial Reperfusion Induced Damage: Catheter Delivery of Polymeric Therapeutics (PREMICAT)*

While myocardial ischaemia/reperfusion (I/R) injury during angioplasty can be reduced by intravenous delivery of cardioprotective agents, mortality rates remain high, signifying the need for improved cardioprotection. Therefore, we propose the acute administration of polymer-based cardioprotective therapeutics through a novel catheter which allows for controlled, local delivery. We hypothesize that local delivery of cardioprotectants will be more effective at reducing I/R injury than intravenous administration. Furthermore, polymeric formulation should increase drug solubility and stability, decrease toxicity and systemic exposure, and reduce local shear stress. Specifically, polyglutamate nanogels were developed through covalent modification with cardioprotective drugs. In vitro and in vivo uptake has been assessed in microvascular endothelial cells, cardiomyocytes and in a swine model of I/R, respectively. Therapeutic potential to improve cardiac function in vivo is ongoing.

**P24**

**Dr Carlos Sanchez-Cano**

University of Warwick

*Assessing the biological properties of novel P(PEGA) and P(ManAm) particles.*

Nanoparticles are ideal systems for the delivery of drugs to their biological target in the organism. To fulfil well this role as delivery vectors they need to be readily accumulated in cells and selected tissues, not show toxicity in the absence of their payload, and be able to be removed safely from the organism after treatment. We have developed a new series of novel nanoparticles created via RAFT-emulsion polymerisation of n-butyl acrylate and t-butyl acrylate. This synthetic approach allows good control over particle size simply by modifying the volume of monomer in the polymerisation, whilst also maintaining a high degree of uniformity. Both P(PEGA) and P(ManAm) particles with diameter ranging from 30 to 180 nm have been generated. Herein we report preliminary studies on the interaction of our nanoparticles with cultured mammalian cells. This constitutes a first step to assess the biocompatibility of our P(PEGA) and P(ManAm) nanoparticles.

**P25**

**Miss Caroline Bray**

University of Warwick

*Aqueous RAFT Polymerization of AMPS Monomer*

2-Acrylamido-2-methylpropane sulfonic acid (AMPS®) polymer is employed in a wide range of applications, including personal and health care, coating, water treatment and in the oil industry; and is typically obtained via conventional radical polymerization. We have studied the use of the RAFT process to control the polymerization of AMPS® and obtain well-defined polymeric architectures compared to materials obtained via conventional radical polymerization. Initial work has focused on establishing optimal reaction conditions for RAFT polymerization, paving the way for the synthesis of more complex architectures, such as block, star and hyperbranched polymers. In this study, several parameters have been tuned, including pH, monomer type, CTA and initiator concentration. In addition, two CTAs have been tested to mediate RAFT polymerization of AMPS® to study the effect of alkyl chain length (Z group) which has been shown to dramatically affect the control of the polymerization.

**P26**

**Mrs Charlotte Mable**

University of Sheffield

*Loading of Silica Nanoparticles in Block Copolymer Vesicles during Polymerization-Induced Self-Assembly: Encapsulation Efficiency and Thermally Triggered Release*

Poly(glycerol monomethacrylate)-poly(2-hydroxypropyl methacrylate) diblock copolymer vesicles can be prepared in the form of concentrated aqueous dispersions via polymerization-induced self-assembly (PISA). In the present study, these syntheses are conducted in the presence of varying amounts of silica nanoparticles of approximately 18 nm diameter. This approach leads to encapsulation of up to hundreds of silica nanoparticles per vesicle. Encapsulation efficiencies can be calculated using disk centrifuge photosedimentometry, since the vesicle density increases at higher silica loadings while the mean vesicle diameter remains essentially unchanged. Small angle X-ray scattering (SAXS) is used to confirm silica encapsulation, since a structure factor is observed at q &#8776; 0.25 nm–1. Finally, the thermoresponsive nature of these vesicles enables thermally triggered release of the encapsulated silica nanoparticles simply by cooling to 0–10 °C, which induces a morphological transition.

**P27**

**Mr Chen Zhu**

University of Warwick

*TBC*

**P28**

**Mr Christopher Desire**

UTAS

*Supracolloidal Structures for Separation Science*

**29**

**Mr Christopher Stubbs**

University of Warwick

*Poly(ampholytes) as Ice Recrystallisation Inhibitors*

Antifreeze (glyco) proteins (AF(G)Ps) are highly active Ice Recrystallisation Inhibitors (IRI), however issues with their synthesis and extraction limit their commercial use as cryoprotectants. Poly(ampholytes) have been found to be effective synthetic analogues to these AF(G)Ps, however previous work has focussed on non-well defined structures. In this work, Maleic anhydride containing copolymers, obtained from RAFT polymerisation, are functionalised with nucleophilic species leading to regular mixed charge polymeric structures. These samples are then quantitatively evaluated for their potential as effective Ice Recrystallisation Inhibitors via a standard splat assay. This work builds on previous group research into non-hydroxylated synthetic polymers with IRI activity.

**P30**

**Dr Christopher Waldron**

King Abdullah University of Science and Technology (KAUST)

*TBC*

**P31**

**Mr Connah Burnett**

University of Warwick

*A New Catalytic Mechanism for End-Functional Polyolefin-Polar Block Copolymers*

One of the holy grails of polymer synthesis is the production of polyolefin block copolymers. Much time and effort has been spent in the search for efficient synthesis routes yet the goal still remains. Our group has recently discovered the Catalytic Hydride Initiated Polymerization (CHIP) mechanism which delivers end-functional polyolefins with high productivity and excellent end-group fidelity. By fine tuning the conditions during polymerization and exploiting a unique reactive mode at the chain end, a large range of novel functionalised polyolefin materials can be prepared, including, through the use of &#945;-olefins comonomers, a range of functionalized LLDPE polymers.

This range of functional polyolefins can be used as macromonomers in a simple free radical reaction to produce polyolefin-polar block copolymers (PO-b-PX). We are currently investigating the commercial applications for these materials.

**P32**

**Ms Coralie Jehanno**

POLYMAT - UPV/EHU

*Nitroxide radical chemistry for polymerization and depolymerization catalysis*

XXIst century main challenge for chem. involve evolution of hazardous and polluting processes to environmentally friendly routes. In that scope, dvt of effective organocatalysts, non-toxic and cheaper than metal-based catalysts, led scientists to explore prop. of small molecules under mild conditions. Nitroxide radicals are organic molecules with unique properties used in a variety of fields, as mediator for polymerization (NMP), as electrode in org. batteries as well as oxidation catalyst. The “persistent radical effect” observed for some nitroxides made them stable radicals able to efficiently catalyse alcohol oxidations with a co-catalyst. This work is focused on the possibility of transferring results from org. chem. to polymer chem., especially for depolymerization of oxygen-containing polymers. The use of different nitroxide structures under greener conditions, electrochem., enzyme co-catalyst, have been explored for alcohol oxidation before going further to depolymerisation.

**P33**

**Mr Craig Jesson**

The University of Sheffield

*End-Group Removal for RAFT-synthesised Nanoparticles using Hydrogen Peroxide*

RAFT synthesised polymers are often coloured and malodorous due to the presence of the sulfur-based RAFT end-group(s). In principle, such RAFT end-groups can be removed by treating molecularly-dissolved copolymer chains with excess free radical initiators or amines or oxidants. Herein we report a convenient method for the removal of RAFT end-groups from aqueous dispersions of diblock copolymer nano-objects using hydrogen peroxide. This oxidant is relatively cheap, has minimal impact on the copolymer morphology and produces benign side-products that can be readily removed via dialysis. We investigate the efficiency of end-group removal for various nano-objects prepared using either dithiobenzoate or trithiocarbonate CTAs using UV GPC.

**P34**

**Miss Cristina Resetco**

Department of Organic Chemistry, Polymer Chemistry Research Group, Ghent University

*BIOINSPIRED THIOLACTONE CHEMISTRY PLATFORM FOR MULTIFUNCTIONAL POLYMERS*

Multifunctional polymer resins are indispensable in meeting multiple requirements for material performance, such as toughness, durability, hardness, chemical resistance, barrier properties, etc. The ability to introduce different functional groups in a simple and economic way is important for enabling future development of smart materials with added value.

In this work, we highlight thiolactone chemistry as a platform for smart materials employing bio-based thiolactone building blocks. We demonstrate conversion of thiolactone derivatives to isocyanate-free polyurethanes for smart materials. Renewable building blocks can be incorporated into polymers via the synthesis of thiolactone-based monomers and aminolysis of the thiolactone. The combination of thiolactone and thiol-ene chemistry, forms a sustainable platform for smart materials that can be tailored to a wide variety of applications.

**P35**

**Mr Dan Coward**

University of Edinburgh

*Expanding the Monomer Scope of Iron-Mediated Controlled Radical Polymerisation*

Controlled radical polymerisation is an important development in polymer chemistry. CRP is able to achieve control over molecular weight and dispersity. One strategy of control is through use of a metal mediator to reversibly trap a growing polymer chain. This is achieved through either ATRP or OMRP. Iron presents an exciting area of research as it is inexpensive, non-toxic and can act through both mechanisms.

Aminebis(phenolate) (ABP) iron complexes are excellent mediators of styrene and methyl methacrylate, achieving dispersities as low as 1.07. The mechanism has been well studied, with the interplay between ATRP and OMRP discussed. However there has been limited work investigating the efficacy of these mediators with the range of vinyl monomers available. This work looks to expand the range of monomers whose CRP is effectively mediated by ABP iron complexes, with a variety of acrylates having been tested in both homo- and co-polymerisations, including bio-sourced alkenes.

**P36**

**Miss Danielle Lloyd**

University of Warwick

*Controlled Depolymerization in Carbonated Water*

Single Electron Transfer – Living Radical Polymerisation (SET-LRP) has been shown to be a very versatile technique since its introduction in 2006 by Percec. Within recent years, Haddleton et al., have extended this system to allow for the facile and well controlled polymerization of water soluble monomers such as acrylamides. Utilizing a similar system we herein report the fast polymerization and controlled depolymerization of acrylamides and acrylates in carbonated water using SET-LRP. Our results indicate that N-Isopropyl acrylamide (NIPAm) can be polymerized within 10 minutes to > 99 % conversion with low dispersities (Ð = 1.14) and controlled molecular weights being obtained. Allowing the polymerization to continue leads to the observation of controlled depolymerization (40 % conversion, Ð = 1.16) and the reformation of NIPAm monomer. Similar observations have also been observed with other acrylamides (e.g. hydroxyethyl acrylamide) and acrylates (e.g. hydroxyethyl acrylate).

**P37**

**Mr David Makepeace**

University of Surrey

*Using Particle Size Ratios to Control the Fracture Properties of Films from Latex Blends*

Colloidal dispersions of polymer particles in water (latex) are used to deposit films for many applications, e.g. coatings, adhesives and inks. Blending soft and hard particles is a promising way to manipulate film mechanical properties. The resulting microstructure is determined by the volume fraction of the hard phase &#632; and also the size ratio (R) of particles in a blend.

Here, the effect of R in a bimodal blend on the resulting particle packing and ordering was explored. Large (350 nm diam.) soft particles were blended with either 350 nm or 50 nm hard particles with varying &#632;. Different types of particle packing were found as R was varied. The addition of hard particles to a blend increased the elastic modulus but also led to embrittlement: fracture occurred at lower strains. With R=7:1, the embrittlement increased gradually with an increased &#632;. An abrupt transition was found for R=1:1. These results are explained using geometric models of particle packing.

**P38**

**Miss Devanshi Singh**

Department of Chemistry, University of Sheffield

Target specific drug delivery systems ensure site specific drug delivery in unison with desirable effects and faster cures (e.g.: Photodynamic therapy). Hyperbranched polyglycidol and PAMAM dendrimers are one of them. Hence, PAMAM dendrimer & hyperbranched Polyglycidol of similar molecular weights were synthesized and their subsequent drug encapsulation abilities via co-precipitate method were studied. For this, Ibuprofen and Tetracarboxyphenyl porphyrin (TCPP) were used as model drugs. From the results obtained, it was proven that both the polymers/macromolecules are efficient drug transporters with PAMAMs being better as they encapsulated more drug molecules compared to PG.

Carrying forward from this, it is postulated that when drug encapsulated dendrimers of variable sizes are put together with varied targeting amino acid ligands and a suitable protein template; the end result will consist of a perfectly sized dendrimer functionalized with the best amino acid ligand forming a strong complex with the protein template/target protein (aka Self-selection method).

**P39**

**Mr Dharam Raj Kumar**

University of Manchester

*Mechanistic Investigation for the Ring Opening Metathesis Polymerisation of Alkoxy and Akkyl Su*

Dharam Raj Kumar, Benjamin J. Lidster, Ralph Adams, Michael L. Turner\*

Ring opening metathesis polymerisation (ROMP) allows control of the molecular weight, narrow polydispersities (ÐM), selective end functionalisation and defined regioregularity.1 ROMP has been successfully applied to various strained cyclic alkene monomers like norbornene, cyclobutenes, paracyclophanedienes, using Ru and Mo carbene based initiators. Substituted poly(p-phenylenevinylene)s (PPVs) are a widely studied class of conjugated organic polymers that exhibit favourable electronic and optical properties and were the first polymers

**P40**

**Miss Diana Palma Ramírez**

Instituto Politécnico Nacional (IPN) and Loughborough University

*Transparent IPN of PMMA/PU based on renewable material and luminescent CePO4 nanostructures: Comparison of dispersion method*

Poly(methyl methacrylate) (PMMA) mechanical properties must be improved when it is used for structural applications. The synthesis of interpenetrating polymer networks (IPNs) has been proposed to enhance it. In the same approach, the dispersion of inorganic luminescent nanostructures can also improve it and avoid the structural damage caused by the UV radiation from the sun. These properties are greatly influenced by the dispersion method. In this work, a series of IPNs are obtained by sequential polymerization of vegetable oil based polyols based polyurethane (PU) with PMMA. CePO4 nanostructures with monoclinic structure are dispersed using mechanical stirring and sonication to determinate the conditions to reach a high dispersion and the effect of different ratios on optical properties. Optical results indicated that the degree of miscibility as well as the transparency can be modulated with PU amount. Tensile strength of alloys were improved significantly with respect to PMMA neat.

**P41**

**Mr Dominic Collis**

School of Engineering and Material Science, Queen Mary, University of London

*Design and synthesis of hyaluronan (HA)-based glycopolymers for self-assembly with HA-binding peptides*

Hyaluronan (HA) is a highly abundant anionic polysaccharide found throughout mammalian connective tissues. It has a simple linear structure of alternating units of N-acetyl-glucosamine and glucuronic acid. Despite its simple structure, HA is capable of an amazing variety of conformations, rapidly interchanging in solution. HA is involved in the extracellular matrix organization and many aspects of cell behaviour, essential to a wide range of biological processes. Varying lengths of HA affect its biological functions and it has been suggested that the interaction of HA with specific proteins (HA-binding proteins), which are responsible for stabilizing particular conformations of the polysaccharide, leading to many HA-protein complexes. This work aims to design and synthesize glycopolymers mimicking the composition and structure of HA and combine these glycopolymers with HA-binding peptides, such as Pep-1 identified by phage display, to develop innovative supramolecular biomaterials.

**P42**

**Mr Dominic Keller**

Karlsruhe Institute of Technology - Institute of Toxicology and Genetics & Institute for Chemical Technology and Polymer Chemistry

*Nitrilotriacetic Acid-Functionalized Nanoparticles via PISA for Enzyme Immobilization*

Enzyme immobilization is a common method to increase stability under a range of reaction conditions. In addition, it provides a means to more easily recycle the biocatalysts or even to employ them in continuous processes. Nanoparticles (NPs) based on amphiphilic block copolymers are poorly explored systems for enzyme immobilization. We develop nanoparticles (NPs) containing surface-displayed nitrilotriacetic acid (NTA), able to bind specifically to His-tagged enzymes. For this purpose, novel initiators bearing the NTA moiety are synthesized and used in nitroxide-mediated polymerization (NMP) to obtain well-defined hydrophilic polymers. Afterwards, polymerization-induced self-assembly (PISA) is used which leads to the desired amphiphilic block copolymer NPs with various NTA contents in the corona. The resulting NPs are then fully characterized. Protein/enzyme immobilization and activity are finally investigated.

**P43**

**Dr Dominika Regentova**

The University of Nottingham

*Bio-derived polymers from terpene acrylic and methacrylic monomers*

A catalytic route to access acrylic and methacrylic monomers synthesised from naturally available terpenes is described. Free radical polymerisation yields bio derived polymers with a wide range of physical properties which have wide range of potential commercial applications.

**P44**

**Miss Elena Bobbi**

Dublin City University & Royal College of Surgeons in Ireland

*Synthesis of hybrid triblock copolymers forming thermosensitive micelles in water*

The delivery of hydrophobic and degradable drugs represents a significant challenge. Micelles have shown promise for the delivery of these drugs due to their ability to shield them from the biological environment. In this work hybrid triblock copolymers have been synthesized by the combination of RAFT and N-carboxyanhydride (NCA) polymerisation comprising N-isopropylacrylamide, PEG-acrylate and &#61543;-benzyl-L-glutamate blocks and their micelle formation studied. The distinctive block copolymer structure is expected to produce micelles with a thermoresponsive shell and a hydrophobic polypeptide core. It is envisaged that by fine-tuning of the triblock copolymer structure, micellar dis-assembly or size changes can be triggered thermally. The materials have been investigated by Dynamic Light Scattering (DLS), UV-Vis and CD spectroscopy as well as microscopy to determine their behaviour in solution at different temperatures.

**P45**

**Miss Elif Kurnaz**

Bogazici University, Department of Chemistry, Polymer Research Center

*Extension of Linear PIBs to Higher Molecular Weight Linear and Network Products via Thiol-ene Chemistry*

This research focuses on the preparation of high molecular weight rubbery linear or crosslinked polyisobutylenes (PIBs) from low molecular weight liquid PIB precursors by thiol-ene click chemistry. Thiol-ene click leads to polymer blocks by chain extension. The synthetic strategy to prepare both high molecular weight linear PIBs and PIB networks consists of three steps: (i) synthesis of the difunctional carbocationic initiator 5-tert-butyl-1,3-bis(2-chloro-2-propyl)benzene (t-Bu-m-DiCumCl), (ii) synthesis of well-defined PIBs by living carbocationic polymerization followed by end-capping with allyltrimethylsilane, and (iii) UV light induced thiol-ene click reaction in the presence of 2,2-dimethoxy-2-phenyl acetophenone (DMPA) photoinitiator. The effect of photoinitiator concentration, reaction time, nature of the thiol, and thermal initiation on the efficiency of radical thiol-ene click addition leading to extension and crosslinking were investigated.

**P46**

**Ms Emily Pilkington**

ARC Centre of Excellence in Convergent Bio-Nano Science & Technology

*Nanotechnologies for IAPP Aggregation Inhibition and Anti-Protein Fouling*

Recently, nanotechnology has become an active component in research on neurological disorders and type 2 diabetes (T2D). Graphene oxide, for example, has been shown by our group to effectively mitigate the aggregation and toxicity of human islet amyloid polypeptide (hIAPP), a major contributor to pancreatic &#946;-cell death in T2D. We have further developed a strategy for probing membrane fluidity in cells exposed to hIAPP of various states, and demonstrated the complex nature of hIAPP-mediated toxicity. Additionally, we developed a scheme of grafting naturally occurring zwitterionic phosphorylcholine (PC) onto iron oxide nanoparticles (IONP). IONP-PC performed equally well or better than IONP-PEG in stability, biocompatibility and protein avoidance. Both IONP-PEG and IONP-PC induced higher membrane ordering. Hyperspectral imaging showed, however, that IONP-PC was better dispersed in intracellular space, pointing to the promise of PC functionalisation in drug delivery and MRI.

**P47**

**Mr Fabian Marquardt**

Institute of Technical and Macromolecular Chemistry, RWTH Aachen University and DWI–Leibniz-Institute for Interactive Materials

*Ring-Opening of D,L-Homocysteine Thiolactone Functionalized Polyglycidols: Adjustment of Antimicrobial Properties*

Antimicrobial polymers are an attractive alternative to low molecular weight biocides, because they are non-volatile, chemically stable and can be used as non-releasing additives. Polymers with pendant quaternary ammonium groups and hydrophobic chains exhibit antimicrobial properties due to the electrostatic interaction between the polymer and the cell wall, and the membrane disruptive capabilities of the hydrophobic moiety.

Herein the synthesis of cationic/hydrophobic, cationic/hydrophilic and zwitterionic polyglycidols is presented. The synthetic concept comprises (1) functionalization of linear polyglycidols with p-nitrophenyl chloroformate, (2) followed by reaction with homocysteine thiolactone, (3) ring-opening of thiolactones via one-pot double modification with dimethylaminopropylamine and specific acrylates, (4) and quaternization of tertiary amines to produce well-defined polyglycidols. The synthesized polymers are investigated in regard to their antimicrobial properties.

**P48**

**Miss Fadoi Boujioui**

Institute of Condensed Matter and Nanosciences – Bio & Soft Matter

*One-Pot Synthesis of Electro-Active Gel via Cu(0)-Mediated Radical Polymerization and Click Chemistry*

Gel presents a great interest for electrochemical devices. Indeed, an electrolyte swollen gel enables a good ionic diffusion and brings good mechanical properties. Moreover, it prevents the dissolution of electroactive polymers in electrolyte. The click reaction between an azide and an alkyne is proved to be fast and efficient. And it is utilized particularly well with Copper-controlled radical polymerizations, due to the use of the same catalyst in each process. The electro active polymer used is the poly(2,2,6,6-tetramethylpiperidinyloxy-4-yl methacrylate) (PTMA). It is based from TEMPO stable lateral group which enable it to present high power performance.

Herein, we report the one-pot synthesis of electroactive gel by Cu(0)-mediated reversible-deactivation radical polymerization in conjunction with the copper-catalysed cycloaddition of azides and alkynes. Moreover, the mechanical and electrochemical tests of gels were studied.

**P49**

**Mr Fehaid M Alsubaie**

University of Warwick

*TBC*

**P50**

**Mr Felipe C. Fernandes**

University of Warwick

*Bio-based thermoset polymers from waste vegetable oil*

Development of epoxy resins from waste vegetable oil (WVO) emerges as an opportunity to the resins market through cost reduction, also addressing a solution to incorrect oil disposal. Challenges are the heterogeneity and lower reactivity, overcame by purifications developed in this work. Two routes were explored to produce polymers from WVO. Straight epoxidations were investigated; purification with aqueous extraction proved to increase conversions/selectivity when mCPBA was used. Fatty acid allyl esters (FAAE) were also prepared by transesterification with allyl alcohol, enabling the insertion of terminal epoxide. Bio-based thermosets were prepared from epoxidized WVO (EWVO) / FAAE (EFAAE) with phthalic anhydride and triethylamine. DSC revealed that EFAAE presented higher heat of curing due to higher epoxy equivalent. DMA analyses showed Tgs of -1.8 and 11.7 oC for EWVO and EFAAE, respectively. These findings opens space for further studies of thermosets from waste oils.

**P51**

**Dr Feng Wang**

*Enhancing Mechanochemical Endurance of Polymers by Introducing “Back-loops”*

Mechanophore is a force-sensitive molecular unit within a polymer chain. Judiciously designed mechanophores can be used to understand the principles of force transmission at the molecular level. Here, a disulfide mechanophore with a ''back-loop'' (in the form of a macrocycle), is designed to study how the molecular architecture of the mechanophore can divide the transmitted force. Polymers with different “back-loop” sizes were synthesized and tested under solvodynamic shear (ultrasonication) to understand the effect of the macrocycle size on the total bond scission rate. In comparison with classic linear polymers, polymers with cyclic mechanophores show enhanced mechanical endurance under similar shear conditions, and with larger back-loop provide more stability than those with smaller size.

**P52**

**Dr Florian Szillat**

Dentsply DeTrey GmbH

*Tailor-made aromatic dimethacrylate as a substitute for bisphenol A based cross-linkers in restorative dental materials*

A series of 2,7-bis(methacryloyloxy-alkyloxy)naphthalenes were synthesized via a reliable two-step reaction starting from 2,7-dihydroxynaphthalene as core structure. Among these novel bismethacrylates especially the new aromatic dimethacrylate 2,7-bis(methacryloyloxy-hexyloxy)naphthalene (NAHMA, M = 496,63 g/mol) is an extremely interesting compound, which exhibits several remarkable properties, e.g. a relatively high refractive index (nD20 = 1.539) and a low viscosity (0.51 Pa\*s at 23 °C). Design of experiments (DoE) was utilized to evaluate the influence of varying amounts of NAHMA in unfilled, photo-activated resins. Optimized resin mixtures were subsequently used in composite formulation and yielded materials with comparable performance to commercial dental composites. Results suggest, aromatic dimethacrylate NAHMA is a promising substitute for bisphenol A based cross-linkers like Bis-GMA, which still are the most popular base monomers used in restorative dental materials.

**P53**

**Dr George Polymeropoulos**

King Abdullah University of Science and Technology (KAUST), Physical Sciences and Engineering Division (PSE), Kaust Catalysis Center (KCC), Polymer Synthesis Laboratory, Thuwal 23955, Saudi Arabia

*Well-Defined Linear, 3-Miktoarm Star and Cyclic Triblock Terpolymers of Styrene, Isoprene and 2-Vinyl Pyridine: Synthesis, Molecular and Morphological Characterization*

The self-assembly of linear block co/terpolymers as well as of the corresponding three arm stars have been extensively studied. In the case of cyclic polymers there are only a few studies concerning block copolymers, so the synthesis and self-assembly of cyclic terpolymers is still a challenge. We were able to synthesize and study the morphology of cyclic terpolymers of poly(isoprene), polystyrene and poly(2-vinylpyridine) along with the corresponding linear and 3-miktoarm (3µ) star for comparison reasons.

The synthesis of all terpolymers was accomplished by using anionic polymerization high vacuum techniques and appropriate linking chemistry. All intermediates and final products were characterized by size exclusion chromatography, NMR and FT-IR. The self-assembly in solution and in bulk, studied by dynamic light scattering and transmission electron microscopy respectively, revealed the enormous influence of the structure on the micellar and morphological properties of terpolymers.

**P54**

**Mr George S. Pappas**

WMG (Warwick Manufacturing Group)

*Polymer functionalization of Carbon Nanotubes by radical addition directly on the sp2 carbons*

Surface modification of graphene and carbon nanotubes is almost the only option for the application of these materials in different research areas. The modifications cover a wide range of chemical methods, from non-covalent interactions to covalent bonding. Here, we utilize the radical addition method for the polymer modification of multi-wall carbon nanotubes (MWCNTs) and few-layer graphene (FLG) directly on the sp2 carbons. Poly (methyl acrylate) (PMA) was synthesized by photo-induced living radical polymerization and characterized by NMR and GPC. The polymer was directly grafted on the surface of FLG and MWCNTs utilizing Single-electron transfer living radical polymerization (SET-LRP) conditions, in order to reactivate the polymer’s end-groups and form radicals that can attack the sp2 bonds of the carbon materials. The modified FLG and MWCNTs were characterized by SEM, EDS, FT-IR and TGA. The impact of the modification process on the sp2 network was evaluated by Raman spectroscopy.

**P55**

**Dr George Zapsas**

King Abdullah University of Science and Technology (KAUST), Physical Sciences and Engineering Division (PSE), Kaust Catalysis Center (KCC), Polymer Synthesis Laboratory, Thuwal 23955, Saudi Arabia

*“Stitching” reaction of organoboranes: A powerful tool towards the synthesis of well-defined complex macromolecular architectures*

Organoborane (R3B, 3-arm star with boron junction point) can be transformed, through a well-known stitching reaction, to the corresponding 3-arm star R3COH with carbon junction point and a –OH group attached to the carbon. Based on this reaction we have synthesized a few novel 4-miktoarm stars by using anionic polymerization high vacuum techniques to afford macroanions, which after reaction with trifluoroborane (linking agent) produced boron-junction point 3-arm stars, followed by stitching reaction and an appropriate polymerization method, using either the –OH directly (ring opening polymerization of cyclic ethers or esters) or indirectly (atom transfer radical polymerization, etc).

**P56**

**Mr Glenn Vanluchene**

Gent University

*Tailoring Cellular Uptake of Gold Nanoparticles Via the Hydrophilic-to-Hydrophobic Ratio of their (Co)polymer Coating*

For many biological applications, the use of engineered gold nanoparticles is promising due to their cytocompatibility, chemical stability and easily tuned electronic and optical properties. In the past, the influence on cellular uptake of size, shape and surface chemistry of gold nanoparticles has already been investigated. However, the influence of the hydrophobic/hydrophilic ratio of a polymer coating has not been as well documented. To investigate this, we synthesized a library of well-defined HEA-MEA copolymers using Reversible Addition-Fragmentation chain Transfer (RAFT) polymerization. Subsequently, the particles were analyzed for their thermo-responsive behavior and cellular uptake mechanism. Furthermore, the mechanism of cellular uptake and the formation of a protein corona around the particles were investigated. These results can form a rational base on which particles can be engineered to optimize cellular uptake

**P57**

**Mr Gordon Herwig**

Department of Chemistry, University of Warwick

*Crosslinked polyorthoesters by step-growth polymerisation*

Polyorthoesters (POEs) have been intensively studied over the last decades and various potential biomedical applications were identified. This class of polymers is characterized by improved degradation properties such as enhanced integrity and biocompatibility. However, complications in both synthesis and adjustability of mechanical properties prevented the application of POEs in biomedicine to date.

Various POEs with different functionalities were synthesised in this project. Selecting crosslinking agents with different structure and functionality led to the formation of small molecules, long chains or networks, respectively. A range of chemical and physical properties of the molecules were characterised including spectroscopic and mechanical data. The results give insight into the formation of crosslinked POEs and the relationship between structure and function of these polymeric materials.

G.H. would like to thank The Leverhulme Trust for funding his Ph.D. studentship.

**P58**

**Dr Gregory N. Smith**

University of Sheffield

*Ion-containing poly(stearyl methacrylate)–poly(benzyl methacrylate) (PSMA–PBzMA) diblock copolymers in nonpolar solvents*

Poly(stearyl methacrylate)–poly(benzyl methacrylate) (PSMA–PBzMA) diblock copolymer nano-objects synthesized by polymerization-induced self-assembly (PISA) have been well established recently. These formulations are exclusively nonionic, as the formation of ions in nonpolar solvents is disfavored due to their low relative permittivity. Charge in nonpolar solvents, however, is important for fundamental colloid science (interactions are very long ranged) as well as for industrial applications (electrophoretic displays or dispersion in petrochemicals).

Recently, we have succeeded in charging PSMA–PBzMA nano-objects using an ionic monomer (consisting of a polymerizable trimethylammonium cation and fluorinated tetraphenylborate anion) through random copolymerization into both the PSMA and PBzMA blocks. Despite the small number of ionic groups (between 0.2 and 10 mol %), we have observed dramatic effects on both the electrophoretic mobility of the nano-objects and the morphologies formed.

**P59**

**Dr Guhuan Liu**

University of Science and Technology of China

*Hyperbranched Self-Immolative Polymers (hSIPs) for Pro-grammed Payload Delivery and Ultrasensitive Detection*

Upon stimuli-triggered single cleavage of capping moieties at the focal point and chain terminal, self-immolative dendrimers (SIDs) and linear self-immolative polymers (l-SIPs) undergo spontaneous domino-like radial fragmenta-tion and cascade head-to-tail depolymerization, respectively. The nature of response selectivity and signal amplifica-tion has rendered them an unique type of stimuli-responsive materials. Moreover, novel design principles are required for further advancement in the field of self-immolative polymers (SIPs). Herein, we report the facile fabrication of wa-ter-dispersible SIPs with a new chain topology, hyperbranched self-immolative polymers (hSIPs), by utilizing one-pot AB2 polycondensation methodology and sequential post-functionalization.

**P60**

**Mr Hamza Qasem**

University of Sheffield

*Studying the Microenvironment within Hyperbranched Polymers*

Copolymerisation of 3,5-diacetoxybenzoic acid with stearic acid enable the modified hyperbranched copolymers to be more soluble in range of non-polar solvents such as heaxane, toluene, and ethyl acetate. Loading pyridine as core in the hyperbranched polymers (HBPs) which allow the globular structure of the hyperbranched orientate and bind substrates within active catalytic sites in different conditions. The ultimate aim is to examine and determine whether or not HBPs could be used as a soluble catalytic support system and to control reactions selectivity in wide-ranging solvents, however, it was found that they could.

**P61**

**Mr Han Mertens**

Radboud University Nijmegen

*Polymersomes as mucosal vaccines*

Synthetic Fc–antigen conjugates can function as mucosal vaccines: the Fc fragment of an antibody mediates active transport across the mucosal membrane and the subsequent antigen uptake by antigen-presenting cells. Both mucosal and systemic immunity can be induced this way. However, a single antigen is often not sufficient to induce long-term protection from a pathogen. Furthermore, the Fc–antigen coupling has to be revisited for every antigen.

Polymersomes provide the advantage of being able to deliver multiple antigens due to their vesicular nature. Also, since the Fc–polymersome coupling is independent of the antigens contained, creating multiple vaccines is easier. This research aims to functionalise biodegradable polymersomes with modified Fc fragments using maleimide–thiol conjugation. The polymersomes are partially maleimide-functionalised, while a cysteine has been introduced in the Fc fragments to enable monofunctionalisation.

**P62**

**Mr Hong Yu Yang**

Sungkyunkwan University

*TBC*

**P63**

**Miss Hui Du**

College of Chemistry, Chemical Engineering and Materials Science, Soochow University

*An antithrombotic hydrogel with thrombin-responsive fibrinolytic activity: breaking down the clot as it forms*

We develop a hydrogel that triggers fibrinolytic activity only in response to thrombin, a feature product of blood coagulation. Specifically, polyacrylamide-based hydrogel incorporating tissue plasminogen activator (t-PA) and a thrombin-cleavable peptide as crosslinker is prepared. In response to the appearance of thrombin, t-PA is released from the gel and activate plasminogen to plasmin on the surface, thereby leading to fibrin degradation. The rate of release of t-PA depends on the degree of crosslinking of the hydrogel and on the thrombin concentration. Moreover, the release of t-PA is switched “on” and “off” in the presence and absence, respectively of thrombin. The t-PA-loaded hydrogels lyse fibrin only in response to thrombin, indicating that they have thrombosis-triggered fibrinolytic properties. The approach developed in this work therefore may provide a solution to the (so far) intractable problem of clotting and thrombosis on blood contacting devices.

**P64**

**Miss Ine Van Nieuwenhove**

Ghent University

*Development of a biomimetic temperature-responsive polymer material consisting of N-vinylcaprolactam for lipofilling applications*

There is a clear and urgent need for the development of injectable solutions for adipose tissue reconstructions that are outperforming the currently existing techniques. The present work aims to assess the potential of a synthetic smart polymer based on N-vinylcaprolactam (NVCL) to be applied as injectable solution. NVCL is a hydrogel building block that can be thermally triggered to undergo a phase transition around body temperature. Poly-(N-vinylcaprolactam) was synthesized via RAFT/MADIX in order to obtain well-controlled polymers. Different solvent systems, from homogeneous to heterogenous, were investigated for these controlled polymerizations. It was observed that a good control of the polymerization could be obtained applying a solvent mixture of water and ethanol. Subsequently, the potential of a biomimetic semi-synthetic hydrogel network was investigated by combining PNVCL together with fibrin.

**P66**

**Dr Iwona Kwiecien**

1 Centre of Polymer and Carbon Materials, Polish Academy of Sciences; 2 School of Biology, Chemistry and Forensic Science, Faculty of Science and Engineering, University of Wolverhampton

*Bioactive PHA and gamma-PGA oligomers - synthesis and structural characterization*

The aim of the research was applying (trans)esterification reaction as the one-pot synthesis method for obtaining conjugates of selected bioactive compounds with bacterial biopolymers. The 4-(2-hydroxyethyl)phenol (tyrosol), a natural phenolic compound, was used as a model of a bioactive compound with a hydroxyl group. Selected biopolymers, i.e. poly(3-hydroxybutyrate-co-4-hydroxybutyrate) and poly-&#947;-glutamic acid, were used as polymeric carrier. The (trans)esterification reactions of these biopolymers were carried out in melt. The structures of obtained products were established at the molecular level using electrospray ionization tandem mass spectrometry. The application of polyglutamic acid in the synthesis, allows to obtain the conjugates which contains more than one bioactive compound covalently bonded to the PGA oligomer chains.

Acknowledgments: This work was supported by the Polish National Science Centre (Decision No DEC-2013/11/N/ST5/01364).

**P67**

**Mr Jaipal Gupta**

International Institute for Nanocomposites Manufacturing, WMG

*TBC*

**P68**

**Mr Jawad Abaies**

University of Sheffield

*Explore Controlling Macromolecular Environments*

The synthesis and application of optically active polymers are topics currently attracting much consideration. polymers containing amino acids have many applications. one of these applications is enantio-selective separation. Well-defined amphiphilic non-chiral di-block copolymers, methoxypolyethylene glycol-b-dimethylaminoethyl methacrylate block copolymer(s)( mPEG-DMAEMAn), were synthesized using ATRP . Encapsulation abilities of micelles formed by non-chiral polymer were studied. Later, ability of this polymer to form cross-link with hydrophobic compound will be studying. preparation of chiral polymer(s)( amphilic copolymer contain amino acid attached to side chain or main chain), the ability to form micelles and their capability for enantio-selective separation is still in progress

**P69**

**Mr Jens Natterodt**

Adolphe Merkle Institute

*Polymer nanocomposites with cellulose nanocrystals functionalised with 2-ureido-4[1H]pyrimidinone*

Cellulose nanocrystals (CNCs) are rigid, non-toxic, fibrous nanoparticles that gain interest as reinforcing fillers in industrially produced polymers. However, their polar nature makes their compounding with nonpolar polymers difficult: phase-separated mixtures form unless specific processing methods are employed or the CNCs surface is decorated with nonpolar groups, surfactants, or polymers. As none of these methods is universal and the reinforcing ability is often reduced while additional processing is required, we herein show the use of 2-ureido-4[1H]pyrimidinone (UPy) as a “universal” compatibilizer finding that CNCs can be readily dispersed both in nonpolar and polar solvents. In toluene the UPy motifs form intra-CNC dimers, the CNCs are hydrophobic and well-dispersed, while they also disperse in DMF as the UPy moieties dissociate and form UPy-solvent interactions. This feature is exploited to integrate UPy-modified CNCs into various polymers and study their mechanical properties.

**P70**

**Mr Jérémie Lacombe**

Matière Molle et Chimie, UMR 7167 CNRS-ESPCI

*Synthesis and Structure of Supramolecular Polyethylene*

Low-molecular weight (~1000 g/mol) mono and bifunctional supramolecular polyethylene (PE) have been synthesized with high functionalities (90%). Catalyzed Chain Growth Polymerization of ethylene followed by post-reactions gave PE bearing two hetero-complementary groups: thymine (Thy) or 2,6-diaminotriazine (DAT).

We observed by SAXS lamellar morphologies arising from microphase separation of the polar end-groups and the non-polar chains and frozen by the crystallization of PE. When end-groups are not crystallizable (DAT/DAT or Thy/DAT), the PE crystallinity is not much altered. On the contrary, associated Thy/Thy pairs crystallize in planes at high temperature (180°C) and induce a strong confinement of the PE chains resulting in a significant decrease of PE crystallinity (17%). Those results show that crystallization drives more likely to mesoscopic organizations than directional (H-bonds) and non-directional (dispersion) supramolecular associations.

**P71**

**Dr Jeroen A.C.M. Goos**

Monash Institute of Pharmaceutical Sciences, Monash University

*Nanoparticles for PET/MR imaging: visualising tumours in the brain*

Anatomical data on brain tumours is generally provided by magnetic resonance imaging (MRI). The use of positron emission tomography (PET) to image tumour biology has been hampered due to the short half-life and high uptake in normal brain tissue of current PET tracers. Combining MRI and PET into a single imaging nanoparticle may overcome such disadvantages.

Star polymers were synthesized in which DOTA was complexed with gadolinium(III). Precursors for fluorine-18 PET imaging were incorporated using pH-sensitive linkers. Stability of the linkers was assessed in monomer derivatives containing imine, hydrazone, acyl hydrazone or oxime functionalities, using decreasing pH series.

Controlled release of the PET component appeared to be pH-dependent. The linkers exhibited different levels of stability under equi-acidic conditions.

Depending on the desired speed of delivery of the PET component, release rate could be tuned based on the appropriate choice of pH-sensitive linker.

**P72**

**Professor Joachim E. Klee**

DENTSPLY

*Tailor-made aromatic dimethacrylate as a substitute for bisphenol A based cross-linkers in restorative dental materials*

A series of 2,7-bis(methacryloyloxy-alkyloxy)naphthalenes were synthesized via a reliable two-step reaction starting from 2,7-dihydroxynaphthalene as core structure. Among these novel bismethacrylates especially the new aromatic dimethacrylate 2,7-bis(methacryloyloxy-hexyloxy)naphthalene (NAHMA, M = 496,63 g/mol) is an extremely interesting compound, which exhibits several remarkable properties, e.g. a relatively high refractive index (nD20 = 1.539) and a low viscosity (0.51 Pa\*s at 23 °C). Design of experiments (DoE) was utilized to evaluate the influence of varying amounts of NAHMA in unfilled, photo-activated resins. Optimized resin mixtures were subsequently used in composite formulation and yielded materials with comparable performance to commercial dental composites. Results suggest, aromatic dimethacrylate NAHMA is a promising substitute for bisphenol A based cross-linkers like Bis-GMA, which still are the most popular base monomers used in restorative dental materials.

**P73**

**Mr Joji Tanaka**

University of Warwick

*Differential Binding of N-acetylgalactosamine Glycopolymers to C-type Lectins*

Poly(N-acetylgalactosamine) prepared via sequential Cu(I)-mediated polymerisation and alkyne-azide click (CuAAC) was investigated with surface plasmon resonance (SPR) for human lectin interactions. The resulting polymers were shown to interact and bind strongly and specifically to Macrophage Galactose Lectin (MGL) (KD: 1.11 µM) but did not bind at all to a closely related lectin, DC-SIGN. The cluster glycoside effect of poly(N-acetylgalactosamine) to MGL was investigated by polymer chain length and architecture. The chain length did not affect the binding of MGL (KD: 0.17 µM – 0.52 µM), however, when compared to a hepatic C-type lectin of a similar binding specificity, Asialoglycoprotein Receptor (ASGPR) the binding affinity was greatly affected (KD: 0.37 µM – 6.65 µM). The data suggests that known differences in the specific configuration/orientation of the carbohydrate recognition domains of MGL and ASGPR are responsible for the differences in binding.

**P74**

**Mr Joonhee Lee**

Ulsan National Institute of Science and Technology (UNIST)

*Thermoresponsive PEG-based Functional Polymer Tunable by pH*

Thermoresponsive polymers with pH tunability are successfully synthesized by post-modification of the poly(ethylene oxide-co-allyl glycidyl ether) P(EO-co-AGE) copolymer using three different aminoethanethiols. Well-defined P(EO-co-AGE) copolymers are prepared via controlled anionic ring opening polymerization of EO containing 10 mol% of functional AGE comonomer. Respective amine moieties are introduced to side chains of P(EO-co-AGE) via facile thiol-ene click chemistry to provide a pH-tunable thermoresponsive property on the copolymer. Molecular weight, polydispersity and thiol-ene reaction efficiency were investigated by 1H NMR spectroscopy and size-exclusion chromatography (SEC). Lower critical solution temperature (LCST) was determined by the transmission spectra of the 0.1 wt % aqueous polymer solutions under varying pH values. LCST value could be suppressed by increasing pH and the cloud point at the same pH was different in accordance with the types of amine functional group.

**P75**

**Mr Joshua Holloway**

Ghent University

*Sequence-defined oligomers: From a manual to automated approach*

Synthetically copying nature to advance polymer science is one of the key challenges of today. Nature’s biopolymers have precise control over monomeric order. Huge advances have been made in polymer chemistry in recent decades with respect to polymer structure and properties but precise control over the order of monomers in synthetic polymers still remains a relatively new area. Advances made by us in the field of sequence-defined oligomers has seen our research progress from manual to automated synthesis. We present here a thiolactone based, protecting group free, solid phase, two-step iterative protocol. Step one consists of thiolactone ring opening by aminolysis in the presence of an acrylate, installing the desired side chain variation, while step two then installs a new thiolactone moiety on the main chain. The comparison of the manual and automated synthesis of those oligomers (up to decamers) will be highlighted.

**P76**

**Miss Julia Rho**

University of Warwick

*Probing the dynamics and assembly of cyclic peptide polymer nanotubes*

Cyclic peptide nanotubes have recently been gathering attention for their potential biological uses as a drug carrier, antimicrobial or biosensor. Our group has developed cyclic peptide (CP) polymer conjugates which form tubular structures with a defined diameter but most importantly which have vastly improved solubility compared to non-conjugated CPs. For biological applications it is crucial to know the stability and a possible exchange of the single cyclic peptide conjugates in these nanotubes. Therefore, this project will focus on studying the dynamics of model conjugates based on known fluorescence studies, including excimer formation, FRET and fluorescence quenching. Our key objectives are to: establish an efficient conjugation of the respective dyes or quenchers to the cyclic peptide and study the fluorescence properties of these dye conjugates and their dynamics.

**P77**

**Mr Junliang Zhang**

University of Warwick

*Synthesis of Sequence-Controlled Single Chain Polymeric Nanoparticles by Nature-Mimicking Process*

The highly specific activities of biopolymers such as proteins, are mainly determined by the remarkable control of the tertiary three-dimensional structure which arises from the controlled folding of a single polypeptide chain.Such controlled folding process is governed by the precise positioning of amino-acid along the chain. Reproducing how proteins fold their linear polymeric chains into perfectly defined nanostructures is a challenging goal in the field of macromolecular design. In order to mimic the precision of the folding process, controlling the location of monomer sequences along a polymer chain is the first significant issue to address. Multiblock copolymers are an appealing option to achieve this target since the sequence of segments within a multiblock copolymer can be controlled on demand. By precisely introducing foldable functionalities in a defined region of a single polymer chain, the folding of a specific sequence can then be controlled on demand.

**P78**

**Miss Katharina Clitherow**

(1) School of Clinical Dentistry, (2) Dept. of Chemistry, University of Sheffield, Sheffield, UK

*Development of electrospun polymer devices for drug delivery to the oral mucosa*

Electrospinning is a versatile manufacturing method that has considerable potential for the fabrication of an adhesive polymer dressing or drug delivery device as it enables manufacture with a broad range of polymers and drugs. Creating this device is important in the oral medicine field as it allows oral diseases to be targeted locally. The aim of this research was to evaluate electrospinning for the preparation of oral mucosal patches that can be modified to introduce therapeutic properties, e.g. antimicrobial activity. Key material characteristics, the rheology and conductivity of poly(caprolactone) and poly(vinyl pyrrolidone) were analysed to determine if polymer concentration and additional adhesive particles affected the fibre morphology in the electrospun patch. Incorporating fatty acids into the polymer system is currently being researched as these affect the permeability of the polymer fibres and thereby modify drug release kinetics, as well as having anti-fungal properties.

**P79**

**Miss Kathryn Murray**

University of Sheffield

*Transdermal drug delivery for the treatment of burn scar contracture*

Wound contracture is a normal physiological process that occurs during wound healing. However, excessive contracture can occur as a result of severe burn injury leading to disfigurement and decreased joint mobility, particularly in children. Contracture is initially reversible, however collagen crosslinking by lysyl oxidase (LOX) leads to permanent contracture. The inhibition of Lysyl oxidase (LOX) has proven to be beneficial in reducing scar contracture. Previous attempts to reduce wound contracture using systemic therapy have resulted in widespread, non-specific loss of collagen crosslinking, resulting in osteolathyrism and angiolathyrism. We describe a novel treatment to prevent wound contracture using a transdermal approach to deliver pro drugs of a potent LOX inhibitor. We are developing a transdermal patch consisting of a polymeric matrix to encapsulate the pro drug and deliver it to the site of injury.

**P80**

**Dr Katie Styan**

Commonwealth Scientific and Industrial Research Organisation

*Self-Initiated Photografting Polymerisation - a new hammer in the surface engineer’s toolbox*

Self-initiated photografting polymerization (SIPGP) was used to couple the polymerizable initiator monomer 2-(2-chloropropanoyloxy)ethyl acrylate to a range of polymeric substrates. The technique requires only UV light to couple the initiator (in solution) to surfaces; no photoinitiator was added. The functionality of the initiator surface was demonstrated by subsequent surface-initiated atom transfer radical polymerization (ATRP). The initiator surface density can be varied by inclusion of a diluent monomer or via selection of initiator and irradiation parameters. Use of this one-reactant one-step technique for creating an initiator surface, and for modulating the initiator surface density, is new.

**P81**

**Mr Kevin De Bruycker**

Ghent University

*Reversible grafting of polymer brush micropatterns*

Micro- and nanostructured polymer substrates are attractive in materials science, since an excellent control of film thickness and high grafting densities are accessible, especially using a grafting-from approach. To date, many different polymer materials and lithography techniques have been used to tailor surface properties, yielding substrates with enhanced functions. However, only very few reactions offer stable yet dynamic grafting, resulting in switchable surface properties.

In this work, surfaces were functionalised via microcontact chemistry using reversible TAD-indole chemistry. The fast reaction at room temperature enables efficient surface patterning within a few minutes while the pattern can be erased at elevated temperatures, thereby regenerating a writable surface. Therefore, this TAD based strategy offers the possibility to generate rewritable substrates by grafting polymers in any desired micropattern and with any desired functional group.

**P82**

**Ms Kseniia N. Grafskaia**

Moscow Institute of Physics and Technology (State University)

*In situ studies of self-assembling polymer based molecules during the ion-conducting membranes formation*

The world’s demand for renewable power sources is constantly growing due to finite reserves of fossil fuel. The ion-exchange membrane fuel cells constitute one of the possible routes toward the development of renewable energy sources. The organic liquid crystal materials are the promising class for such systems. They are adaptable for various external effects. By employing the principles of self-organization they could form a wide range of different structures with intriguing functional properties .

The main goal of this work is: to study the mechanisms of low-molecular self-assembled molecules structure formation to design ion-selective membranes with tailoring structure.

The main objectives are : to create experimental unit for in situ studies of the external conditions effects on structure formation processes;

to analyze the phase behavior of self-assembled amphiphilic compounds under different external conditions (temperature, solvent vapor, UV irradiation).

**P83**

**Miss Laura Macdougall**

University of Warwick

*The Evaluation of Poly(ethylene glycol) Hydrogels Formed by Efficient in situ Nucleophilic Thiol-yne Click Chemistry*

Hydrogels have received a lot of attention in recent literature, as a consequence of their distinct biomaterial characteristics.1 This enables hydrogels to have similar properties to soft tissue, thus permitting their use in tissue engineering. Poly(ethylene glycol) (PEG) is a widely studied hydrophilic polymer for hydrogel synthesis. The thiol-yne click reaction follows an efficient, nucleophilic pathway at 37°C without the use of an external stimuli. By functionalising PEG with alkyne and thiol functional groups thiol-yne reactions can rapidly occur forming robust hydrogels.2 The PEG chains can be tailored to allow the hydrogels to have tuneable strengths and structures. This work explores the properties of thiol-yne click PEG hydrogels via rheology, compression testing and cryo scanning electron microscopy. 1. A. S. Hoffman, Adv. Drug Delivery Rev., 2002, 54, 3-12. 2. V. X. Truong, M. P. Ablett, S. M. Richardson, J. A. Hoyland and A. P. Dove, J. Am. Chem. Soc., 2015, 137, 1618-1622

**P84**

**Miss Laura Wilkins**

University of Warwick

*Glycopolymer Anti-infectives against Cholera*

Multivalent glycopolymers have been shown for decades to have higher affinity for lectins due to the cluster glycoside effect. However, due to the promiscuity of all lectins (especially towards monosaccharides), these glycopolymers do not specifically interact with a single protein target, which has limited their development. Here we will show progress towards making 'selective glycopolymers’. That is glycopolymers which mimic nature glycans to have high specificity as well as affinity (which is already easy to achieve); this is achieved by targeting allosteric binding sites, in addition to the primary sugar site. RAFT polymerisation of monomers capable of being post-modified with two functionalities is key to this approach. The synthesis and binding interactions will be studied.

**P85**

**Dr Li Yan**

Department of chemistry, Tsinghua University

*Controlling the accumulation of water at oil-solid interfaces by gradient solid substrates*

We demonstrated a strategy to control the accumulation of water at the oil-solid interface by using gradient solid substrates, which can be prepared by vaporing diffusion of organosilanes. The substrate near the source of organosilanes possessed a higher hydrophobicity which decayed over the distance. DICM and LSCM images were used to determine the water droplets growing. Over 4 days, it is shown that water droplets at more hydrophobic regions tended to be regular spherical shape. This is attributed to the hydrophobicity of the underlying substrate, which dewets the droplets to be rounded shape. However, along the gradient from hydrophobic to hydrophilic, the water droplets gradually turned to irregular shapes, as hydrophilic surfaces pin the edge of droplets and result in distorted water droplets during their growth. These results suggest that the formation of water droplets can be controlled by tuning the underlying substrate.

**P86**

**Mr Luis Olaechea**

Adolphe Merkle Institute

*Stimuli-responsive Pt(0) containing metallosupramolecular polymers*

Supramolecular polymers (SPs) are macromolecules formed by self-assembly of monomeric units via non-covalent interactions. SPs combine the physical properties of polymers and the advantages of dynamic supramolecular interactions, which bestow them with stimuli-responsiveness. Metallosupramolecular polymers (MSPs) are a subgroup of SPs which are typically formed through the coordination of multitopic ligands with metal salts. Building on our previous work on cross-linked Pt(0)-containing MSPs, we present a framework for the synthesis of linear Pt(0)-containing MSPs through ligand exchange between Pt(0)(styrene)3 and a diphenylactetylene-functionalized ditopic monomer. We will discuss the thermal dissociation of these assemblies, which leads to the in situ formation of matrix-stabilized Pt nanoparticles (NPs). Compared to current examples found in literature, this procedure does not require the reduction of previously introduced metallic salts for the synthesis of metal NPs.

**P87**

**Mr M. Noé Fanjul Mosteirín**

Chemistry Department, University of Warwick

*Organo-catalysed synthesis of polycarbonates from CO2*

Emissions of CO2 to the atmosphere have been proved that are one of the most important factors of the greenhouse effect and therefore responsible of the climate change. Developments along these last two decades have been made trying to capture these emissions, and in the last few, using the CO2 as a sustainable raw material. Green organocatalysts derivatives from amidines and guanidines such as 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU) and 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD) are proposed to be able to catalyse the ring expansion of oxiranes and oxetanes with CO2 affording valuable polycarbonates which have a large potential for biomedical applications.

**P88**

**Miss Majda Akrach**

Chemistry Department, University of Warwick

*TBC*

**P89**

**Mr Marcel Lorenz**

ETH Zurich, Institute of Chemical and Bioengineering

*Novel macroporous materials for protein purification*

Monoclonal antibodies (mAbs) are deemed as one of the most promising strategies for cancer treatment. However, purification of such therapeutic proteins constitutes up to 80 % of the overall production costs, emphasizing the need for alternative strategies.

This study aims at the development of functionalized macroporous materials for protein purification by chromatography. Poly[styrene-co-(4-vinylbenzylazide)] nanoparticles were synthesized by emulsion polymerization. By employing click chemistry and atom transfer radical polymerization various functional groups could be grafted from or onto the particle surface. The particles were aggregated by reactive gelation under shear to form clusters having pores between 0.1 and 1 µm, thus enabling separation of large biomolecules.

Our synthetic strategy is wide in scope and in combination with the effective control of the particle porosity this approach yields packing materials with high potential for mAbs purification.

**P90**

**Miss Maria Inam**

University of Warwick

*Hydrogel-micelle networks based on crystallisation-driven self-assembly*

With the aim of preparing cationic cylindrical micelles via the crystallisation-driven self-assembly of poly(L-lactide) (PLLA)-containing polymers, PLLA-b-poly(acrylamidoethylamine) and PLLA-b-poly(dimethylaminoethylmethacrylate) (DMAEMA) block copolymers were synthesised using a dual RAFT/ROP initiator. The polymers were assembled into cationic spherical micelles with the aim of assembling into cylindrical micelles in future.

Surprisingly, when heated in a single solvent above the Tg of PLLA, PLLA-b-PDMAEMA polymers of different coronal lengths were consistently assembled into uniform cationic diamond-shaped structures.

The addition of these cationic spherical, cylindrical and diamond-shaped structures will be incorporated into alginate hydrogels to monitor the effect on mechanical strength. Initial results using the anionic control PLLA-b-poly(acrylic acid) show differences in mechanical strength between hydrogels containing spherical and cylindrical particles.

**P91**

**Dr Maria Jose Gonzalez**

Department of Chemistry, University of Toronto, Toronto ON, Canada and BASF Corporation, Advanced Material and Systems Research, Wyandotte, Michigan, USA

*Understanding Polymer Diffusion in Waterborne Coatings and its Influence on Final Film Properties*

Concern for the environment has been driving major changes in the coatings industry. To reduce the amount of volatile organic compounds (VOC’s) released to the atmosphere, new technology is being developed to replace solvent-based coatings with water-based coatings. Our partner BASF provides a portfolio based on acid functional acrylics and acid functional styrenic acrylic copolymers to the marketplace. This type of polymers has the potential to serve as the basis for environmentally friendly tough and robust paints. In order to optimize the properties, one needs knowledge of the rate of polymer diffusion in the coating. Fluorescence Resonance Energy Transfer (FRET) is a known technique for following polymer diffusion and relies on energy transfer between two chromophores. In this poster, we describe synthetic methodologies developed to post-functionalize such polymer with chromophores to enable FRET measurements. We also present FRET measurements results using the labeled-polymers.

**P92**

**Miss Mariana Gameiro**

University of Nottingham

*Novel and Sustainable method to develop greener materials*

In recent years, polymers from renewable resources have become increasingly interesting due of their low cost, ready availability and potential for biodegradability. Moreover, they greatly contribute to global sustainability without depleting important resources by using non-petrochemical feedstocks. Enzymatic polymerisations have provided a new synthetic strategy and, combined with supercritical fluid can be regarded as an environmentally friendly process since mild reaction conditions are used and no toxic solvents are needed. In this study, we target glycerol and succinic acid condensation polymerisation in bulk and in supercritical conditions (with and without the presence of an enzyme) to obtain poly(glycerol succinate) (PGSuc), which was characterised in terms of their molecular weight, thermal and mechanical properties. PGSuc shows potential for commercial application as a new, “green” surfactant that could be valuable in biomedical, household and industrial applications.

**P93**

**Miss Marianne Rolph**

University of Warwick

*The Hydrolytic Behaviour of DMAEA Functionalised Polymeric Stars*

Ester hydrolysis is readily exploited to produce degradable polymers, with the majority of work focussed on hydrolysing the polymer backbone. In contrast, hydrolysis of pendent ester linkages, whilst widely acknowledged, has not been extensively studied. Recently Truong et al. carried out an in depth study into the hydrolysis of linear homopolymers of N,N’-(dimethylamino)ethyl acrylate (DMAEA).1 This self-catalysed hydrolysis required neither an internal nor external stimulus. Aiming to probe the effect of tethering DMAEA within a polymeric scaffold we prepared a series of polymeric stars of different arm lengths, type and crosslinking density and investigated the effect of temperature on the hydrolysis. Hydrolysis was found to be strongly temperature dependent with both a higher crosslinking density and a longer arm length affording greater protection, yet the composition and nature of the arm had little impact.1. Truong, N.P. et. al, Biomacromolecules, 2011, 12, 1876-1882

**P94**

**Miss Marie Finnegan**

Queen's University Belfast

*Biodegradable Biocompatible Copolymer Networks closely Mimicking the Adhesive Properties of the Extracellular Matrix*

Synthetic biocompatible polymer networks (gels) are highly desirable as 3D tissue engineering scaffolds. These materials can be designed to closely mimic the properties of the extracellular matrix (ECM) which consists of cell-adhesive and cell-inert domains (patches). Herein, microphase separation of two hydrophilic homopolymers, poly[(2-methacryloyloxy)ethyl phosphorylcholine] (PMPC) and poly[oligo(ethylene glycol) methacrylate] (POEGMA), on the gel surface was utilised. The gels were prepared by RAFT polymerisation using a biodegradable acetal-based cross-linker. Attachment of an RGD cell-adhesive peptide via thiol-ene chemistry to one of these polymers combined with microphase separation, results in the formation of cell-inert and cell-adhesive domains on the gel surface, mimicking the adhesive heterogeneity of the ECM. GPC and NMR were used for homopolymer characterisation. The phase separation on the gel surface was examined by SEM and energy-dispersive x-ray spectroscopy (EDX).

**P95**

**Mr Martijn Droesbeke**

Department of Organic and Macromolecular Chemistry, Polymer Chemistry Research Group and Laboratory, Ghent University

*Vinylogous Urethane Vitrimers: Controlling the Viscoelastic Properties via Catalysis*

Vinylogous urethane vitrimers are polymer networks that can undergo rapid network rearrangements, stress relaxation and viscoelastic flow through swift addition/elimination reactions of free amines. In this work, these materials have been combined with simple additives like acids and bases, which were found to significantly influence the covalent exchange kinetics on a molecular level and gave a wide range of viscoelastic properties on a material level. The reported strategy thus offers exquisite control of the viscoelastic properties of the vinylogous urethane materials,

useful in the rational design of vitrimer elastomers with short relaxation times at elevated temperatures, but negligible exchange at service temperature, which avoids undesired elastomer creep.

**P96**

**Mr Mathieu A. Ayer**

Adolphe Merkle Institute

*Stimuli-Responsive Azo-Containing Polymeric Materials*

Azo compounds are widely studied as radical polymerization initiators but few studies have demonstrated their use as stimuli-responsive motifs in macromolecular constructs. The azo motif is activated by heat or light resulting in the cleavage of its C-N bonds inducing N2 release and producing radicals that can further react. Here we present the syntheses of novel linear azo-containing polyurethanes and azo-crosslinked poly(vinyl alcohol) organogels. We report the thermally and optically induced response of these materials in the solid state, in the form of irreversible cleavage of the azo motifs and thus chain breakage. For the linear polyurethanes this leads to a molecular weight decrease, concomitant with a significant reduction of the strain at break, and the tensile strength. The azo-containing organogels undergo a de-crosslinking reaction which also causes pronounced changes of the material’s mechanical properties. Since N2 is formed in the process, foaming is observed.

**P97**

**Mr Matthew J Derry**

University of Sheffield

*In situ small-angle X-ray scattering studies of sterically-stabilized diblock copolymer nanoparticles formed during polymerization-induced self-assembly in non-polar media*

RAFT dispersion polymerization of benzyl methacrylate is utilized to prepare poly(stearyl methacrylate)-poly(benzyl methacrylate) (S-B) diblock copolymer nano-objects in mineral oil. Polymerization-induced self-assembly (PISA) occurs under these conditions. Spheres, worms and vesicles are obtained when using a relatively short S13 macro-CTA, whereas only kinetically-trapped spheres are accessible when using longer macro-CTAs (S18 or S31). Small-angle X-ray scattering (SAXS) is used to monitor the morphological transitions during the PISA syntheses. This enables the evolution of particle diameter, aggregation number and packing density of copolymer chains to be monitored when targeting S31-B2000 spheres. A combination of DLS, TEM and both in situ and post mortem SAXS studies indicate that the S13-Bx vesicle membrane thickens with increasing PBzMA DP while the overall vesicle dimensions remain constant. Thus the vesicles grow inwards, as recently reported for an aqueous PISA formulation.

**P98**

**Mr Matthew J Rymaruk**

The University of Sheffield

*Bespoke contrast-matched diblock copolymer nanoparticles enable the rational design of highly transparent Pickering double emulsions*

Highly transparent oil-in-water Pickering emulsions are prepared using contrast-matched organic nanoparticles. This is achieved via addition of either sucrose or glycerol to an aqueous dispersion of diblock copolymer nanoparticles prior to high-shear homogenization with an equal volume of oil. The resulting Pickering emulsions comprise polydisperse oil droplets of 20-100 µm diameter and exhibit up to 96 % transmittance across the visible spectrum. In contrast, control experiments using non-contrast-matched copolymer nanoparticles as a Pickering emulsifier only produced highly turbid emulsions. Therefore, for the preparation of highly transparent Pickering emulsions it is essential to use isorefractive nanoparticles in order to minimize light scattering. Finally, contrast-matched hydrophobic diblock copolymer nanoparticles are also prepared that, when combined with the hyrophilic nanoparticles, enable transparent oil-in-water-in-oil Pickering double emulsions to be obtained.

**P99**

**Dr Matthias Hartlieb**

University of Warwick

*Stimuli responsive cyclic peptide nanotubes*

The formation of nanotubes from cyclic peptides having an alternating D-/L- chirality was first described in the 1990s by Ghadiri and coworkers. One outstanding property is their interaction with bacterial membranes, resulting in their disruption, ultimately, leading to the death of the microorganism. However, issues with the original design were the aggregation of the cyclic peptide nanotubes (CPNT) into large assemblies, as well as their toxicity against mammalian cells. One approach to solve these problems is the conjugation of polymers to CPNT, preventing an aggregation and restricting the length. Our aim is to design CPNT, which are reversibly connected to a polymeric shell. CPNT which are toxic to bacteria and/or mammalian cells, when not conjugated to a polymer were designed and connected to a polymer shell using a cleavable connection to create stimuli responsive CPNT having a switchable toxicity. This is shown for either redox- or protease- responsive systems.

**P100**

**Dr Maude LE Hellaye**

*Stimulable latex particles as stabilizers of anti-Bancroft type Pickering emulsions.*

Pickering emulsions are surfactant-free metastable dispersions kinetically stabilised by colloidal particles. The application field of such materials is considerably widespread. The design of emulsions which can evolve under the effect of an external stimulus is a topic of current investigation. Numerous studies aimed at establishing the correlation between the preferred wettability of particles and the type of emulsion (direct O/W or reverse W/O). Bancroft’s rule establishing that a colloid preferentially dispersed in water (in oil respectively) stabilizes preferentially a direct (a reverse respectively) emulsion is generally valid. We show experimental results using hydrophobic core-PAA grafted shell particles for which this Bancroft rule applies very well.

Here we also describe the preparation of poly(styrene) latex particles via miniemulsion polymerization in the presence of newly synthesized biobased stabilizers, e.g. poly(acrylic acid) hydrophobically modified by terpenes, issued from renewable biomass. Interestingly, with such particles anti-Bancroft type emulsions were obtained. We discuss this peculiar behaviour.

**P101**

**Miss Megan Thomsett**

University of Nottingham

*The sustainable functionalisation of biomass for the synthesis of novel polymers*

This research aims to functionalise various terpenes, in a sustainable manner that will not cause adverse effects on the environment. The monomers obtained will be used for polymerisations as well as build on work previously carried out by the Howdle group. The overall objective of this research is to synthesise novel and useful polymers derived partly or entirely from renewable feedstocks.

**P102**

**Dr Michal Kwiecien**

1. Centre of Polymer and Carbon Materials, Polish Academy of Sciences 2. School of Biology, Chemistry and Forensic Science, Faculty of Science and Engineering, University of Wolverhampton

*Novel biocompatible terpolyesters consisting structural fragments of polyhydroxyalkanoates biopolyesters*

Polyhydroxyalkanoates (PHA) are a group of biodegradable and biocompatible biopolyesters which are useful for wide range of medical applications. However, for some sophisticated application it is not possible to use the unmodified PHA due to their mechanical properties. The presented study are focused on used of selected PHA biopolyester as a source a building blocks for synthesis novel terpolyester. The well defined PHA oligodiols can be obtained via selective reduction of PHA biopolyester with the aid of lithium borohydride. In this communication the application of PHA oligodiols in the synthesis of new polymeric materials (terpolyesters) will be presented. The terpolyesters were obtained via polycondensation process of oligodiols with sebacoyl chloride. Additionally, structural characterization as well as the preliminary biocompatibility test of the resulting terpolyesters will be presented.

Acknowledgement: This work was supported by the PNSC: No. DEC-2013/11/B/ST5/02222

**P103**

**Ms Mona Kab Omir**

University of Liverpool

*Preparation of Solid Lipid Nanoparticle (SLN) using branched copolymers*

Nanomedicine research focuses on developing various stable drug delivery systems that often require surfactant stabilisers. Here we have focussed on solid lipid nanoparticle (SLN) formation and the use of branched copolymers as a novel surfactant with the aim of removing low molecular weight surfactants from future therapeutic options and improving the drug delivery of poorly water-soluble drugs. A series of branched oligo(ethylene) methacrylate copolymers have been synthesised with varying DPn, within the primary chains, different branchers and a range of brancher to initiator ratios. ATRP was used in a modified “Strathclyde” approach and high molecular weight, water-soluble branched polymers were formed. Emulsion studies with model oils have shown the excellent stabilising properties of the polymers over several weeks. Initial studies with lipids that have high melting points have shown encouraging formation of stable SLNs.

**P104**

**Mr Moon Soo Gil**

Theranostic Macromolecules Research Center and School of Chemical Engineering, SungKyunKwan University

*A novel injectable, biodegradable and pH sensitive hydrogel conjugated to human serum albumin for sustained and prolonged release of therapeutic proteins.*

Protein therapeutics has gained remarkable attention in treating cancer, diabetes, inflammatory diseases, and abnormal growth. Major advantages of protein therapeutics are high target-specificity, reduced potential to interfere with normal biological processes, and fewer side effects compared with small-molecule drugs. Recently, our group proposed cationic, pH sensitive hydrogels as in vivo release carriers for human growth hormone (hGH). Furthermore, Human Serum Albumin (HSA) which can bind a number of therapeutic drugs and proteins was conjugated to pH temperature-sensitive hydrogel and applied for sustained hGH release. Owing to the intriguing assembly behavior of hydrogels, they could form strong ionic complex, good binding affinity with protein/drugs and deliver encapsulates in a sustained manner. The protein-loaded hydrogel greatly retarded the initial burst and exhibited sustained drug release in vitro and in vivo.

**P105**

**Miss Ni Yi**

Imperial College London

*CO2-derived polycarbonates and block copolymers for biomedical appolications*

Aliphatic polycarbonates have attracted great attention in the biomedical field as they are (bio)degradable and have low toxicity. The use of carbon dioxide as a monomer in the production of aliphatic polycarbonates is promising as it enables partial petrochemical substitution and value-add to waste gas.

This poster will describe the syntheses of aliphatic polycarbonates from CO2 and epoxides and ‘ABA’-type triblock copolymers of polycarbonates (B) and polyesters (A). A focus for the work has been to apply epoxides, illustrated in this case by vinyl-cyclohexene oxide, which are compatible with post-polymerization (with olefin groups), so as to allow various post-polymerization functionalizations to modify and improve polymer properties for specific biomedical applications. A series of functional polycarbonates and triblock copolymers has been synthesized and their suitability for applications as antimicrobials and as matrices in bone tissue engineering will be described.

**P106**

**Mr Nicholas Penfold**

University of Sheffield

*pH-Responsive Non-Ionic Diblock Copolymer Nano-Particles*

Poly(glycerol monomethacrylate)-poly(2-hydroxypropyl methacrylate) (PGMA-PHPMA) diblock copolymer worm gels were prepared by RAFT aqueous dispersion polymerisation using a newly synthesised morpholine-functionalised RAFT agent, MPETTC, at pH 7.0-7.5. These worms form soft, free-standing aqueous hydrogels at 15% w/w solids. Protonation of the morpholine end-groups at pH 3 increases the hydrophilic character of the PGMA stabiliser block; this induces a worm-to-sphere morphological transition, which leads to a gel-sol transition. This was characterised by dynamic light scattering, transmission electron microscopy and rheology studies. On returning to pH 7, regelation is observed. Such diblock copolymer worm gels remained intact when acidified in the presence of electrolyte. Moreover, regelation is also observed in relatively acidic solution (pH < 2), as the excess acid acts as a salt under these conditions and so induces a sphere-to-worm transition

**P107**

**Dr Nicholas Warren**

University of Sheffield

*Testing Vesicles to Destruction: SAXS and Mass Spectrometry Studies on Block Copolymer Vesicles Prepared via Polymerisation-Induced Self-assembly*

Various characterisation techniques are used to probe the structure of poly(glycerol monomethacrylate)-poly(2-hydroxypropyl methacrylate) (G55-Hx) vesicles prepared via polymerisation-induced self-assembly. While fixing the degree of polymerisation of the corona block at 55, x is tuned from 200 to 2000. This resulted in a monotonic increase in the vesicle wall thickness which is observed TEM images and quantified using small-angle x-ray scattering (SAXS).Both dynamic light scattering and SAXS indicate that there is little change in the overall vesicle diameter for 400 < x < 800 indicating a gradually shrinking lumen. The aggregation number is also determined using both SAXS and charge detection mass spectrometry (CD-MS) studies. As far as we are aware, this is the first time that mass spectrometry has been employed to characterise block copolymer vesicles. At x values above 1000, the vesicular morphology is no longer stable, with a much larger, ill-defined morphology being observed.

**P108**

**Mr Nikolaos Engelis**

The University of Warwick

*Synthesis of Methacrylic Block Copolymers via Sulphur-free RAFT*

The dynamic development of polymer science allowed achieving significant results during the past two decades. However, there are still several emerging areas, one of which is the controlled synthesis of methacrylic block and multiblock copolymers. Modern techniques such as NMP and ATRP allow the synthesis of block macromolecules with desired properties.[1], [2] Nevertheless, they often require special attention due to toxicity of reagents or sensitivity to oxidizing agents.

**P109**

**Mrs Noor Hadzuin Nik Hadzir**

UNSW Australia

*Use of dense carbon dioxide in preparation of polymeric nanoparticles via miniemulsion polymerization*

Miniemulsion polymerization is an attractive synthetic route to polymeric nanoparticles mainly due to the fact that particle formation occurs directly from monomer droplets, thus enabling synthesis of a range of particle types not readily accessible via other heterogeneous polymerization processes. It is desirable to develop novel, versatile methodologies for the preparation of miniemulsions using low energy methods and circumvent the typical requirement for high energy mixing. We have been exploring the use of low pressure carbon dioxide to facilitate the formation of polymerizable miniemulsions. The present work is concerned with the elucidation of conditions required for these systems to proceed as miniemulsion polymerizations as opposed to emulsion polymerizations or hybrid emulsion/miniemulsion polymerizations.

**P110**

**Mr Nuttapol Risangud**

University Of Warwick

*Degradable polyurea microcapsules from stable isocyanatoethyl methacrylate prepolymers*

Polycaprolactone (PCL) has been known as biocompatibility and good biodegradability material, which can be decomposed into small molecular weight and non-toxic species. The extraordinary nucleophilic reactivity of isocyanate has received a great interest as a modified and synthetic tool. Different types of isocyanate side chain containing copolymers which were synthesized by Cu(0)-mediated radical polymerization (SET-LRP): poly (methyl methacrylate-co-isocyanatoethyl methacrylate) (p(MMA-co-IEM)) and poly(benzyl methacrylate-co-isocyanatoethyl methacrylate) (p(BnMA-co-IEM). Modification of the isocyanate group in the copolymer, in this case in-situ, is a simple method to confirm if isocyanates are still present and reactive. Products were characterized by 1H and 13C NMR, and FTIR spectroscopy and SEC. Furthermore, p(BnMA-co-IEM) was used for the fabrication of liquid core microcapsules via oil-in-water interfacial polymerization with diethylenetriamine as crosslinker.

**P111**

**Mr Oliver W Scaife**

Loughborough University

*Novel Supramolecular Polymers for Aqueous Viscosity Modification*

Polymeric viscosity modification of aqueous solutions is predominantly based on hydrophobic interactions between pendent alkyl chains or hydrophobic backbones within hydrophilic polymers. Hydrophobic interactions are relatively weak and lack specificity compared to other supramolecular interactions. Supramolecular interactions like metal coordination and hydrogen bonding are superior to hydrophobic interactions as they can be specific, directional and significantly stronger.

Previous research has shown that dendritic species containing ethylhexyl amide (EH) moieties exhibit gelating behaviour in organic solvents, attributed to hydrogen bonding between the EH groups.

In this work the effect of the incorporation of H bonding groups on the solution properties of polymers will be studied. These polymers will be synthesised via Controlled Radical Polymerisation (CRP) techniques such as Reversible Addition Fragmentation Chain Transfer (RAFT) Polymerisation.

**P112**

**Mr Panagiotis Bexis**

Department of Chemistry - University of Warwick

*Organocatalytic Ring Opening Polymerisation & “Grafting from” functionalised &#949;-caprolactone macroinitiators*

The design and synthesis of highly functional polymers is essential to meet the demands of advanced applications in materials science. Functional &#949;-caprolactones can be synthesised through the simple ring-expansion of their corresponding cyclohexanones via a Bayer-Villiger oxidation with meta-chloroperoxybenzoic acid (m-CPBA). This has ultimately led to a large range of functional cyclic esters. The “grafting from” approach in which polymer chains are grown from a polymer with multiple initiation sites located along its backbone (macroinitiator) can lead to less overall control over the length of the polymer grafts, however, greater control of the overall length of the graft copolymer, as well as access to higher graft densities can be achieved. Careful choice of the synthetic method, grafting density, composition and length of the polymer backbone and side-arms, allows graft copolymers with unique structural characteristics and a range of functionalities to be prepared.

**P113**

**Dr Panayiotis Bilalis**

King Abdullah University of Science and Technology (KAUST), Physical Sciences and Engineering Division (PSE), Kaust Catalysis Center (KCC), Polymer Synthesis Laboratory, Thuwal 23955, Saudi Arabia

*Modification of Graphene Oxide with Polypept(o)ides through Surface Initiated Ring Opening Polymerization*

While the synthesis of many graphene/polymer hybrid materials has been reported recently, the combination of graphene with polypept(o)ides has hardly been touched upon. Polypeptoids, structural isomers of natural polypeptides, also known and as poly(N-substituted glycine)s, possess very interesting properties like biodegradability and minimal cytotoxicity.

In the present work, we report the modification of graphene oxide (GO) with well-defined polysarcosine (the simplest analogue of the family of polypeptoids) through surface initiated ROP (Ring Opening Polymerization). Primary amine groups were introduced onto the graphene sheets to initiate polymerization of sarcosine N-carboxy anhydride. Polymerization conditions were optimized to yield well defined grafted GO having sufficient water dispersion. The physicochemical properties of this novel hybrid materials were studied by TEM, SEM, DLS, XPS, FT-IR and SEC.

**P114**

**Professor Patrice Bourson**

LMOPS University of Lorraine

*Advantages to do in-situ measurements by Raman spectroscopy and coupling with other techniques for the determination of physico-chemical properties of polymers*

Raman spectroscopy RS is a technique particularly rapidly evolving in spectral qualities, quality of instruments and transportability. This allows uses in-situ or real time measurments and permit to control or optimize the properties of polymer and for example the possibility of their use for monitoring the industrial flows directly into the plant or reactor. We show, in this presentation, two examples of real-time monitoring of the physico-chemical properties of polymers by Raman spectroscopy and coupling experiments. The first example showing interest to make in-situ measurements to determine the mechanical properties of polymers, and so to establish an original coupling (Raman - extensometer) for characterizing in real time the microstructure of a polymer during the mechanical deformation. The second example, consists the control in real time of industrial flows using RS combined with a chemometrics study to monitor very effectively an industrial production of a polymer.

**P115**

**Ms Patricia Monks**

Royal College of Surgeons in Ireland

*Effect of chain length on polymer stabilised magnetic nanoparticles incorporated into a hydrogel network for improved thermal response*

Magnetic nanoparticles offer distinguishable advantages from bulk materials, such as reactivity and mobility due to their size. The integration of magnetic nanoparticles into hydrogels (3D hydrophilic polymer networks) has the potential to alter the properties of the original material and create a novel hydrogel matrix that can be manipulated using magnetic field.

In this work, epoxy linker functionalised nanoparticles undergo ring opening coupling reactions to coat the nanoparticles with aminated polymers of various chain lengths for integration into a simple epoxy-amine hydrogel network. The physical effects of the branch length on the nanoparticles in the hydrogel network, and the thermal response from an applied magnetic field on both the stabilised nanoparticle solutions and the hydrogels will be investigated.

This research aims to explore ways to improve the thermal response from nanocomposites for hyperthermia treatment and controlled drug delivery.

**P116**

**Mr Patrick A.J.M. de Jongh**

University of Warwick

*Alternating N-acylated poly(aminoester) materials: macromonomer synthesis, polymerisation, responsive properties and low-fouling behaviour*

The spontaneous zwitterionic copolymerisation of nucleophilic and electrophilic monomers enables the synthesis of alternating copolymers. By copolymerising 2-oxazolines with acrylic acid, an ester functionality is introduced into a poly(2-oxazoline) backbone, resulting in degradable N-acylated poly(aminoester)s (NPAEs), which possess &#945;-vinyl and either &#969;-carboxylic acid or amido end groups.

We present the preparation of a library of NPAEs from three nucleophilic and two electrophilic monomers. 1H NMR and MALDI-ToF MS and MS/MS were employed to gain further insights in their composition. The &#945;-vinyl end group allowed their successful polymerisation by aqueous redox-initiated RAFT polymerisation to form NPAE-based comb polymers. Turbidity measurements by UV spectroscopy revealed an LCST behaviour, similar to the well-known poly(2-oxazoline)s. Furthermore, these comb polymers show a low-fouling behaviour when grafted on a gold surface.

**P117**

**Mr Patrik Olsson**

University of Warwick

*Synthesis and modification of calcium carbonate particles*

Surface modifying or templating synthesis with the use of calcium carbonate particles as a starting point allows for a diverse range of particles, in terms of morphology and other properties, to be made.

**P118**

**Mr Paul Goring**

University of Warwick

*Polyethylene Block Copolymers: A Versatile 2 Step Synthesis Exploiting a Novel Radical Mechanism.*

A versatile, 2-step process for the synthesis of a variety of polyethylene block copolymers of tuneable molecular weight is presented. The radical reaction has thus far been able to copolymerise end-functionalised Polyethylene (PE) with monomers including vinyl esters, acrylates, methacrylates and styrenes through the utilisation of a newly-discovered mechanism centred on the formation of a stable tertiary benzylic radical from the reversible termination of a growing polymer chain to the vinyl end group of the PE. The synthesis is reliable and scalable.

**P119**

**Miss Paula Kishi Kuroishi**

Department of Chemistry, University of Warwick

*Synthesis and Post-Polymerisation Modification of an Epoxy-Functional Polycarbonate*

The synthesis of an epoxide-functional polycarbonate was achieved by organocatalytic ring-opening polymerisation (ROP) of trimethylenepropane oxirane ether carbonate (TMOC) using 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD) as catalyst, with the resulting polymers showing low dispersities and molecular weights close to predictable based on monomer to initiator concentration ratio. Subsequently, the post-polymerisation functionalisation of PTMOC with thiols was investigated, where the reaction using dodecanethiol required large amounts of lithium hydroxide, which led to decomposition of the polymer backbone. Utilising benzylmercaptan, relatively low conversions were observed in the presence of the same catalyst. Finally, thiophenol was shown to have higher activity towards the functionalisation of PTMOC, that was further studied with a range of organocatalysts, achieving conversions of 90% with 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU).

**P120**

**Mr Philip Richardson**

University of Surrey

*Understanding the Mechanism of the Coagulant-Dipping Process for Latex Glove Manufacture*

In industrial manufacturing, nitrile gloves are produced via a coagulant dipping method. In this method, hand-shaped moulds are coated in salt (the coagulant) prior to dipping into a wet colloidal dispersion, i.e. latex. The diffusion of the salt from the mould destabilises the latex and leads to rapid coagulation. We have investigated this phenomenon experimentally using particle tracking analysis to study coagulation rates of a typical nitrile-butadiene rubber latex as a function of the salt concentration. A theoretical model has been developed combining DLVO theory with Fickian diffusion, and the results of the model have been compared to experimental results.

**P121**

**Mr Pratik Gurnani**

University of Warwick

*Tuneable polymeric nanoparticles with precise size control synthesised via RAFT-emulsion polymerisation*

Nanoparticle based treatments have become increasingly relevant over the last few decades within healthcare applications. However lengthy synthetic procedures, poor control over size and reduced stability over time have limited the progress of some nanoparticle therapeutics entering into the clinic. Herein, we report the synthesis of novel P(PEGA) based di-block macro-CTA surfactants, and further nanoparticle synthesis via RAFT-emulsion polymerisation of n-butyl acrylate and t-butyl acrylate. We show defined control of the resulting particle diameter ranging from 30 to 130 nm simply by modifying the volume of monomer in the polymerisation, whilst also maintaining a high degree of uniformity. Carboxylic functionality at the particle surface yields a highly stable latex with negligible aggregation over a 1 year period, and could provide a useful anchor site for post-synthesis modification.

**P122**

**Miss Rachel A. Hand**

University of Warwick

*Synthesis of Hydrogels and Application to Absorb Chemicals for Analysis.*

Submitted for poster presentation

Hydrogels are suberabsorbent, gel-like polymers that for decades have been used for medical applications such as wound care.1 Herein we investigate using their absorbent nature to capture then recover chemicals from within the hydrogel for detailed analysis by FID-GC and GC-MS. As a product of this, we will be developing a suitable method for the consistent quantitative analysis of absorbed chemicals.

References

1. US Pat., US20130121952A1, 2013.

**P123**

**Dr Raoul Peltier**

University of Warwick

*Block vs Random: Influence of architecture on the cellular uptake of single chain copolymers*

The use of polymers in biomedicine, either in the form of soluble polymers or nanostructures, has revolutionised the field of drug delivery over the past few decades. Polymers are for example widely used to facilitate the transfer of cargos across biological barriers. In that respect, the chemical and physical properties of polymeric systems are known to play an important role. Of particular interest is the impact of monomers distribution on the resulting biological properties of copolymers. The use of modern polymerisation techniques as rendered more accessible the preparation of well-defined copolymers, either as blocks where sequence of the same monomer are juxtaposed along the same polymeric chain, or as random copolymers where monomers are statistically distributed along the chain. Here, we investigate on the influence of polymer architecture (block Vs random polymers) on the cellular uptake of single chain copolymer.

**P124**

**Mr Rassou Somasoudrame**

IPCM-Chimie des Polymères ; UPMC

*Anionic Ring Opening Polymerization of Glycidylphtalimide by Monomer Activation*

Polyamine are potential materials for a large number of applications due to their metal or anionic polyelectrolyte binding capacity and affinity for various support. Furthermore, their high water solubility allows for the formation of nanoparticules, suitable for biological applications such as gene delivery. Most of the processes to design such polymers is cationic polymerization, of epichlorohydrin or alkyloxazoline. The design of poly(etheramine) represents a new investigation field to improve existing materials. We decided to revisit the glycidylphtalimide polymerization, to obtain poly(etheramine). We confirmed the poor polymerizabilty of this monomer through standard AROP conditions, but the activated monomer mechanism(4,5) with phosphazene base counteranion was used to overcome this drawback. The livingness of the polymerization, and the initiation mechanism will be discussed to provide new development of this promising monomer.

**P125**

**Mr Rob Keogh**

University of Warwick

*Dynamics and Self-Assembly Behaviour of Fluorescent Polymer Nanostructures – Pure versus Blended Micelles*

Understanding, predicting and controlling self-assembly behaviour of stimuli responsive block copolymers remains a pertinent challenge. As such, we have shown that response to stimuli and micelle properties can be tuned not only by changing the comonomer ratio of the associative block of amphiphilic diblock copolymers but by blending two different diblock copolymers together in the correct mixing ratios to target specific stimuli response. Here we explore the limitations of this methodology with a focus on the effect of changing the hydrophobicity and Tg of the associative block. Furthermore, through the use of a novel RAFT agent functionalised with a highly emissive aminobromomaleimide fluorophore, the properties and internal structures of the resultant fluorescent micelles are investigated. Determining critical micelle concentration, probing degree of hydration of micellar cores and the latter’s effect on exchange dynamics – “frozen” versus “dynamic” micelles – is initially explored.

**P126**

**Mr Robert A. Young**

University of Warwick

*The synthesis of novel thermochromic particles and how to alter their temperature response.*

Novel Thermochromic Particles: Synthesis and Characterisation

**P127**

**Miss Rosa Catania**

School of Pharmacy, University of Nottingham

*TBC*

**P128**

**Mr Ross W Jaggers**

University of Warwick

*Vesicles and Particles: Manipulation of Soft Matter*

Large polymeric vesicles and capsules (ca. 300 micrometers in diameter) are widely used as macroscopic compartments in applications such as nanoreactors, molecular delivery vehicles and cell mimics. The incorporation of functionalized nanoparticles into such structures offers the potential for responsive hybrids, where upon the interaction of particle and soft matter creates controllable, macroscopic systems that can act out of equilibrium in their aqueous environment. Examples of these hybrids are demonstrated.

**P129**

**Mr Sam Irving**

University of Nottingham

*Polymers for 3d printing applications*

Supercritical CO2 (scCO2) is a green solvent that has advantageous properties for polymer synthesis and processing. Among others, this includes the ability to induce the formation of spherical polymer particles with low polydispersity in situ.

This work concerns the synthesis and modification of polymers in scCO2 for 3d printing applications. Specifically, microparticulate powders will be produced which are designed for selective laser sintering, a powder bed technique where particles are fused together into well-defined architectures.

To this end, we have synthesised a series of polymer microparticles that have been further functionalised to produce core-shell structures. The modified particles are expected to enhance the mechanical properties of the 3d printed parts by improving particle-particle interactions, thus yielding materials with superior interlayer bonding that can overcome current limitations of 3d printed products.

**P130**

**Mr Sam Lawton**

University of Warwick

*Structure-Property Relationships of Conjugated Polymers in Organic Photovoltaics*

Inspired by the growing demand for economically viable and renewable energy sources, organic photovoltaics (OPVs) are attracting significant attention. With efficiencies exceeding 10 %, donor/acceptor blends or bulk heterojunction (BHJ) devices are amongst the most promising and nearing commercialization. However, many of the recent advances in performance are not fully understood, thus a better understanding of the structure-property relationships is required to accelerate advancement in the field.

This work will describe the synthesis of various donor polymers and analysis of their structure and properties by NMR, SEC, UV/Vis and electrochemical techniques as well a correlation with device efficiencies. We are working to maximize processability and efficiency of the donor polymer in the BHJ whilst gaining a more detailed understanding of the role donor structure plays in device efficiency.

**P131**

**Mr Sam Pearce**

University of Bristol

*Control of Two-Dimensional Nanostructures by Crystallisation-Driven Self-Assembly*

Two-dimensional (2D) nanostructures, such as graphene or metal oxide nanosheets are of interest in a broad range of applications including drug delivery and photovoltaics. However, methods to control the formation of 2D soft materials by self-assembly are rare. Polyferrocenylsilane (PFS)-containing block copolymers (BCPs) undergo crystallisation-driven self-assembly (CDSA), providing controlled length BCP micelle fibres of low dispersity. Amphiphilic 1D BCP micelles have allowed access to complex superstructures, such as “windmill” supermicelles and large micelle superlattices. Such control over 2D structures by CDSA has far more limited scope. Current work involves using CDSA of PFS-containing homopolymers and polyelectrolyte block copolymers to form 2D platelets of various aspect ratio, with a variety of potential applications.

**P132**

**Miss Sara Schmidt**

EaStCHEM, School of Chemistry, University of Edinburgh

*3D Microarrays of Hydrogels for Biomedical Applications*

The development of the polymer microarray has allowed for high-throughput screening of polymeric materials for biomedical applications.

Herein, we demonstrate the development of polymer arrays of 3D materials with defined structures that better can mimic the complex physical and mechanical properties of the in vivo environment. Hydrated polymeric networks, hydrogels, are promising materials for 3D cell culture since they form gels with tuneable properties e.g. stiffness, chemical composition and degradability.

An initial set of 3D hydrogels were synthesised from water-soluble polymers and a cross-linker. These hydrogels showed promising properties for biomedical applications, including high water content, porosity and degradability. Furthermore, they can easily be chemically and physically modified to create a library of hydrogels, which can be screened for selected biological interactions using the microarray approach.

We thank the ERC for funding (ADREEM)

**P133**

**Miss Sarah Byard**

The University of Sheffield

*Polymerisation-Induced Self-Assembly of All-Acrylamide Diblock Copolymer Nano-objects Prepared via RAFT Aqueous Dispersion Polymerisation*

Polymerisation-induced self-assembly (PISA) affords an efficient route to preparing a wide range of well-defined polymer nano-objects. The ability to produce these nano-objects in aqueous media is appealing for many industrial applications. In practice, this can be achieved through the chain extension of a water-soluble polymer, which acts as a steric stabiliser, with a suitable water-soluble monomer that produces an insoluble polymer. One such suitable core-forming monomer for such aqueous dispersion formulations is diacetone acrylamide. In principle, the ketone group on this monomer offers an opportunity for post-polymerisation derivatisation. This work presents the efficient, well-controlled PISA synthesis of poly(dimethyl acrylamide)-poly(diacetone acrylamide) diblock copolymer nanoparticles. The effect of varying the diblock composition and solids content on the diblock copolymer morphology has been investigated.

**P134**

**Dr Sarah Canning**

University of Sheffield

*Diblock Copolymer Nanoparticles via RAFT Aqueous Emulsion Polymerization of Less Activated Monomers*

Polymerization-induced self-assembly (PISA) presents a robust strategy to produce well-defined copolymer nanoparticles in a wide range of solvents at high solids and is potentially amenable to industrial-scale production. In principle, polymerization of less activated monomers (LAMs) can be achieved using reversible addition-fragmentation chain transfer (RAFT) polymerization. Here we present the well-controlled RAFT solution polymerization of N-vinyl pyrrolidone (NVP), followed by the RAFT aqueous emulsion polymerization of vinyl acetate (VAc) at ambient temperature. PNVP homopolymer is used as a water-soluble macro-CTA to form sterically-stabilized PNVP-PVAc diblock copolymer nanoparticles of tunable size via PISA. Selective deprotection of PVAc to afford poly(vinyl alcohol) (PVA) produces double-hydrophilic PNVP-PVA diblock copolymers.

**P135**

**Mrs Serap Apaydin**

Boaziçi University Department of Chemistry/Polymer Research Center

*Synthesis of 3-in-1 Type Coreshell Nano Reinforcer-Toughner-COMPATIBILIZER for RIGID MATRICES via GRAFTING APPROACH*

Poly(ethyleneoxide) blocks (PEO) were synthetically grafted onto polystyrene-b-poly(ethylene/butylene)-b-polystyrene (SEBS) by the reaction of the maleated SEBS and hydroxyl terminated PEO. The comb-branch copolymers consist of a hydrophobic SEBS triblock backbone and crystalline PEO pendants in structure. An idealized morphology was created and verified by SEM and AFM techniques. The grafting efficiency was followed by NMR, FTIR spectroscopic as well as gravimetric techniques. In the observation of their phase behaviors and thermal stabilities, DSC and TGA were intensively used. The graft copolymer having suitable polar sites were then reinforced with minor amount of silica nanotubes, Halloysite by using high shear mixing technique in solution. It is believed that nanosilica based zones will be surrounded by PEO chains attached to continuous nonpolar SEBS matrix by creating a reinforcer/toughener/compatilizer activity for the classic nonpolar rigid engineering polymers.

**P136**

**Ms Shona O'Brien**

Royal College of Surgeons in Ireland

*Development of complex polypeptide networks*

This research involves the development of complex polypeptide networks with advanced mechanical properties as well as the ability for (bio)functionalisation. Functional copolypeptides were synthesised through amino acid N-carboxyanhydride (NCA) polymerisation of glutamic acid esters. Introduction of cross-linkable groups is achieved through either pre- or post-polymerisation side-chain modification. Cross-linking experiments using “click” reactions will be tested to investigate their ability to form a dense polypeptide network. Being derived from amino acids, these networks are biocompatible and degradable and are envisaged for biomedical applications such as hydrogels for the delivery of active ingredients.

**P137**

**Mr Shuai Chen**

School of Materials Science and Engineering, Tongji University

*Preparation of Polymersomes with a Photo-cross-linkable and Biodegradable Membrane in Pure Water for Highly Efficient Loading of Hemoglobin and Nucleic Acids*

Generally cross-linked structures are not degradable. Herein, we report a novel polymer based on poly caprolactone with a photo-cross-linkable cinnamoyloxymethyl pendant group. Once copolymerized with poly(ethylene oxide) (PEO), the block copolymer can directly dissolve in water to form polymersomes. The polymersomes formed can be effectively cross-linked under UV irradiation. Moreover, the cross-linked vesicular structures can be degraded by either enzyme or acid. The polymersomes can further efficiently load and release DOX in a controlled manner, and are able to load various biomacromolecules (proteins, RNA and DNA) while direct dissolving in water. The loading efficiency of hemoglobin (Hb) is 75%, the loading efficiency of RNA is 80% and the loading efficiency of plasmid is 90%, which are extremely high. This polymeric nanoplatform shall be promising for future biomedical uses.

**P138**

**Mr Sjören Schweizerhof**

DWI-Leibniz-Institute for Interactive Materials, RWTH Aachen University

*Functionalization of gold nanorods with PNIPAm: Switching their optical properties*

The optical properties of gold nanorods (AuNR) are highly dependent on the size, shape as well as on the interparticle distance. This unique feature has prompted us to control the surface properties so as to manipulate or direct their self-assembly. In particular AuNR and ordered structures thereof are promising for applications such as optoelectronics and sensing. The objective of this work is the selective functionalization of AuNR with thiol-functional, thermoresponsive polymers based on PNIPAm. Taking advantage of the thermoplasmonic properties of the AuNR and the temperature sensitivity of the PNIPAm tethers on the gold surface allows establishing systems where optical properties can be reversibly switched by light or directly by temperature changes. We therefore investigated the controlled grafting of PNIPAm to the rod surface, the aggregation behavior of the functionalized AuNR depending on the modification conditions and parameters that affect their heat-induced aggregation.

**P139**

**Mr Stefan Cairns**

University of Edinburgh

*A New Synthetic Pathway to Polyesters*

The controlled synthesis of aliphatic polyesters has been rooted in the ring opening polymerisation of cyclic esters and o-carboxy anhydrides. However, the monomers that lead to desirable polymer properties often pose a synthetic challenge. A route that utilises the expulsion of CO2 to drive the polymerisation has enabled a wider array of aliphatic polyesters to be synthesised. This has inspired our work to use the release of stable small molecules such as formaldehyde and acetone, which are potentially recyclable, as the driving force for polymerisation. Our new synthetic route employs a series of 1,3-dioxolan-4-ones and has been successfully applied to a variety of monomers in the series. Readily available enantiomerically pure starting materials gives access to isotactic enriched polymers. The synthetic route has also been shown to be compatible with standard ring opening polymerisations, as the two routes have been shown to operate in tandem.

**P140**

**Mr Stefan Engel**

Institute of Technical and Macromolecular Chemistry, RWTH Aachen University and DWI – Leibniz-Institute for Interactive Materials

*Microgel supported enzymatic ring-opening polymerisation of e-caprolacton (e-CL)*

The enzymatic ring-opening polymerisation of lactones is a method of increasing interest for the synthesis of biodegradable and biocompatible polymers. It was shown, that the immobilisation of CaLB and the reaction medium play an important role for the polymerisation esp. of small lactones like e-CL. We investigated a route for the preparation of nanostructured microgels based on polyglycidol which were loaded with CaLB to increase its esterification ability in aqueous solution. To find the ideal environment of the free CaLB in the microgel we investigated the acceptable water concentration and the accessibility for the monomer in model polymerisations in toluene as well as the influence of reengineered CaLB variants on its polymerisation ability. We observed that the water concentration should not exceed 500 ppm to allow esterification and minimize hydrolysis. Further reengineering of CaLB increases the Mn and Mw values of P(e-CL) by a factor of 1.5 or 2 respectively.

**P141**

**Miss Stephanie Edwards**

University of Liverpool

TBC

**P142**

**Mr Steve Merritt**

*TBC*

**P143**

**Dr Tatiana Lovato**

Durham University

*PEO-oligosaccharide co-polymers as soil release additives for laundry detergents*

Soil release polymers (SRPs) may be used as additives during a wash cycle to improve soil detachment from the surface of textile fibres. They achieve this by (reversible) physical adsorption to the fibres during the wash cycle, thereby modifying surface properties and forming a protective layer. In a subsequent wash cycle adsorption is reversed and the SRP desorbs, simultaneously removing the soil. We here present the synthesis of a PEO-maltose co-polymer with potential as a SRP for cellulosic fabric.

The synthetic approach adopted involved the synthesis of the co-polymer backbone via step growth polymerisation between PEGDA and ethylenediamine, followed by a reductive amination between the free amine functionality and maltose.

**P144**

**Mr Thiago Guimarães**

Laboratoire de Chimie, Catalyse, Polymères et Procédés (C2P2), LCPP group, Univ. Lyon 1.

*Synthesis of polystyrene/iron oxide hybrid particles via RAFT-mediated emulsion polymerization*

The incorporation of iron oxide nanoparticles into polymer latexes has attracted increasing attention due to the magnetic properties conferred to the resulting particles. On the other hand, the ability to control macromolecular architectures can be of key importance in designing materials with novel properties. In this work, reversible addition-fragmentation chain transfer (RAFT) polymerization was exploited to synthesize well-defined cationic and anionic amphiphilic block copolymers. An aqueous dispersion of iron oxide clusters was next prepared using a strategy based on emulsification/solvent evaporation in which the block copolymers were used as stabilizers. These clusters were then used as seeds in the emulsion polymerization of styrene/divinyl benzene resulting in a core-shell morphology. One particular advantage of this process is that the surface functionality of the resulting magnetic particles can be tuned aiming at the magnetic separation of different biological targets.

**P145**

**Mr Thibault Derouineau**

Matière Molle et Chimie, UMR 7167 CNRS-ESPCI & Total, Centre de Recherche de Solaize

*Dynamic covalent polymers as viscosity modifiers*

It is a challenge in many industrial applications, e.g. cosmetics, inks, adhesives, lubricants, paintings, etc., to control the rheological properties of organic formulations. Here, we describe a new approach to control the viscosity of organic solutions as a function of temperature. For that purpose, we designed two sets of random copolymers that have temperature dependant solvent affinity as well as the ability to reversibly connect through the formation of dynamic covalent bonds. Those macromolecules were prepared by controlled radical polymerization which allowed preparing copolymers with adjustable molecular weight, solvent affinity and functionality. Rheological studies of the linear viscoelasticity and flow behavior as a function of temperature exemplify the efficiency of this system to control the viscosity of organic solutions. By manipulating the composition and functionality of the copolymers it is possible to adjust the response of the systems as a function of temperature.

**P146**

**Mr Thomas Bennett**

The University of Nottingham

*Functionalising Nanostructured Block Copolymer Microparticles in Supercritical Carbon Dioxide for the Development of Advanced Materials*

Supercritical carbon dioxide is an effective medium for the in situ synthesis of polymeric microparticles with low dispersities. Recently, this methodology has been expanded towards the synthesis of block copolymers using RAFT polymerisation, leading to the formation of well-defined particles with nanostructured domains. Furthermore, the morphology of these domains could be altered by varying the ratio of the two blocks to obtain a variety of internal structures including lamellar, hexagonally packed cylingers, gyroid and spheres. In this work, we have taken a variety of nanostructured polymer microparticles and used these structures as templates to direct the assembly of various inorganic materials. It is expected that this will prove a facile method for the creation of structured inorganic materials with reproducible dimensions on both the nano- and microscale.

**P147**

**Mr Thomas Berki**

Loughborough University

*Synthesis of metal-containing responsive polymer nanoparticles for use in MRI (Magnetic Resonance Imaging)*

Magnetic resonance Imaging (MRI) is one of the most widely used imaging techniques to visualise human anatomy, and plays a crucial role in the diagnosis of disease. MRI is a non-invasive and non-destructive (no ionizing radiation) diagnostic tool, it exhibits high resolution imaging capacity. However, current MRI technologies suffer a number of drawbacks, including limited specificity, a short bio-circulation time, limited contrast at high magnetic field, as well as a lack of control over signal intensity. We will investigate the use of stimuli-responsive polymer particles containing Gd chelates for MRI applications. Developing a new generation of CAs will allow us to address these problems and achieve a better control on both specificity (targeted delivery) and signal intensity. Moreover, by optimising such tuneable polymer scaffolds, it may be possible to develop theranostic systems (diagnostic combined with drug delivery).

**P148**

**Mr Thomas Floyd**

University of Warwick

*Core-Shell ‘Hyperstar’ Polymers composed of a Hyperbranched Thiol-Yne Core and Poly(oxazoline) Shell.*

We present the synthesis of water soluble core-shell particles comprising of a hydrophobic hyperbranched polymer core and hydrophilic poly(oxazoline) shell. The formation of the hyperbranched core proceeded by slow addition of a bifunctional monomer, containing a thiol and alkyne functionality, to a trifunctional alkene core, in the presence of a photointiator and ultraviolet light. This yielded well defined hyperbranched polymers with low dispersities, high degrees of branching and a surface functionalised with alkyne moieties. Cationic ring-opening polymerisation of the 2-ethyl oxazoline monomer was used to prepare a series of thiol functionalised poly(2-ethyl oxazolines) with varying degrees of polymerisation (25, 50 and 100). Coupling of the poly(oxazolines) to the surface of the hyperbranched core was completed by use of the thiol-yne ‘click’ reaction to yield core-shell ‘hyperstar’ particles with varying sizes.

**P149**

**Mr Thomas Gibson**

Queen's University Belfast

*Biodegradable PEG-based Star-shaped Polymers by RAFT Polymerisation for Protein/DNA Delivery*

Star-shaped polymers (SSPs) are promising protein/DNA delivery vehicles due to their small size (~100 nm) and enhanced cellular uptake. SSPs can be formed by the cross-linking of linear polymer chains using molecules containing two or more polymerisable groups. Herein, we explore the preparation of oligo (ethylene glycol) methacrylate (OEGMA) and 2-(dimethylamino)ethyl methacrylate (DMA) based ‘arm-first’ SSPs by RAFT polymerisation. A degradable acetal-based cross-linker was used to prepare SSPs with acid-labile cores. This type of poly(ethylene glycol)-based nanocarriers are endowed with both anti-immunogenic and non-toxic properties, allowing for ‘stealthy’ delivery of biologically important molecules. The DMA units provide positive charges on the SSPs that can be used for binding negatively charged proteins or DNA by electrostatic interactions. SSPs and their linear precursors were characterised by NMR spectroscopy and GPC. The size of the SSPs was determined by DLS.

**P150**

**Miss Ting Wei**

College of Chemistry, Chemical Engineering and Materials Science, Soochow University

*A Smart Antibacterial Surface for the On-Demand Killing and Releasing of Bacteria*

In this work, the synergistic effects of combining stimuli-responsive polymers and nanomaterials with unique topographies to achieve smart antibacterial surfaces with on-demand switchable functionalities are explored. Silicon nanowire arrays are modified with a pH-responsive polymer, poly(methacrylic acid), which serves as both a dynamic reservoir for the controllable loading and release of a natural antimicrobial lysozyme and a self-cleaning platform for the release of dead bacteria and the reloading of new lysozyme for repeatable applications. The functionality of the surface can be simply switched via step-wise modification of the environmental pH and can be effectively maintained after several kill–release cycles.

**P151**

**Dr Vincenzo Taresco**

The University of Nottingham

*Synthesis and characterization of a new set of N-acyl amino acids-grafted biodegradable polyesters for pharmaceutical applications.*

Poly(glycerol-adipate)(PGA) opens new frontiers as a biocompatible and biodegradable platform. PGA is produced by an enzymatic one-step reaction leading to a low degree of branching. Polymers with high Mw can be readily synthesized without any post-polymerization reactions under mild conditions. The pendant hydroxyl groups can be esterified to enhance the biological and chemical properties of PGA. In this work we explore coupling PGA with different natural amino acids. These novel multiresponsive polymers were characterized employing a variety of physico-chemical techniques. Using simple coupling reactions, targeted functionalization degrees with quantitative esterification were achieved with interesting new polymer properties. These results illustrate the possibilities of tailoring PGA to expand its potential in the pharmaceutical and medical fields. This large set of modifications can offer materials with a greater range of molecular complexity compared to common unmodified polymers.

**P152**

**Mr Vu Dao**

Monash University

*Synthesis of high molecular weight diblock polymers using aqueous RAFT-mediated gel polymerisation*

The synthesis of high molecular weight and well-defined polymers using reversible addition-fragmentation chain transfer (RAFT) polymerisation remains a challenge and has only been the centre of attention in a limited number of studies. We employed a simple aqueous RAFT-mediated gel polymerisation technique to synthesise high molecular weight AB diblock polymers with low polydispersities (&#272; < 1.50). These polymerisations were conducted in the presence of water-soluble trithiocarbonate RAFT agents and a variety of different acrylic monomers. The use of said gel polymerisation method in combination with a redox initiation system allowed for the rapid chain propagation of these water-soluble monomers under low reaction temperatures (below ambient). Further optimisation work is being conducted to gain a higher molecular weight for these diblock polymers, whilst maintaining a good control over the molecular weight distribution.

**P153**

**Mr Wei Yu**

*Crystallization-Driven Self-Assembly of polylactides containing triblock copolymer*

Amphiphilic copolymers can be self-assembled to form a wide range of morphologies such as spherical micelles, vesicles and cylinders. While the compositional window to access cylindrical micelles is very small, such nanostructure can be easily accessed using the Crystallisation-Driven Self-Assembly (CDSA) of crystalline-coil diblock copolymers. This study will probe the CDSA behaviour of polylactide containing triblock copolymers, poly(dimethylacrylamide)-block-poly(L-lactide)-block-poly(dimethylacrylamide)) (PDMA-b-PLLA-b-PDMA). These polymers were synthesised using Ring Opening Polymerisation (ROP) and Reversible Addition-Fragmentation chain-Transfer (RAFT) polymerisation and the CDSA behaviour of the triblock copolymers were studied under a range of assembly conditions.

**P154**

**Mr Wenjun Zhan**

College of Chemistry, Chemical Engineering and Materials Science,Soochow University,P. R. China

*Preparation of bioinspired blood compatible surface via step-wise incorporation of biomolecules*

In this work, we developed a bioinspired blood compatible surface combined fibrinolytic and vascular endothelium-like properties. Polyurethane surface is modified with a copolymer that serves as a linker-spacer for sequential attachment of two molecules, a modified cyclodextrin with lysine ligands and REDV peptide. The resulting surfaces exhibit resistance to non-specific protein adsorption, but adsorb plasminogen selectively from blood plasma, thereby facilitating the fibrinolytic pathway to lyse nascent clots. At the same time, the surfaces promote the adhesion and proliferation of endothelial cells. Importantly, neither of the two functions of lysine and REDV peptide is compromised by the presence of the other. These results suggest a new strategy to engineer multifunctional surfaces with enhanced blood compatibility in both the short and long term.

**P155**

**Dr Xiangqiang Pan**

Soochow University

*Application of Selenol-X Chemistry in Polymer Synthesis*

The concept of “click chemistry”, introduced by Finn, Fokin, and Sharpless not more than two decades ago, can be implemented in a broad range of different disciplines as chemistry, materials and biology. Some excellent examples of this chemistry, such as the Cu(I)-catalyzed cycloaddition of alkynes and azides (CuAAC), Diels-Alder, thiol-ene chemistry, thiol-yne chemistry, have been proven to be powerful and versatile synthesis techniques for the preparation of functional materials. Moreover, new trends and driving force from different backgrounds strongly influenced the method development of new “click” chemistries. Recently, some new click reactions have been reported, such as the strain-promoted cycloaddition of alkynes and azides (SPAAC), Diels–Alder reactions based on triazolinediones (TAD), Sulfur(VI) Fluoride Exchange (SuFEx).

**P156**

**Mr Yamin Abdouni**

Queen Mary, University of London

*Sequence controlled glycopolymers: A tool for selective lectin binding?*

Glycopolymers are of great interest because of their multivalent interactions with lectins. The glycoside cluster effect results in a great binding avidity towards these carbohydrate binding proteins. Over recent years several complex mannose-based glycopolymer architectures have been established, each one of them improving the binding affinity towards the animal lectin DC-SIGN (which takes part of the immune system and plays an important role during HIV infection). However, this binding affinity is not yet selective. We believe that multi-arm glycopolymers with a controlled carbohydrate sequence should not only improve the binding avidity towards these lectins, but we also believe controlling the sequence will enable the desired specificity which will result in a reduction of possible side-effects connected to other lectins. Furthermore, a cyclodextrin core should provide us a tool for drug encapsulation and possible further supramolecular interactions.

**P157**

**Mr Yi Li**

Sungkyunkwan University

*TBC*

**P158**

**Mr Yin Ning**

The University of Sheffield

*Rational synthesis of sulfate-based diblock copolymer nanoparticles and their efficient occlusion within calcite*

Occlusion of organic nanoparticles within inorganic crystal offers a unique model to examine biomineralization while providing a versatile route to new nanocomposite materials. Herein, a series of poly(ammonium 2-sulfatoethyl methacrylate)-based diblock copolymer nanoparticles are prepared via RAFT-mediated polymerization-induced self-assembly (PISA). Their anionic charge character and size distributions are evaluated by aqueous electrophoresis, dynamic light scattering and transmission electron microscopy. XPS studies confirm that the stabiliser density of these nanoparticles can be tuned by varying the PISA synthesis conditions, e.g. using either aqueous emulsion polymerisation or dispersion polymerisation in ethanol/water mixtures. Some of these anionic nanoparticles can be efficiently incorporated within calcite crystals, with thermogravimetric analysis indicating up to 7.5 wt% (14.8 vol %) occlusion.

**P159**

**Miss Yingying LIU**

VTT Technical Research Centre of Finland Ltd (Finland)

*Protein-polymer bioconjugate via SET-LRP for antifouling surfaces*

Surface modification of poorly reactive materials requires energy intensive, environmentally aggressive pre-treatments such as plasma, UV-irradiation or aggressive chemicals. Here we used hydrophobins, small Janus-like amphiphilic proteins produced by fungi, to activate the surfaces of such materials. We prepared conjugates of hydrophobins with an initiator for SET-LRP and allowed them to self-assemble into films through their hydrophobic patch, followed by in situ growth of polymer layers. SET-LRP allows fast and precisely controlled polymerization under mild conditions, requiring only very small amounts of copper catalysts. Herein, we prepared antifouling surfaces via both “grafting-from” and “grafting to” strategies. The antifouling properties were characterized by QCM-D, and the morphology of surfaces was investigated by AFM and SEM. These antifouling surfaces may lead to new methods and technologies for biomaterials and biosensors.

**P161**

**Mr Yu Zhao**

The State Key Laboratory of Molecular Engineering of Polymers and Department of Macromolecular Science, Fudan University

*Synthesis and self-assembly of glycopolymers with pendent oligosaccharide moieties*

This research focuses on synthesis of a newly designed oligosaccharide with dendritic structures and its crossponding glycopolymers, as well as its self-assembly behavior and the mechanism behind. We suppose it would contribute to both theoretical study of chemical glycobiology and practical application of novel biometerials. Through a 14-step total synthesis, we obtained the target products. The study of self-assembly behavior relies on dynamic light scatting (DLS), proton NMR and UV spectrum. According each evidence, we gain the insight into the self-assembly and association mechanism of the complex system

**P162**

**Mr Yuanhui Xiang**

Case Western Reserve University

*Polymerization of silyl ketenes*

Development of unique polymeric backbones and structures is key to accessing novel materials and expanding the usefulness and applications of polymeric materials. Herein we report experimental and theoretical investigations of the polymerization of triisopropyl silyl ketene using alkoxide initiators, and identify the oligomeric and polymeric products formed. Triisopropyl (TIPS) ketene reacts with benzyl alkoxide to give a delocalized anion that can polymerize thorugh the oxygen or carbon atoms to give polyacetal and polyketone, respectively. This work gives insight into the design of new monomers and lays a foundation for the preparation of multiple polymer backbone functionalities from a single monomer.

**P163**

**Mr Yunxiang He**

University of Bristol

*Water-Soluble Cylindrical Micelles for Nanomedicine via Living Crystallisation Driven Self-Assembly*

Cylindrical micelles have shown immense advantages as drug delivery vectors compared to traditional spherical micelles. Living crystallisation driven self-assembly (CDSA) has emerged as an effective method to form cylindrical micelles based on crystalline-coil block copolymers (BCPs) and control their length in dimensions. Herein, the formation of water-soluble cylindrical micelles and block comicelles of controlled length based on polyferrocenyldimethylsilane (PFS) BCPs and their preliminary biological evaluation will be presented. In addition, extension of this strategy to more biologically-relevant cylindrical micelles based on crystallisable organic polymers will be shown.

**P164**

**Mr Zan Hua**

University of Warwick

*Living Micelles with Tuneable Morphologies through Interactions between Nucleobase-Containing Synthetic Polymers in Aqueous Solution*

Herein, we report the preparation of nucleobase-containing synthetic amphiphilic diblock copolymers using RAFT polymerization. Well-defined spherical micelles can be formed in aqueous solutions through the self-assembly of amphiphilic nuceleobase-containing copolymers. Following assembly, copolymers with complementary nucleobases were introduced into the micellar solutions. The effect of such complementary nucleobase polymer was explored by DLS, SLS, SAXS and TEM. Depending on the length of the hydrophobic segment, a change in particle morphology could be observed. Nucleobase-containing copolymer interactions present a new and versatile method to access various self-assembled nanostructures.

**P165**

**Mr Zhanyao Hou**

Ghent University

*Anthracene-based Hydrogels: From Supramolecular to Covalent Conversion via Photo-irradiation*

Generally, Hydrogels can be classified into covalent and supramolecular hydrogels. In supramolecular hydrogels, a sol-gel transition can occur, which expanded their applications. However, poor non-covalent bonds are not stable against dilution, which limited their applications. We designed a new hydrogel that can undergo the conversion of non-covalent to covalent crosslinking based on anthracene group. Anthracene-containing poly(N-acryloylmorpholine) copolymers which form hydrogels were prepared by RAFT polymerization followed by a nucleophilic substitution reaction. Upon the addition of CB[8], a supramolecular hydrogel should be formed by host-guest interaction between CB[8] and two anthracene groups. Such a supramolecular hydrogel can be further converted into its corresponding covalently crosslinked hydrogel upon the irradiation at 365 nm. The studies of the formation of supramolecular hydrogel and the conversion between non-covalent and covalent crosslinking are currently ongoing.

**P166**

**Miss Zoe Roberts**

University of Warwick

*Preparation and Characterisation of Thermoplastic Elastomers Containing Biodegradable Hard Segments*

The use of a wide range of degradable hard segments of polyurethanes, including those derived from amino acids, has been of great interest as a result of their susceptibility to degradation but also because of their non-toxic byproducts. Variation in the hard segment composition, opens up greater control over the degradation and mechanical properties. A series of thermoplastic polyurethane elastomers with degradable hard and soft segments were synthesised. The incorporation of degradable linkages within the hard segment enables the more complete breakdown of the material. The resultant properties of these materials were studied, including mechanical analysis, contact angle analysis and hydrolytic degradability and in turn were correlated to polymer structure and composition which provided a greater understanding of the structure-function relationship of these materials.

**P167**

**Dr Ignacio Martín-Fabiani**

University of Surrey

*Water Barrier Properties of Films Made from Particles Using a Modified Polymerisation-Induced Self-Assembly (PISA) Process*

The presence of surfactants in latex films causes detrimental effects on water permeability and adhesion. Here, we report the synthesis of surfactant-free latex particles, using hydrophilic macromolecular RAFT agents (macroRAFTs) in water. In a Polymerization-Induced Self-Assembly (PISA) process, macroRAFTs can act as stabilizers during emulsion of acrylic monomers to obtain self-stabilized particles. Our results show that films made from these particles have lower water vapour sorption and liquid water uptake than conventional latex films made via conventional emulsion polymerization. NMR relaxometry allowed us to determine the degree of water confinement within soaked coatings. Notably, both the use of a less hydrophilic macroRAFT and a slight reduction in its content have a strong and positive impact on the barrier properties. The results presented here provide evidence for the potential of self-stabilized latex particles for the development of new waterborne protective coatings.

**P168**

**Miss Elizabeth Jones**

The University of Sheffield

*How do Spherical Diblock Copolymer Nanoparticles Grow during RAFT Alcoholic Dispersion Polymerisation?*

A poly(2-(dimethylamino)ethyl methacrylate) (PDMA) chain transfer agent was used for the RAFT dispersion polymerisation of benzyl methacrylate (BzMA) in ethanol. GPC analysis indicated a well-controlled polymerisation. The PBzMA block becomes insoluble as it grows, leading to the in situ formation of diblock copolymer nanoparticles via polymerisation-induced self-assembly. Varying the DP of the PBzMA block while using a given PDMA block produced a series of spherical nanoparticles with mean diameters ranging from 35 to 100 nm diameter. These nanoparticles were characterised by TEM, DLS, MALLS and SAXS. Mean aggregation numbers calculated from SAXS and MALLS are in good agreement and scale approximately linearly with PBzMA DP. This suggests that spherical micelles grow in size not only as a result of the increase in copolymer molecular weight during the PISA synthesis, but also by exchange of individual copolymer chains between micelles and/or by sphere-sphere fusion events.

**P169**

**Mr Abdessamad Kaassis**

UCL

*Pulsatile drugs release from electrospun poly(ethylene oxide)–sodium alginate blend nanofibres*

Novel and highly tuneable pulsatile drug delivery systems have been prepared through the electrospinning of a blend of poly(ethylene oxide) (PEO), sodium alginate (SA), and drugs. Fibres were prepared with a range of loadings of drugs and SA. The resultant fibres formed novel three dimensional structures contain crystalline drugs. It was found that at pH 6.8 (reminiscent of the intestinal tract) the fibres dissolve very rapidly, freeing all the embedded drugs quickly. However, at condition that mimic the gastrointestinal transit an unusual two stage release mechanism is seen. This comprises a rapid burst release, followed by a period where no further drug is released, and then a final stage of release freeing the remainder of the drug into solution. The amount of release in the initial stage, and the length of time between the first and final drug release stages, can be controlled by adjusting the drugs and/or SA contents. This results in highly tunable pulsatile release materials.

**P170**

**Mr Adrian Williams**

PSS Polymer Standards Service GmbH

*Characterization of poly (methyl methacrylate)-graft-poly (styrene)s using various chromatographic techniques.*

Two graft copolymer samples of identical average composition were synthesized by grafting polystyrene onto a broadly distributed PMMA backbone. GPC with viscometry and light scattering detection, GPC with UV and RI dual detection, gradient chromatography and 2D chromatography were applied to determine sample heterogeneity. While only limited information was retrieved by conventional GPC or GPC with molar mass sensitive detection, GPC with UV and RI revealed different chemical heterogeneity of the samples. Using gradient chromatography and 2D chromatography it was possible to identify non-grafted side chains and unreacted parent PMMA as well as the actual graft copolymer molecules. While in one sample, a heavily grafted product was formed in addition to non-grafted PMMA, the second sample did not contain any non-grafted PMMA but a graft product of lower grafting density. The different product distributions were explained by the different synthetic procedures.

**P171**

**Miss Alaa Kadhim**

One pot synthesis of star-shaped copolymers based on poly (e-caprolactone) and Polyglycerol for hydrophobic drug carriers

*One pot synthesis of star-shaped copolymers based on poly (e-caprolactone) and Polyglycerol for hydrophobic drug carriers*

Amphiphilic star shaped poly(e-caprolactone)-b-hyperbranched polyglycidol (sPCL-b-HPG) was successfully synthesized and used to deliver a verity of hydrophobic drug molecules. The first step of the synthesis involved the polymerization of e-caprolactone (CL) from a multifunctional core (trimethylolpropane (TMP)) to give the initial star polymer (SPCL) via ring opening polymerization. Then, glycidol was polymerized directly from the SPCL-HPG. The structure of SPCL-HPG was characterized by 1H-NMR, FTIR and GPC. TMP cored SPCL-HPG was used to encapsulate hydrophobic drugs: tetrakis 3,5-dihydroxyphenyl porphyrin (TDHPP, Mn=743) and 3,5-diacetoxyphenyl Porphyrin cored Hyperbranched Polymer (3,5-diacetoxybenzoic acid) (P-HBP, Mn=3000) respectively. The results showed that the drugs solubility in SPCL40-HPG60 were enhanced significantly. SPCL-HPG provide an alternative choice of drug carriers for different size of poorly soluble drugs.

**P172**

**Mr Alan Rigoussen**

Luxembourg Institute of Science and Technology (LIST)

*Investigation on the compatibilization of immiscible polymers blends*

Polylactide (PLA), a bio-based polymer with interesting properties, has limited applications according to its brittleness and poor thermal stability. Polymer blending of PLA with acrylonitrile-butadiene-styrene (ABS), a petroleum based thermoplastic with interesting thermal and mechanical properties, is an effective method to enhance the properties of PLA aiming at extending its applications. However, the incompatibility between PLA and ABS remains a challenge to obtain a polymer blend with tailored properties. Compatibilization of PLA and ABS using cardanol, a naturally occurring phenolic compound, has been implemented by reactive extrusion. In this presentation, we will highlight the efficiency of cardanol as compatibilizer and the compatibilization mechanisms based on the reaction of cardanol with the polymers.

**P173**

**Miss Alba Castañon**

The University of Nottingham

*Synthesis of CO2-soluble hydrocarbon based stabilisers by RAFT/MADIX polymerisation*

Carbon capture is now a major global process and our aim is to make positive use of the captured CO2 as an alternative and clean solvent for polymer synthesis. We report the synthesis of hydrocarbon based CO2-soluble polymers that work as surfactants in dispersion polymerisation and overcome the limitations requiring fluorinated or siloxane materials that are expensive and not environmentally acceptable and can be used in a wider variety of monomers than the previous ones reported.1

A range of P(VAc-s-VPi)-b-PNVP block copolymers with different molecular weight and molar ratios were synthesized using controlled radical polymerisation techniques (RAFT/MADIX) and analysed by NMR (1D and 2D), GPC (in THF) and DSC. Solubility of the samples in scCO2 was determined using a variable volume view cell designed at The University of Nottingham.

**P174**

**Ms Alessia Weiss**

ARC Centre of Excellence in Convergent Bio-Nano Science and Technology, and the Department of Chemical and Biomolecular Engineering, The University of Melbourne, Parkville, Victoria 3010, Australia

*Controlled Protein Adsorption on Zwitterionic Replica Particles*

There is mounting evidence that the formation of a protein corona around drug delivery vehicles is the primary determinant of their biological behaviour in vitro and in vivo, as this changes the particle’s ‘synthetic identity’ to a ‘biological identity’. Therefore, it is crucial to understand how particle design parameters such as size and surface chemistry as well as the biological milieu which includes protein solution composition and adsorption conditions influence this process. This understanding will assist in the design of smarter drug carriers, which either diminish protein adsorption or take advantage of the adsorbed corona. Furthermore, it will facilitate predicting protein corona formation and therefore bio-nano interactions. In this study, we investigate the adsorption of proteins around zwitterionic poly(2-methacryloyloxyethyl phosphorylcholine) replica particles under varying conditions as well as the impact of flow by using defined microfluidic systems.

**P175**

**Mr Alex Oliver**

University of Bristol

*Patchy Micelles via the “Living” Crystallization-Driven Self-Assembly of Polyferrocenylsilane Triblock Terpolymers*

Living crystallization-driven self-assembly of crystalline-coil diblock copolymers allows the formation of well-defined micellar architectures with controlled size and dimensionality.1 Although a variety of architectures are possible through this route, there are several limitations towards preparing materials with distinct microphase coronal structures.2 ABC triblock terpolymers, with two chemically different polymers attached to a central core-forming block, can open new routes to polymer nanostructures within the corona of micelles.3 Herein, we will report the synthesis of a variety of PFS-containing ABC triblock terpolymers and the solution-phase self-assembly of these materials towards the formation of “patchy” structures.

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**P176**

**Dr Alexander Ilchev**

Department of Chemical and Environmental Engineering at the University of Nottingham

*Poly(D,L-Lactide) Star Polymers as Dispersants for Hydroxyapatite Nanoparticles during Nanocomposite Manufacturing*

Star polymers of rac-poly(lactic acid) (s-PLA) were prepared for use as dispersants for hydroxyapatite nanoparticles in a polymer matrix. Better control of the stars’ molecular weight and dispersity was achieved in all polymerisations relative to similarly prepared linear PLA. This was attributed to the degenerative chain transfer process between the star polymer’s arms causing a greater probability of transfer relative to propagation during polymerisation. The reaction temperature was optimized to allow for the shortest reaction times while keeping the catalyst concentration below the limits for biomedical materials and minimizing the rates of degradation reactions to below detectable levels. All reactions were carried out to over 90% conversion. The residual lactide was efficiently removed by vacuum distillation. The poor thermal diffusivity of PLA coupled to an exothermic enthalpy of polymerisation may result in a thermal runaway for larger scale polymerisations.

**P177**

**Dr Amanda K. Pearce**

University of Nottingham/University of Queensland

*Localised delivery of doxorubicin to prostate cancer cells through a PSMA-targeted hyperbranched polymer theranostic*

The therapeutic potential of hyperbranched polymers targeted to prostate cancer was investigated. PEGMA hyperbranched polymers were synthesised via RAFT polymerisation to feature targeting ligands for PSMA on the periphery, with doxorubicin attached through hydrazone formation, which allowed controlled release of the drug from the polymers in in vitro endosomal conditions. The polymers could target PSMA-expressing prostate cancer cells in vitro and facilitate transport of doxorubicin into the cells as confirmed by live cell confocal imaging. Finally, the ability of the complex to induce a therapeutic effect on prostate cancer cells was investigated through a tumour regression study, which confirmed that the DOX-loaded polymers could significantly reduce the volume of prostate tumours in vivo in comparison to free drug and a polymer control, with no adverse toxicity to the animals. This work therefore demonstrates the potential of this system for prostate cancer theranostics.

**P178**

**Dr Alexandra Gower**

University of Nottingham

*Accelerated Synthesis of Polymers via Electromagnetically Heated Catalytic Chain Transfer Polymerization Using Cobalt and Iron Catalysts*

This paper reports work to improve the CCTP of acrylates via the use of electromagnetic heating/excitation and chain transfer agents (CTA) which are more sustainable than the benchmark cobalt centered CCTP catalysts. These CTAs are based on iron and exhibit greater activity with acrylates than the cobalt centered species. By comparison with cobalt, iron is more toxicologically acceptable for use in catalyst systems that are intended for applications in biomedical devices. The synthesis of a range of Fe CTAs is detailed, as is a comparison of their performance with methyl methacrylate and methyl acrylate. In the case of the acrylate monomer, when CCT was conducted using Fe CTAs and conventional heating, the polymerization was inhibited. By adopting MWH, previously reported to promote FRP propagation over termination, it is demonstrated the inhibition can be overcome. This demonstrates improved CCTP with acrylates and supports the proposal that MWH can increase the rate of propagation.

**P179**

**Dr Ana Sousa-Herves**

Glycosystems Laboratory, Instituto de Investigaciones Químicas (IIQ).

*Polymeric Glyconanogels as Inhibitors of Lectin-Mediated Viral Infections*

Carbohydrate-protein interactions mediate many biological processes including tumour progression, inflammation, and viral infection. These interactions are typically characterized by a high selectivity and a low affinity, which is compensated in Nature by multivalency.

In this communication, we will report the synthesis and characterization of multivalent glyconanogels prepared from FDA-approved Poly(ethylene glycol) (PEG). The nanogels display multiple mannose moieties and have been designed to interact with the cellular receptor DC-SIGN by mimicking viral structures. DC-SIGN is a lectin that recognizes highly mannosylated glycoproteins, and is known to play a key role in the initial stages of many viral infections, including HIV and Ebola virus. Finally, infection assays performed with an artificial Ebola virus demonstrated the potent antiviral activity through specific DC-SIGN recognition of the glyconanogels.

**P180**

**Miss Anna P. Constantinou**

Imperial College London

*Thermoresponsive Gels Based on Multiblock Copolymers*

Triblock and tetrablock copolymers were synthesised using Group Transfer Polymerisation (GTP). These polymers were based on poly(ethylene glycol) (PEG) based methacrylates, the hydrophobic n-butyl methacrylate (BuMA) and the hydrophilic, pH-responsive as well as thermoresponsive 2-(dimethylamino)ethyl methacrylate (DMAEMA). Several structural polymeric characteristics were varied like the length of the PEG group for the triblock copolymers and the position of the blocks for tetrablock copolymers. The influence of these structural characteristics on the polymers self-assembly ability and their thermoresponsive properties with emphasis on their ability to form injectable gels was investigated.

**P181**

**Miss Anne Fuhrmann**

Laboratory of Organic Chemistry and Functional Materials, Department of Chemistry, Humboldt-Universität zu Berlin

*Switching the healing capability of dynamic covalent polymers by light*

The reversible thermoresponsive crosslinking of polymers contributes significantly to the field of smart, self-healing materials [1]. A prominent motif is the Diels-Alder reaction in which the pair of maleimide and furan is the most reliable [2,3]. Herein, we apply our concept of photocontrolling a reversible reaction [4] to polymer networks consisting of thermo- and photoresponsive furyl-substituted diarylethene crosslinkers and maleimide-containing copolymers. By turning the Diels-Alder crosslinking reaction ON or OFF with light, we demonstrate a control of the local healing of scratches in thin films. We envision a use of these responsive polymers in coating applications where the healing ability of the films can be controlled by irradiation with light of different wavelengths.

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**P182**

**Ms Anne-Kristin Trützschler**

Friedrich-Schiller Universität Jena, Laboratory of Organic and Macromolecular Chemistry/JCSM

*Entering the Brain: Glutathione modified polyethylenimin derivative for brain delivery*

The controlled delivery of genetic material into cells is more topical than ever. Besides viral transfection, non-viral delivery is of high interest, reflected in the large number of transfection agents being proposed. Thereby, poly(ethylene imine) (PEI) represents the gold standard for in vitro applications. While the transfection of cells in vitro is established, the delivery in vivo is demanding. Due to the blood-brain barrier (BBB), the targeting of cells in the brain without active transporters is limited. Recently, the application of glutathione (GSH) as targeting molecule for nanoparticle coating was reported. With this study we show the route to a GSH connected PEI copolymer. Using two synthesis routes, differences in complexation efficiency and cellular interaction of amines placed in the backbone and side chain were studied. With that approach polymers with GSH have been synthesized and the ability of crossing the BBB was investigated in a dynamic cell culture model.

**P183**

**Dr Antonio Ruiz-Sanchez**

Newcastle University

*Zwitterionic-Fluoro Hydrogels as Anti-Biofouling Coatings.*

The unwanted fouling of surfaces by organisms presents a huge and largely unsolved problem. From medical implants to the hulls of ships, fouling leads to reduced performance and increased costs. For example, fouling of ship hulls increases fuel consumption up to 40%. Considering there are over 90,000 vessels in the world fleet, with the largest ships consuming over 350 tonnes of fuel per day, the fuel savings and the reduction in greenhouse gas emissions would be considerable if biofouling were eliminated. Fluoropolymers and zwitterionic polymers individually make platforms for achieving fouling deterrence but have never been studied as a conjugate system. We report the copolymerization of fluoropolymers end-terminated with methacrylate functions with methacrylate-based zwitterion monomers to produce polymer coatings in a way which allows control of surface properties. Their antifouling behaviour was assessed and found to relate to coating composition and method of preparation.

**P184**

**Miss Ariane PEYRET**

Laboratoire de Chimie des Polymères Organiques

*Photon-triggered cargo release from polymersomes under temporal, spatial and spectral control*

Polymersomes are robust self-assembled vesicular structures that are employed in many domains. Control over their membrane properties is crucial, in particular in drug delivery applications. Here, we present a method allowing programmed vesicle rupture with full control in time, space and excitation wavelength for selective cargo-release.

We designed a tunable protocol for light-driven polymersome rupture, which combines the advantages of utilizing light as a trigger and the fast release of components from bursting vesicles. Our system is based on laser excitation of hydrophilic dyes encapsulated in the lumen of distinct giant poly(butadiene)-b-poly(ethylene oxide) polymersomes. Upon excitation, the fast generation of reactive oxygen species leads to an increase of the internal osmotic pressure that can not be compensated fast enough, resulting in vesicle rupture. We show that we can rupture polymersomes with high precision, and even to deliver small polymersomes and liposomes.

**P185**

**Mr Ben Martyn**

University of Warwick

*Polymer Coated Gold Nanoparticles for probing heterogeneous glycan environments.*

Polymer coated gold nanoparticles are a versatile system for probing biological systems. Gold Nanoparticles (AuNPs) have a well-defined optical response to aggregation. By combining the strain promoted alkyne-azide cycloaddition (SPAAC) with RAFT polymerisation we can create a modular synthesis of polymer coated AuNPs. This allows us to generate large arrays of glycan environments to probe sugar binding proteins (lectins). This allows us to build a statistical picture of specificity of lectin binding including the synergistic and antagonistic binding caused by heterogeneous environments. This can provide insight into cell-pathogen interactions and aid the development of anti-adhesion therapies.

**P186**

**Mr Bernd Deffner**

Laboratory of Polymer Chemistry, Department of Materials, ETH Zurich

*Molecular weight determination and mechanical behavior of high molecular weight poly(m,p phenylene)s derived by Suzuki polycondensation*

Polyphenylene has always been an appealing synthetic target to polymer chemists because of its unique properties. Recently a poly(m,p-phenylene) bearing acid cleavable side chain was synthesized with a Mw of 300 kDa on a scale of 10 g. This outstanding molecular weight was determined by GPC and confirmed by static light scattering. Further the polymer shows an extended plasticity above its Tg of 180°C, which enabled us producing fibers of different draw ratios. Within the drawn samples, the polymer chains orient along the direction of elongation, which results in an increase of Young’s modulus up to 5 GPa and a yield strength of 140 MPa. Further it was shown by TGA, IR and solid state NMR, that the acid cleavable side chain can be removed quantitatively even from processed polymer fibers. Hereby the tensile stress resistance further increases to a Young’s modulus of 7.5 GPa and a maximum strength of 300 MPa.

**P187**

**Mr Bruno Ernould**

Université catholique de Louvain

*Grafting strategies toward hybrids of a redox polymer and carbon nanotubes for high performance lithium battery cathodes*

Li-ion batteries (LIB) are considered as the more mature technology to address the ever-increasing demand for portable energy sources. However LIB cathodes rely mostly on transition metal oxide materials suffering from limited resources. Consequently organic cathode materials have recently attracted vivid interest as more sustainable potential alternatives. A promising candidate is the poly(2,2,6,6-tetramethylpiperidin-1-oxyl-4-yl methacrylate) (PTMA), which bears TEMPO side-groups able to undergo reversible redox reactions. PTMA displays a high potential of 3.6 V vs Li+/Li, a high stability upon cycling and ultrafast charge/discharge capabilities. Yet, PTMA suffers from its solubility in standard commercial electrolytes and from its electric insulating behavior. To tackle these issues, we propose original strategies toward grafting of PTMA on multi-walled carbon nanotubes in order to provide a chemical anchor and a more intimate contact between the polymer and the conductive carbon.

**P188**

**Dr Byung Kim**

KCPC, The University of Sydney

*Biodistribution and clearance of stable superparamagnetic maghemite nanoparticles in nude mice*

Our group have synthesised superparamagnetic &#120574;-Fe2O3 nanoparticles (SPIONs) that exhibit superb stability in biological settings and are capable of enhancing the penetration of drugs across solid tumour models. This work highlights the biodistribution of these sterically stabilised SPIONs in healthy nude mice following intra-peritoneal injection. After a single injection of 90 mg Fe/kg body weight, SPIONs were found in most of the major organs except for the brain and the kidneys. Despite such a high dose of SPIONs, no onset of fibrosis or macroscopic damage to the tissues was observed, while some earlier studies showed damage to the liver and kidneys. No cytotoxicity was observed in the current study because the SPIONs did not aggregate and were cleared from the mice within 7 days, partly by the action of macrophages. The stability of the maghemite cores in cells was found to be crucial to the ability of the macrophages to remove the SPIONs.

**P189**

**Mr Carlos M. R. Abreu**

University of Coimbra

*Poly(vinyl chloride): Current Status and Future Perspectives via Reversible Deactivation Radical Polymerization Methods*

Poly(vinyl chloride) (PVC) is one of the more consumed polymers worldwide due to its general versatility and low cost. It is currently used in various applications ranging from packaging to construction. Currently PVC is only being prepared on an industrial scale by FRP. However, the several intrinsic limitations of FRP triggered interest in synthesizing this polymer by reversible deactivation radical polymerization (RDRP) methods. At the present time, SET-DTLRP, SET-LRP, CMRP, RAFT, SARA ATRP and NMP are RDRP methods available for vinyl chloride (VC) (co)polymerization. These RDRP methods will be critically discussed from three major standpoints: degree of control over polymerization, limitations and potential applications on an industrial scale.

**P190**

**Dr Caroline Biggs**

The University of Warwick

*Surface grafted polymers for microarray platforms and understanding biochemical interactions*

There is an urgent need for new technologies to detect and probe bacterial infection and carbohydrate arrays (glycoarrays) have gathered significant interest for this purpose. At the start of the infection process, pathogens adhere onto the host cells, commonly through protein-carbohydrate interactions. Probing these interactions can be efficiently achieved by the presentation of carbohydrates in an array format, which can detect bacteria and provide structural information on their adhesion proteins and carbohydrate specificities. Using polymer linkers to immobilise the carbohydrates onto the surfaces (glass, silicon or gold) can provide a route to higher resolution arrays and the ability interrogate whole bacteria, whilst reducing non-specific binding and therefore minimising false positive outputs.

**P191**

**Mr Charlie Jarrett-Wilkins**

University of Bristol

*Controlled Self-Assembly of Perylene Diimides*

The ability to design and prepare well-defined supramolecular structures on the nanoscale with dimensional control is of growing interest. This length scale can be accessed by the self-assembly of small molecules, such as perylene diimides (PDIs), driven by non-covalent forces between molecules. These structures, usually termed supramolecular polymers, possess tunable interactions between 'monomer' units by way of the functionality of the small molecule.1 While formation of long fibres has been shown and there is a growing understanding of the energy landscape of supramolecular polymerisation,2 precise control over the length of these fibres has yet to be demonstrated. Herein we describe the synthesis and self-assembly (via seeded growth) to control the lengths of fibres formed by PDIs.3

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**P192**

**Miss Charlotte Boott**

University of Bristol

*Functional Nanomaterials using Crystallization-Driven Block Copolymer Self-Assembly in Two-Dimensions*

The solution self-assembly of block copolymers (BCPs) has provided access to a range of functional nanoscale objects with a high degree of precision. One particularly promising approach for the formation of controlled nanostructures from BCPs is crystallisation-driven self-assembly (CDSA). Living CDSA has been successfully employed to prepare one-dimensional cylinders of controlled length and narrow length distributions.(1) Recent work has shown that the living CDSA method can be extended to two dimensions, and provide routes to concentric lenticular(2) and rectangular(3) 2D block comicelles with well-defined regions of nanosegregated coronal functionality employing BCP only and hompolymer/BCP blend systems respectively.

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3. H. Qiu, et al, Science, 2016, accepted.

**P193**

**Mr Chin Ken Wong**

School of Chemistry / Centre for Advanced Macromolecular Design (CAMD) UNSW

*Non-spherical polymersomes: Unusual shapes obtained through fine-tuning of pi-pi stacking interactions*

In this work, we report on the preparation of non-spherical polymersomes (traditional polymersomes are generally spherical) from perylene-containing diblock terpolymers. We demonstrate that by introducing aromatic molecules like perylenes onto polymers, and by varying &#960;-stacking strengths between perylene moieties, we could impart size- and shape- tunability into the resulting self-assembled polymer structures. We show that by changing the solvent quality used in the self-assembly process (which in turn affects the degree of &#960;- &#960; interactions), we could obtain polymersomes that are either tubular or ellipsoidal (with variable aspect ratios). These uncommonly-shaped polymersomes are of particular interest to us for drug delivery investigations because recent studies have shown that non-spherical, high aspect ratio micro/nanoparticles have significantly improved cellular uptake properties, circulation time and tumor accumulation properties.

**P194**

**Mr Chongyu Zhu**

University of Warwick

*A Polymeric Colistin Prodrug for Multidrug-Resistant Gram-Negative Bacteria*

Although colistin is a very potent antibiotic, it is also quite toxic to the human body, particularly to the kidneys. PEGylating colistin may help to reduce its toxicity as well as to prolong its duration of blood circulation and thus action. However, the covalent PEG attachment of colistin will lead to a complete loss of activity. Therefore, in this work, a releasable PEGylation approach, which targets the colistin Thr residues, has been investigated. A poly(ethylene glycol) (PEG)-based polymer was successfully introduced onto the targeted sites of the colistin using well-developed esterification chemistry. The subsequent polymer-peptide conjugate can then be hydrolysed to release the native peptide in vitro at 37 oC within 24 h while remain relatively stable at ambient temperature. Furthermore, the release rate of the native colistin can be controlled by varying the number of mPEG attachments which in turn leads to different antibiotic activities against MDR bacteria.

**P195**

**Mr Christoph Englert**

Friedrich Schiller University Jena

*Novel modifications of poly(ethylene imine)*

Among the various types of non-viral vectors, poly(ethylene imine) (PEI) has been used as the gold standard since it possesses one of the highest cationic charge density potential of all organic macromolecules. PEI reveals an extremely high gene transfection efficiency in vitro. However, the net positive charge of PEI/polyplexes led to major drawbacks concerning toxicity, aggregation and undesired non-specific interactions with cellular and non-cellular components, particularly in vivo. Herein, we present the design of biodegradable and more biocompatible PEI derivatives by modifying the backbone and/ or side chains using simple and efficient reactions. Presented PEI-based copolymer systems are investigated for gene transfection in vitro and in vivo.

**P197**

**Mr Daniel Leibig**

Institute of Organic Chemistry, Johannes Gutenberg University Mainz, Duesbergweg 10-14, 55128 Mainz, Germany

*Microstructure analysis of linear and hyperbranched copolymers by 1H NMR kinetic studies*

In the last decade, the need for multi-functional polymers for specialty applications is growing constantly. Copolymerization of two or more monomers is a direct route to highly functional polymers. However, ordinary analysis methods do not offer information about the comonomer sequences of such polymers. Nevertheless, knowledge of the microstructure and the exact monomer distribution is essential for future applications of the polymers.

Recently, we developed a method to study the direct comonomer consumption during polymerization via 1H NMR kinetics. We are able to monitor the anionic ring opening polymerization of epoxides and the carbanionic living polymerization of styrene and its derivatives. Here, we present detailed microstructure analysis of linear and hyperbranched polyethers and multi-functional polystyrenes. In summary, 1H NMR kinetic studies offer information about the monomer sequence of multi-functional polymers and reactivity ratios of comonomers can be calculated.

**P198**

**Dr Daniel Lester**

University of Warwick

TBC

**P199**

**Mr Jérémy Demarteau**

Center for Education and Research on Macromolecules CERM, University of Liège, Liege, Belgium

*Organocobalt complexes as source of radicals for the controlled polymerization of unconjugated monomers*

Organocobalt(III) complexes with acetylacetonate ligands are characterized by weak C-Co bonds which is useful for initiating and controlling the radical polymerization of unconjugated monomers. In this communication, we will describe an innovative synthetic route towards halomethylcobalt(III) complexes and demonstrate their potential as Organometallic-Mediated Radical Polymerization (OMRP) initiators.1 Accordingly, we notably achieved the precision synthesis of ethylene-based copolymers including Ethylene-Vinyl Acetate (EVA) containing statistical and block copolymers.2 We will also present the controlled polymerization of vinylimidazolium-type ionic liquid monomers in organic media or water. Finally, these organocobalt complexes provide new opportunities for functionalizing the above mentioned polymers either at the alpha or at both end-chains. 1. Demarteau, J. et al. Chem. Commun. 2015, 51 (76). 2. Debuigne, A. et al. ACS Symp. Ser. 2015, 1188 (Controlled Radical Polymerization).

**P200**

**Mr Edward Cant**

University of Warwick

*Renewable Biomass-Derived Materials for Use Within Microstereolithography*

Poly(malic acid) is derived from renewable, biomass resources and is well known for its ability to undergo bulk degradation into non-toxic malic acid molecules via hydrolysis. This degradability is a consequence of the shear hydrophilicity of the material. Consequently, functionalising the poly(malic acid) backbone with hydrophobic molecules can decrease the hydrophilic nature of the material, thereby tuning its degradability. In this study we present a novel material derived from the oligomerisation of functionalised malic acid-based monomers in combination with a succinic acid-derived reactive diluent and a thiol-functional cross linker. Introducing a photoinitiator to the composition produces a suitably non-viscous resin that is ideal for use in the µSL process to create precise 3D, degradable structures. We envisage that these structures will find application in both facilitating the rapid prototyping of one-off micro-devices and biocompatible tissue engineering constructs.

**P201**

**Mr Elio Poggi**

Université catholique de Louvain, Bio and Soft Matter division

*Polymeric janus nanoparticles templated by block copolymer thin films*

Janus particles are compartmentalized particles comprised of two or more surface regions with different chemistries or polarities. This broken symmetry gives rise to unique properties, such as the ability to have directional interactions, which are useful in a wide range of applications like catalysis, sensors or imaging. In this context, we report on a method to produce well-defined polymeric Janus particles using as template a nanostructured thin film. In a first step a diblock copolymer is used to produce a thin film with regularly spaced vertical microdomains. Afterwards, these microdomains are selectively cross-linked and functionalized, allowing the grafting by click chemistry of a homopolymer onto the top of them. Since the film microdomains are cross-linked and the grafting only occurs on their surface, the dissolution of the film leads to the formation of well-defined and asymmetric Janus nanoparticles.

**P202**

**Miss Elise Guégain**

Institut Galien Paris-Sud

*A Single Monomer to Confer Degradability and Control the Nitroxide-Mediated Polymerization of Methacrylates*

Reversible deactivation radical polymerization (RDRP) techniques enable the synthesis of well-defined and functional polymers. Among them, nitroxide-mediated polymerization (NMP), which is governed by a thermal process based on reversible activation-deactivation equilibrium, offers important benefits. However, NMP of methacrylic esters is still a challenge. The activation-deactivation equilibrium constant is too high, thus favoring irreversible termination reactions. A good control can be obtained by adding a small amount (< 10 mol.%) of a controlling comonomer such as styrene or acrylonitrile. Importantly, we recently discovered that 2-methylene-4-phenyl-1,3-dioxolane (MPDL), a cyclic ketene acetal (CKA), not only can be successfully copolymerized with methacrylic esters to confer tunable degradability to the resulting copolymer, but can also act as a controlling comonomer for the NMP of methacrylates. A cytotoxic study also demonstrated the innocuousness of MPDL-containing polymers.

**P203**

**Miss Elrika Harmzen**

Stellenbosch University

*Self-assembly of poly (styrene-co-divinyl benzene-co-maleic anhydride) nanoparticles for encapsulation mechanism and capsule formation*

Micro-scale compartments prepared using inverse Pickering emulsions as templates have a number of interesting uses, including the encapsulation of viable microbial cells within the membrane-bound water micro-droplets. Several novel applications for such systems are targeted in the pharmaceutical and food industries.1

**P204**

**Ms Emma Brisson**

Chemical and Biomolecular Engineering, The University of Melbourne

*The Dynamic and Versatile Chemistry of Amino Acid Functional Polymers*

The copolymerization of N-isopropylacrylamide with aldehyde functional monomers facilitates post polymerisation functionalisation with amino acids via reductive amination.[1] Reductive amination is the reduction of an imine formed between an amine and the aldehyde on the polymer. The dynamic nature of the imine as well as the versatility of reductive amination to functionalise a polymer with a range of amino acids is highlighted. Amino acid functional polymers are synthesized without the use of protecting groups with high yields, demonstrating the high functional group tolerance of reductive amination. The resulting temperature responsive, amino acid functional polymers are characterised and their temperature response is explored. Additionally, the dynamic nature of the imine prior to reduction is demonstrated with the shuffling from one amino acid to another.

[1] E.R.L. Brisson, Z. Xiao, L. Levin, G. V Franks, L.A. Connal, Polym Chem 2016, 7, 1945. doi:10.1039/C5PY01915J

**P205**

**Dr Erno Karjalainen**

The University of Nottingham

*Counterion-Induced UCST for Polycations*

This presentation introduces a general method to induce an upper critical solution temperature (UCST) type behavior for polycations. [1] This is done by adding hydrophobic anions into aq. solutions of polycations, which leads to in situ formation of “copolymers” with both hydrophilic and hydrophobic repeating units. The approach is versatile, since -contrary to traditional copolymerization- the ratio of “comonomers” can be decided after the polymerization. Thus a single batch of polycation can be expanded to a plethora of systems with different solution behavior.

The resulting UCST-type cloud points can be manipulated with the concentration of the hydrophobic counterion and by addition of salts. The main focus is on four polycation-counterion pairs, but the approach has been proven to be a viable one for other systems as well. [2,3]

[1] Karjalainen et al. Macromolecules 47, 7581; [2] Karjalainen et al. Macromolecules 47, 2103; [3] Karjalainen et al. Polym. Chem. 6, 3074.

**P206**

**Dr Eva Blasco**

Karlsruhe Institute of Technology

*Fabrication of 3D Gold/Polymer Conductive Microstructures via Direct Laser Writing*

The interest in fabrication of conductive 3D structures on the micrometer scale has increased in recent years due to their potential applications in microelectronics or emerging fields such as flexible electronics and nanophotonics. Nevertheless, the preparation of these conductive microstructures is still challenging. One of the most promising approaches to fabricate them involves the simultaneous photopolymerization and reduction of metallic ions.

In the current study, we report a novel water-based photoresist for the preparation of 3D conductive structures by the mentioned simultaneous process. The photoresist is composed of an acrylate-functionalized PEG, acrylic acid and HAuCl4. By varying the gold content, different structures have been prepared and characterized by SEM and XPS. Conductivity of a wire between prefabricated macroelectrodes has been also measured. The material was also employed to demonstrate the possibility of true 3D microscale connections between gold pads.

**P207**

**Ms Evelien Baeten**

Uhasselt

*Continuous flow synthesis towards complex macromolecular materials: One step multiblock copolymer synthesis*

Continuous flow processes – an innovative alternative for conventional batch operations – are associated with advantages such as the high control of reaction parameters, fast heat-exchange, reduced reaction times and high reaction efficiencies. In combination with controlled/“living” polymerization techniques, the polymer field can gain significantly from microreactor technology.

Specifically, the advantage of coupled microreactor cascades, which allow to carry out reactions in consecution with very high precision, will be discussed. Functional poly(2-oxazoline) triblock copolymers were targeted via cationic ROP in a microreactor cascade. Anionic ROP of cyclic phosphates is also shown, followed by a post-functionalization via thiol-ene under UV to give also an example for polymerization-postpolymerization modification reactor sequence. Last, a versatile platform for multiblock copolymer synthesis in one step via sequential RAFT polymerization is introduced.

**P208**

**Dr Fabien Dutertre**

School of Chemistry, University of Bristol

*Structure and dynamics of dendronized polymer solutions: Gaussian coil or macromolecular rod?*

We investigate the conformation of well-defined dendronized polymers (denpols) based on poly(norbornene) (PNB) and poly(endo-tricycle[4.2.2.0]deca-3,9-diene) (PTD) backbones employing static and dynamic light scattering. Their synthesis by ring-opening metathesis polymerization (ROMP) led to fully grafted and high molecular weight denpols with narrow polydispersity. In dilute solutions, the persistence lengths were estimated by static (radius of gyration) and dynamic (translational diffusion) chain conformational properties of the denpols and were compared to their homologue precursor PNB. The conformation of denpols with a 3rd generation side dendron conforms to a semiflexible chain with a persistence length of about 6-8 nm, virtually independent of the contour length. The assumption of extremely high chain rigidity for this class of polymers is clearly not supported, at least for a 3rd generation dendron.

**P209**

**Mrs Faye Hern**

University of Liverpool

*Xanthate Mediated Sequential Thiol-Acrylate Michael Addition*

Thiol-Michael addition chemistry benefits from mild reaction conditions, minimal by-product formation, high functional group tolerance and high conversion. We have shown previously that xanthates, acting as masked thiols, undergo one-pot deprotection/thiol-acrylate Michael addition to introduce functionality at the surface of dendritic polyesters. Here, we compare the rapid simultaneous and stepwise sequential controlled surface group modification of these materials to selectively introduce desired amounts of surface groups with a range of functionalities. The controlled deprotection and functionalisation of a range of dendritic materials with varying generations and molar ratios of mixed acrylates has allowed the targeting of materials with a range of molar concentrations of functional groups using a small number of starting materials.

**P210**

**Mr Fernando Cabral Salles de Oliveira**

Pharmaceutical and Medicinal Chemistry Department - Royal College Surgeons Ireland - RCSI

*Macrolactone-derived polyesters: Alternative materials in electrospun fibres for biomedical applications.*

Aliphatic polyesters are widely established as biomaterials for example bone screws, tissue engineering scaffolds, and drug delivery systems. An interesting new class of polyesters is poly(macrolactone)s exhibiting mechanical and thermal properties similar to low density poly(ethylene). In this paper we report the first example of PML electrospinning of polyglobalide (PGl) by carefully optimising the spinning conditions. The obtained fibres showed dimensions between micro and nanometres, which confirm the possibility of its application in scaffolds for internal and superficial tissues development. In the degradation experiment after 90 days, the PGl fibres reduced about 30% of its initial mass, which define it as a promissing material to tissue engineering. In cell growth tests, the metabolic activity assay showed that PG1 fibres allow for cell proliferation without any deleterious response in mensenchymal stem cells (MSCs) viability, and thus it is considered as noncytotoxic.

**P211**

**Dr Florent Jasinski**

Centre for Advanced Macromolecular Design

*Monitoring Nanoparticles Morphology using X-Ray Photoelectron Spectroscopy and Mathematical Modelling*

Water-borne paints and varnishes made by emulsion polymerization are among the main materials used to protect and decorate surfaces. The microstructural morphology of latex nanoparticles can be advantageously designed in order to (i) remove volatile organic compounds from the formulation and (ii) achieve optimal coating properties such as hardness, flexibility, gloss.

We present here a new way to monitor nanoparticle morphology using X-Ray Photoelectron Spectroscopy (XPS) combined with mathematical modelling of the feeding process. By increasing the level of complexity in the microstructure using original feed strategies for a high Tg formulation made from styrene and methyl methacrylate, we show that XPS is a reliable and accurate way to determine the morphology of structured latexes such as core-shell or gradient morphology latexes.

**P212**

**Mr Frank Driessen**

Department of Organic and Macromolecular Chemistry, Polymer Chemistry Research Group

*Copper-mediated CRP and Thiolactone Chemistry: A Matching Mix for the Development of well-defined Amphiphilic Dispersing Agents*

Tuning the properties of polymer materials to advanced levels fits the current trends in macromolecular chemistry. Combining different monomers in various topologies regulates the structure-property relationship and enables their use as dispersants. One of the interesting types of complex copolymers resemble toothbrush structures, known to display increased stabilizing properties. A new methodology was developed for the synthesis of amphiphilic graft- and toothbrush copolymers. Combining our thiolactone chemistry with Cu(0)-CRP turned out to be a matching mix for the synthesis of these complex structures. Linear and block-copolymers were synthesized containing thiolactone functionalities via Cu(0)-mediated polymerization, enabling polymerizations to high monomer conversions and end-group fidelities. Polymers containing an acrylate end-group were connected via amine-thiol-ene conjugation to obtain the complex copolymers and their properties as pigment dispersants were evaluated.

**P213**

**Dr Garbiñe Aguirre**

Université de Pau & Pays Adour, UMR 5254, IPREM, Equipe de Physique et Chimie des Polymères

*Smart microgels and films as cosmetic active molecules carriers*

Nowadays, the design of innovative delivery systems (DSs) is driving the new product development in the field of cosmetic. Among different DSs, dual stimuli-sensitive microgels have emerged as well-received ones. Thanks to their sensitivity to two external stimuli, small size, high porosity and capability to be functionalized, they offer more controllable DSs. In this sense, the most studied and applied microgels are those that are pH- and thermo-sensitive. Herein, using dual-responsive oligo(ethylene glycol)-based microgels recently developed,1 the encapsulation of different cosmetic active molecules (hydrophobic/hydrophilic) has been studied at different conditions (pH/temperature). Since these novel microgels are able to spontaneously form self-assembled microgel films, the encapsulation into them has been also studied. The in vitro release profiles of the microgels and films in response to pH and temperature changes have been analyzed.

1 Macromol. Rapid Commun. 2015, 36, 79.

**P214**

**Mr Geng Hua**

KTH Royal Institute of Technology

*One-pot branched copolyester--a facile inimer approach through &#945;-hydroxyl-&#947;-butyrolactone*

To extend the application of &#947;-butyrolactone structures from linear to branched polymers, a one-pot inimer promoted ring-opening copolymerization pathway was developed. The choice of the renewable, cheap and easy available inimer avoids the typical multi-step preparation, which favors the sustainable trend. The widely investigated &#949;-caprolactone and lactide were chosen as model comonomers with the &#945;-hydroxyl-&#947;-butyrolactone as inimer. The mechanism was elucidated and detailed branching kinetics was monitored from reactions in toluene. High conversion of the inimer and comonomers was seen during copolymerization, yielding Mw as high as 72 K (MALLS-SEC). A decreased MHS exponent &#945; (from 0.74 to 0.42) was determined when an increased molar ratio of inimer was charged to the polymerization, which is a direct evidence of increased branching. The degree of branching (DB) was investigated by NMR and triple detector SEC, where the highest DB was around 0.124.

**P215**

**Mr Geoffrey Hibert**

LCPO

*Glycolipids As A Platform For The Synthesis Of Biodegradable Polymers*

Glycolipids are amphiphilic molecules composed of a hydrophilic part, a carbohydrate moiety, and a lipophilic part, a fatty acid derivative.

These bio-based molecules are biodegradable and exhibit a low toxicity. Thanks to the different available functional groups of the fatty acid and sugar moieties; the latter are good candidates for the synthesis of sustainable glycolipids polymers.

In this project, glycolipids were synthesized with a control of the esterification to get only monoesters and diesters. Thus, only primary alcohols of a disaccharide (trehalose) were esterified with various fatty acids without protection of the sugar moiety. Furthermore, these glycolipids were functionalized and polymerized with different strategies. Thus, polyurethanes were obtained by classical polyaddition whereas polyesters were synthesized by acyclic diene metathesis and thiol-ene polymerization.

The polymers obtained exhibit unique properties due to the lipidic and carbohydrate parts.

**P216**

**Mr George Hargreaves**

University of Nottingham

*Accelerated polyester synthesis via the application of electromagnetic heating*

The use of electromagnetic energy in the form of microwaves has previously been shown to heat reaction media in more efficient ways than conventional heating. This has been attributed to the volumetric heating of the medium by the microwave energy, giving a more uniform energy application. These attributes should make electromagnetic heating ideal for high temperature, viscous melt polymerisations.

This paper demonstrates, by implementing microwave heating to melt polycondensation reactions between adipic acid and 1,6-hexanediol at 185 oC, increased conversion rates when compared to conventional heating equivalents. Furthermore, microwave heating also created a better quality product, e.g. less colouration, suggesting the electromagnetically heated reactions proceed with less degradation and side reactions. A range of metal and organo catalysts were studied and a difference in catalyst efficiencies was observed, suggesting that the catalysts react differently between heating method.

**P217**

**Miss Ghislaine BAROUTI**

Institut des Sciences Chimiques de Rennes

*Polyhydroxyalkanoate-based diblock and triblock copolymers: Chemical composition and macromolecular architecture, an easy way to tune the nanoparticles properties for drug delivery applications*

Original Poly(hydroxyalkanoate)s (PHAs) based diblock and triblock copolymers, namely poly(&#946;-malic acid)-b-poly(3-hydroxybutyrate) (PMLA-b-PHB) and PMLA-b-PHB-b-PMLA respectively, have been synthesized. The controlled sequential ring-opening polymerization of &#946;-butyrolactone and benzyl &#946;-malolactonate (MLABe) has been achieved through different catalytic approaches depending on the desired block structure. Various self-assembled systems such as polymerzomes and micelles with tunable hydrodynamic radius (16-300 nm), molecular weight and percentage of extension of the hydrophilic block (10-100%) were obtained as investigated by light scattering measurements. Cell viability of these nanoparticles assessed from MTT assays evidenced no cytotoxic effect (up to 88 µg/mL). All these results demonstrated that these PHB-based copolymers are promising candidates as drug-delivery systems.

**P218**

**Dr Giovanna Sicilia**

School of Pharmacy, University of Nottingham; Australian Institute for Bioengineering and Nanotechnology, University of Queensland

*Self-assembling 19F Nucleic Acid–Polymer Conjugates as Real-Time MRI Probes of Biorecognition*

Polymer-DNA conjugates in which one nucleic acid strand contains fluorine-substituted nucleobases have been prepared and characterised. The efficacy of these novel 19F nucleic acid &#8722; polymer conjugates as sensitive and selective in vitro reporters of DNA binding events is demonstrated through a number of rapid-acquisition MR sequences. The conjugates self-assemble into micellar-like nanoparticles which are stable in solution but which respond readily and in a sequence specific manner to external target oligonucleotide sequences by changes in hybridisation. In turn, these structural changes in polymer-nucleotide conjugates translate into responses which are detectable in fluorine relaxation and diffusion switches, and which can be monitored by in vitro Spin Echo and DOSY NMR spectroscopy.

**P219**

**Mr Glen R. Jones**

University of Warwick

*Aqueous photoinduced polymerization of acrylates in the presence of low copper concentration and halide salts*

Photoinduced metal mediated radical polymerization is a rapidly developing technique which allows for the synthesis of macromolecules or defined molecular weight and narrow molecular weight distributions, although typically exhibiting significant limitations in aqueous media. Herein we demonstrate that the inclusion of halide salts in the presence of low copper concentration and UV irradiation allows for the controlled polymerization of PEG acrylate in aqueous media yielding narrow molecular weight distribution and quantitative conversions. Despite the aqueous medium which typically compromises the end group fidelity, chain extensions have also been successfully performed and different degrees of polymerization were targeted. Importantly, no conversion was observed in the absence of UV light and the polymerization could be switched “on” and “off” upon demand as demonstrated by intermittent light and dark periods and thus allowing access to spatiotemporal control in aqueous media.

**P220**

**Mr Gokhan Yilmaz**

University of Warwick and Queen Mary, University of London

*Synthesis of glyconanoparticles with different morphologies and their interactions with DC-SIGN*

Recent investigations in the glycopolymer technology have allowed the preparation of more complex and well-defined glyco-polymers/particles with several architectures from linear to globular structures (such as micelles, dendrimers and nanogels).1-3 Here, several types of amphiphilic block co-glycopolymers with optimal molecular weights, relatively narrow molecular weight distributions and the same number of mannose units were synthesised via Single Electron Transfer Living Radical (SET-LRP) to generate glyconanoparticles with different morphologies such as spherical and worm-like micelles as well as spherical vesicles. Finally, the interaction of these glyconanoparticles of different size and shape with dendritic cell-specific intercellular adhesion molecule-3-grabbing non-integrin (DC-SIGN) was monitored by surface plasmon resonance (SPR).

**P221**

**Dr Guillaume De Bo**

University of Manchester

*An artificial molecular machine operating on a polymeric track to generate a catalytically active peptide*

The ribosome is an enormous biological molecular machine that joins together amino acids derived from transfer RNA building blocks in an order determined by a messenger RNA strand, creating protein in a process known as translation. We recently reported an artificial small-molecule machine able to synthesize a peptide in a sequence-specific manner. The chemical structure is based on a rotaxane, a molecular ring threaded onto a molecular axle. The ring carries a thiolate group that iteratively removes proteinogenic amino acids from the strand and transfers them to a peptide elongation site through native chemical ligation. Here we report the successful preparation, using a rotaxane elongation strategy, of an artificial molecular machine operating on a polymeric track to generate a catalytically active peptide.

**P222**

**Dr Guping He**

University of Nottingham

*Nano-porous Polymeric Microparticles Prepared in scCO2*

Nanostructured polymeric materials are highly attractive because of their distinctive properties compared to bulk. There are many promising potential applications such as in microelectronics, bio-sensors, biomedicine, and catalysis.[1]

We report here a versatile way to prepare nano-porous polymeric materials with the aid of scCO2. The use of scCO2 allows unusual self-assembly of block copolymers in a microparticulate solid phase. We have synthesized such materials via one-pot RAFT controlled dispersion polymerisation in scCO2[2,3,4] and found that they have very interesting controlled structures comprising cylinder, lamellar and gyroidal which were controlled by varying the block ratio.

We report on new methodologies designed to introduce porosity into these materials and discuss some potential applications.

**P223**

**Dr Haritz Sardon**

POLYMAT, University of Basque Country UPV/EHU

*Towards more sustainable synthesis of polyurethanes*

Polyurethanes (PUs) constitute one of the most important classes of polymeric materials with applications ranging from high-performance structural applications to foam padding. Due to their extreme utility and relatively low cost, these materials account for nearly 5 wt % of total worldwide polymer production and are expected to exceed 18 kilotons annually by 2016. From a green and sustainable chemistry standpoint, the current challenge in the polyurethane’s industry is to switch to more greener approaches for the polyurethane production. Critically, important highlights for the future of polyurethanes will be the utilization of more benign organocatalysis instead of conventionally used tin-based catalyst, the move from toxic isocyanates to isocyanate free approaches, to replace petroleum-based reagents with biobased and/or to make the transition from organic solvent-based to water-based PUs.

**P224**

**Dr Hatice Mutlu**

Institut für Biologische Grenzflächen - Polymeric Materials (IBG III), Institut für Technische Chemie und Polymerchemie, Lehrstuhl für Präparative Makromolekulare Chemie

*TBC*

**P225**

**Dr Henk Huinink**

Eindhoven University of Technology

*Water and ion diffusion in nylon-6; the impact of plasticization*

Nylon-6 is semi crystalline polymer that due to its amide-bond strongly interacts with water. Water only enters the amorphous phase. At low relative humidity (RH), single water molecules bind to the amide moiety. Above a certain RH clusters of water form. Due to water binding, the H-bonds between the polymers are disrupted leading to a softening of the amorphous phase. With GARField NMR depth profiling we have studied the combined process of diffusion and plasticization of the nylon matrix. It is shown that plasticization lags behind the water diffusion front in the matrix. Relaxation experiments on samples completely saturated with water demonstrate that the amorphous phase is heterogeneous and only a small fraction is plasticized significantly. Experiments with MnCl2 solutions show that ion diffusion in the matrix is facilitated by the presence of water.

**P226**

**Mr Hsin-Han Chen**

National Tsing Hua University

*Synthesis and Fabrication of Glycerol-Based Polymeric Biodegradable Films via Slot-Die Coating*

Following the rising global awareness in environmental protection, promotion of the addition of biodiesel to petroleum has become a common practice, leading to increase in the production of biodiesel. With the large amount of biodiesel being produced, large quantities of byproducts are also generated. Crude glycerol is the main byproduct from biodiesel production, and for every 9 kg of biodiesel, 1 kg of crude glycerol is produced. However, it is not economical to purify crude glycerol due to high cost and low efficiency.

**P227**

**Mr Ignacio Insua**

University of Birmingham

*Enzyme-responsive polyion complex (PIC) nanoparticles for targeted antimicrobial delivery*

Antimicrobial-resistant bacteria are a major threat worldwide. Due to the limited pipeline of new antibiotics, novel therapies are required to prevent the spread of resistances. Antimicrobial polymers are great candidates to tackle antimicrobial-resistant strains, yet their toxicity to the host limits their use in clinic. The formulation of such polymers as pathogen-targeted nanodrugs arises as a promising solution to overcome their toxicity.

We present the synthesis and biological evaluation of enzyme-responsive polyion complex (PIC) nanoparticles for the targeted delivery of antimicrobial polymers against Pseudomonas aeruginosa. Such nanomaterials were prepared by electrostatic complexation of a cationic antimicrobial polymer with an acidic peptide degradable by P. aeruginosa's elastase. The synthetic conditions allowed control over the size and physiological stability of PIC particles. The enzymatic degradation and antimicrobial activity of PIC nanoparticles were assessed in vitro.

**P228**

**Ms Ioanna Danai Styliari**

The University of Nottingham

*Investigating the formation of polymer-coated drug nanoparticles through experimental and computational methods.*

The assembly of polymer nanoparticles by solvent/non-solvent precipitation is often based on trial-and-error approaches and the lack of mechanistic understanding of these processes limits our ability to rationally design and optimise polymer nanoparticles for biomedical applications. To this end, molecular dynamic simulations provide crucial information at the near-atomistic level to study drug-polymer interactions during nanoparticle formulation. Here we describe the formation of polymer-drug aggregates; monomethoxy poly(ethylene)glycol (mPEG) 350 - polycaprolactone (PCL) 2000 diblock copolymers dissolved in acetone interact with an aqueous indomethacin nanosuspension. The simulations are complemented with parallel experimental work, based on a modified interfacial deposition method. Such combinations of information from both the micro and macro scales, offer important insights towards a ”structure based formulation design”.

**P229**

**Miss Jana Herzberger**

Johannes Gutenberg-University Mainz

*Thioether functional poly(ethylene glycol) copolymers: Oxidation-responsive micelles and "click" chemistry*

In recent years, functional and responsive macromolecules have received much attention. Applications range from drug delivery to diagnostics, demanding well-defined and “smart” polymers. Poly(ethylene glycol) (PEG), a non-toxic and water-soluble polyether, is well-established for pharmaceutical use. However, PEG itself possesses low functionality and for various applications, an increase of functional groups would be beneficial. We copolymerized PEG with a thioether functional epoxide, rendering redox-responsive and “clickable” PEG copolymers. Light scattering experiments reveal the formation of defined micelles in water and block copolymers respond to oxidants with a change in hydrophilicity leading to micelle dissociation. These preliminary results are promising for future on-demand drug release. Additionally, thioether moieties permit “click”-type reactions, providing access to functional groups such as carboxyl-, propargyl- and amide groups via alkylation and epoxidation.

**P230**

**Dr Jaroslav Mosnacek**

Polymer Institute, Slovak Academy of Sciences

*Oxygen tolerance in copper mediated photoATRP*

Atom transfer radical polymerization (ATRP) can proceed in the presence of limited amount of oxygen, when it is performed under ARGET conditions. In such system CuBr/ligand complex, after its oxidation by oxygen, can be continuously regenerated in situ by reducing agents until all oxygen in the system is consumed; polymerization can then proceed under typical ATRP conditions. In this contribution the studies performed in the presence of limited amount of air under conditions of photoATRP without addition of any reducing agent will be presented. The ligands have to be used in excess to copper catalyst in order to significantly shorter the induction period before starting the polymerization. Experiments showed also high livingness of the polymerization during chain extension performed without removing air from solvent and monomer.

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**P231**

**Miss Jennifer Collins**

University of Warwick

*Conjugation strategies for improving the stability of oxytocin*

Oxytocin, a particularly important neurohypophyseal uterotonic nonapeptide, is currently used as a therapeutic for a variety of reasons, one of the most important being that it is the WHO recommended drug for the prevention of post-partum haemorrhages. However a big problem arises with access to oxytocin in low resource settings due to having a very limited stability in aqueous solutions particularly above refrigeration temperatures, such as in warm climates, with degradation leading to inactivity of the drug. Various peptide conjugation strategies have been employed for the attachment of polymers such as poly(ethylene glycol) (PEG) as a means to improving the solution stability of oxytocin.

**P232**

**Mr Joakim Engström**

Fibre and Polymer Technology, KTH Royal Institute of Technology, 100 44, Stockholm, Sweden

*Surface Modification of Cellulose by Tailored Latex Nanoparticles for Improved Interfacial Adhesion in Composite Applications*

Herein, we have produced latex nanoparticles of a hydrophilic, cationic charged block and varying length of hydrophobic blocks of either poly(methyl methacrylate) or poly(n-butyl methacrylate) in order to investigate the influence of different Tg of the hydrophobic core. The particles were synthesized by RAFT mediated surfactant-free emulsion polymerization employing polymerization-induced self-assembly (PISA). Increasing the hydrophobic block (from 176 to 1410) increased the latex particle diameter (from 35 to 140 nm) while maintaining a homogeneous particle size distribution (polydispersity index (PdI) ranging between 0.01-0.14). The nanoparticles were subsequently adsorbed to nanocellulose and the adsorption was monitored by QCM-D. Evidently, the low Tg particles coalesce more on the surface, whereas the high Tg particles maintained their shape upon the adsorption. The latex nanoparticles can efficiently be utilized to tailor different hydrophobic cellulose surfaces.

**P233**

**P235**

**Mr Joris Haven**

Hasselt University

*On-line Electrospray-Ionization Mass Spectrometry/Microreactor Coupling: A facile Tool for Efficient Reaction Screening and Optimization*

A technique for the continuous on-line monitoring of polymerization processes by electrospray ionization mass spectrometry (ESI-MS) is presented via coupling with a commercial microreactor system. The potential is demonstrated by monitoring polymerizations in real time under synthesis conditions. On-line analysis of chemical processes provides real time data and thus allows for rapid kinetic screening and in consequence efficient optimization of chemical reactions. Several examples for on-line screening are presented, starting from conventional reversible addition–fragmentation chain transfer (RAFT) polymerization over Passerini conjugation reactions towards single-monomer insertion (SUMI) reactions towards the (upscalable) synthesis of monodisperse, precisely defined oligomers. SUMI reactions are synthetically very valuable materials, but in combination with the online monitoring also give access to individual kinetic rate coefficients for monomer propagation.

**P236**

**Mr Kai Pahnke**

Karlsruhe Institute of Technology

*Entropic Chain Effects on Covalent and Supramolecular Association Chemistries*

Reversible covalent and supramolecular bonding is increasingly being employed in applications such as self-healing, stimuli-responsive materials, complex macromolecular architectures or the mimicking of proteins. Normally, dynamic reaction equilibria are tuned via the employed functional groups to alter their electronic properties and thus reaction enthalpy. However, we demonstrate that, rather than modifying the actual motifs, equilibria can be tuned by altering physical chain parameters, e.g., molecular weight and chain stiffness of connected units or the position of the linkage within molecules, thus taking advantage of their effect on entropy. The results were computationally predicted and confirmed via experimental analysis of reversible covalent and supramolecular adducts. An important consequence is the prediction of long-range chain length effects on all chemically controlled reactions of polymeric species such as chain transfer, polymer degradation, and control agent addition.

**P237**

**Dr Katherine Locock**

CSIRO

*Bioinspired Polymers: The Antimicrobial Polymethacrylates*

Naturally occurring antimicrobial peptides (AMPs) have been honed by evolution over millions of years to give highly safe and efficacious antimicrobials. By studying AMPs to identify key aspects of structure and composition (e.g small and highly cationic), suitable synthetic polymer mimics can be designed that hold potential as anti-infective agents.

Our work takes this mimicry one step further by developing new monomers as analogues of amino acids such as arginine and tryptophan, key to the activity of AMPs. Using RAFT, we have produced a range of polymethacrylate copolymers that exhibit potent antimicrobial effects against bacteria, fungi and low toxicity towards human cells. Further, these polymers have shown a biofilm busting capability, eradicating 94% of S. aureus bacteria and 80% of C. albicans fungi present in a mixed biofilm. This was not only achieved by the use of a single antimicrobial agent, but outperformed any clinical combination of antibiotic and antifungal tested.

**P238**

**Miss Katie Pepper**

University of Nottingham

*High-pressure rheology of PLA and PEG blends- a viscosity study on how the presence of additives effects the interaction of CO2 with PLA.*

It is well established that CO2 acts as a plasticiser for many polymers.(1) However, little is understood about how this interaction is affected by the presence of a third component. PLA is readily plasticised by CO2 and commonly used in drug delivery devices.(2) This presentation will explore the effect of excipients on the polymer/CO2 viscosity.

A high pressure rheometer has been used to investigate the effect of PEG on the viscosity of low molecular weight PLA in the presence of CO2. Initial results showed that at 80 °C, ambient pressure PLA has a viscosity of 8 MPa.s. After we pressurised to 140 bar, a significant viscosity reduction to 1 Pa.s was observed. We then investigated the effects of adding increasing amounts of PEG and in each case we recorded polymer viscosity.

Our data show that a polymer/additive/CO2 system is much more complicated than a simple polymer/CO2 system and these observations go some way to explaining the complexity of using CO2 as a processing aid.

**P239**

**Miss Katrin B. Kockler**

Karlsruhe Institute of Technology (KIT), Institut fuer Technische Chemie und Polymerchemie

*Understanding the Fundamentals – Investigating the Kinetics of a Novel Class of N-containing Monomers via PLP-SEC*

Functional poly(methacrylates) are important materials for specialty as well as industrial bulk applications. Precision kinetic data are highly desired and the knowledge of temperature-dependant and monomer-specific propagation rate coefficients, kp, as well as Arrhenius parameters, A and EA, is mandatory for the synthesis of tailor-made polymers. In the current presentation, the IUPAC recommended pulsed laser polymerization – size exclusion chromatography (PLP-SEC) method is used to obtain precision propagation rate coefficients, Arrhenius parameters, and Mark-Houwink-Kuhn-Sakurada (MHKS) parameters for monomers of a to date very rarely investigated group of nitrogen-containing methacrylates, such as 2-(N-ethylanilino)ethyl methacrylate, 2-morpholinoethyl methacrylate or 2-(1-piperidyl)ethyl methacrylate. Furthermore, the data are critically compared among each other to analyze for trends or family type behavior between the different monomers.

**P240**

**Dr Kay Doncom**

University of Warwick

*Polymerisation-Induced Self-Assembly with Zwitterionic Stabiliser Blocks*

Polysulfobetaines are a class of zwitterionic polymers that have grown in interest in recent years. They are highly biocompatible, exhibit anti-fouling properties and display thermo-responsive behaviour. We report the synthesis of a zwitterionic polysulfobetaine by reversible addition-fragmentation chain transfer polymerisation (RAFT) which is then employed as a macroCTA in the aqueous dispersion polymerisation of 2-hydroxypropyl methacrylate (HPMA), leading to polymerisation-induced self-assembly. Systematic variation of the mean degree of polymerization of the PHPMA block and the copolymer concentration enables access to pure phases of spheres, worms or vesicles, as judged by transmission electron microscopy and dynamic light scattering studies. A detailed phase diagram has been constructed and the thermo-responsive behaviour of selected PSBMA-PHPMA nanoparticles was investigated. Finally, the PSBMA-PHPMA vesicles were shown to display tolerance to high salt concentrations.

**P241**

**Mr Kevin Neumann**

University of Edinburgh

*Small Molecule Activation of Nanoparticles – Controlling Drug Release*

Smart materials that respond to an external chemical trigger have numerous potential applications e.g. in drug delivery. To realise their full potential, these “material–trigger“ systems must overcome many challenges, such as lack selectivity within complex and challenging biological systems.

Here we report an amphiphilic polymer PEG-co-PAGE that forms nanoparticles, which respond to a small molecule external trigger, resulting in a significant decrease in the particle size. These nanoparticles encapsulated cargos such as Rhodamine B and doxorubicin, release of which was observed upon treatment with a small molecule trigger. Doxorubicin encapsulated nanoparticles demonstrated controlled “switch on” of cytotoxicity in cell based assays.

Submitted, NNANO-16010170.

**P242**

**Miss Kirsty Walton**

University of Nottingham

*Integrated Molecular Continuous Synthesis of Dispersant Coated Nanoparticles for use in Heathcare applications*

Our work is focused on delivering novel, integrated methodologies for the design and scalable manufacture of next generation resorbable polymer nanocomposites, with the aim to enhance both mechanical strength and the desirable biological properties of such composites. We’ve successfully produced low molecular weight (MW) polymers capable of dispersing hydroxyapatite nanoparticles (HA-NP’s) into Poly(lactic acid) (PLA). The dispersants are primarily PLA based to maximise the interactions between the matrix polymer and the surface of the coated HA-NP’s. The low MW PLA coating must withstand processing temps of 200°C and prevent aggregation of the HA-NP’s in the final composite. Coated HA-NP’s are produced via a high pressure hydrothermal flow reactor as reported previously by Lester et al (2006). We’ve shown that the degree of coating is subject to the length of the dispersant, its morphology, the dispersant ‘head group’ and the location in the reactor that the dispersant is introduced.

**P243**

**Ms Laura Puchot**

Luxembourg Institute of Science and Technology

*Combining lignin-like and vegetable oils: a prospect for the design of novel bio-based benzoxazine thermosets.*

Polybenzoxazine (PBz) are a new class of high performance thermosets, surpassing phenol or epoxy resins in terms of thermal and mechanical properties, chemical resistance and fire retardancy, and are thus considered as promising substitutes for phenolic resins. Nevertheless, the synthesis of benzoxazine (Bz) monomers from petroleum-based reagents remains a major hindrance to the successful spreading of PBz thermosets. Therefore, a new generation of Bz from cardanol or lignin-derivatives has recently emerged. However, the high melting temperature of lignin-based Bz, overlapping their polymerization onset temperature, are hindering their processing. In order to tackle these issues, we propose an original and versatile synthesis of asymmetric bio-based di-functional Bz from cardanol together with lignin-derivative phenolic compounds, exhibiting large difference between melting and polymerization temperatures and an enhanced reactivity.

**P244**

**Miss Laura Shallcross**

University of Sheffield

*Investigating the Interactions of Nanoscale Calcium Phosphates with Polymer Additives*

Challenges involved in the preparation of functional nanoparticles (NPs) include overcoming aggregation which is thermodynamically favourable, but prevents the full functionality of NPs from being expressed. Dispersing NPs would increase their functionality and improve their use in medicine and dentistry. We aim to encapsulate apatite NPs with functional polymer coatings to demonstrate an enabling technology to open new opportunities in medicine, dentistry and elsewhere. Poly(acrylic acid) (PAA) was added to the synthesis of fluorhydroxyapatite (FHA) and hydroxyapatite (HA) NPs. Analysis via FTIR, XRD, TGA and TEM showed the inclusion of PAA in the (F)HA samples had an effect on the morphology and size of the particles. Other polymer additives including linear copolymers of poly(ethylene glycol-b-hydroxyethyl acrylamide), were included in the synthesis of (F)HA. Ongoing work is looking into the effects of these polymers and others to determine their effect on the growth of (F)HA NPs.

**P245**

**Mr Le Bohec Maël**

IMMM UMRCNRS-6283 Avenue Olivier Messiaen Université du Maine 72000 Le Mans

*Synthesis of new cationic copolymers for DNA complexation by combination of RAFT polymerization and "click" chemistry*

Gene therapy is a powerful method to heal diseases like cystic fibrosis and depends on the availability of efficient gene delivery systems. Altered viruses are usually used to deliver specific genes into sick cells but they can be pathogens. Synthetic delivery systems like cationic PEI are developed; however PEI is known to create aggregates under physiological conditions. In this context, we designed an innovative gene nanocarrier system based on a diblock copolymer with one cationic block containing two different aminoethylacrylate entities to improve DNA complexation and self-degradation. The second block, surrounding the first one after complexation, is a PEO to achieve polyplex protection against aggregation under physiological conditions and to improve biocompatibility. The PEO block is surrounded by reactive groups to anchor tripeptide ligands for cells recognition. The resulting nanocarriers have been synthesized using RAFT polymerization and chemoselective coupling reactions.

**P246**

**Miss Lena Charlotte Over**

Karlsruhe Institute of Technology

*Organosolv lignin: sustainable allylation and potential as monomer in polymer chemistry*

Lignin is one of the most abundant biopolymers on earth. Thus, it is a highly available renewable resource and probably the most promising alternative to petroleum-based materials for the synthesis of aromatic compounds. The functionalization of the hydroxyl groups in lignin is essential for material properties of the macromolecular structure for application in polymer chemistry.

The alkylation of phenols with organic carbonates was shown to be non-toxic, sustainable and effective. This functionalization methodology is already well established for different phenols that can serve as model substances for the aromatic hydroxyl groups in lignin.

For organosolv lignin, comparative studies of different bases and temperatures were performed to optimize the allylation with diallyl carbonate. Up to 90% of all lignin hydroxyl groups, both aliphatic and aromatic, were functionalized by allylation. The allylated lignin is shown to be a reactive ene component for the cross-linking of polymers.

**P247**

**Mr Lewis Blackman**

University of Warwick

*Investigating Hysteresis in Thermoresponsive Assemblies*

Thermoresponsive polymers are of great interest as switchable smart materials. pNIPAM, an important thermoresponsive polymer, has been widely studied but the question of its reversibility (hysteresis) may limit its potential. Herein well characterised micelles with tunable aggregation numbers (Nagg), composed of a thermoresponsive corona (pNIPAM) and a non-responsive core block (p(nBA-co-DMA)) were synthesized using RAFT polymerisation. Behaviour at the molecular and macroscopic level was probed using complimentary analyses. Our results showed that the degree of hysteresis increased as a function of core hydrophobicity, which was attributed to differences in core hydration. Similar micellar series were then used to probe different thermoresponsive coronas in order to better understand the origins of hysteresis. These results highlight the need for consideration of the effect that self-assembly plays on the responsive behaviour of particles when compared with free unimers in solution.

**P248**

**Mr Liam Martin**

University of Warwick

*Multiblock Copolymer Synthesis via RAFT at Ambient Temperatures*

We have recently reported one-pot multiblock copolymer syntheses via aqueous ambient-temperature RAFT, utilising the redox pair t-butyl hydroperoxide/ascorbic acid to polymerise certain challenging monomer classes such as acrylates (side reactions at elevated temperatures) and acrylamido monomers whose resulting polymers exhibit low LCST behaviour in water (i.e. NIPAAm, DEA). Using this system we were able to prepare a range of acrylamido, acrylate and acrylate/acrylamido multiblock copolymers with narrow molar mass distributions (Ð &#8804; 1.3) using a cheap and simple initiation method. Following this we are looking to further optimise redox initiation to reduce polymerisation times (choice of redox couple) whilst achieving full monomer conversion, employing lower oxidant concentrations (maximise “livingness”). Here we present our work on the synthesis of complex multiblock copolymers via redox-initiated aqueous RAFT with subsequent optimisations of the redox initiation.

**P249**

**Mr Liam R MacFarlane**

University of Bristol

*Functional Polythiophene-Containing Block Copolymer Nanostructures by Living Crystallisation-Driven Self-Assembly*

As technology is moving further into the nanoscale there is increasing demand for suitable functional nanostructured materials. Polythiophene, a &#960;-conjugated polymer, offers promise in applications such as organic field-effect transistors and photovoltaic cells, where morphological control has proven significant.1 Living crystallisation-driven self-assembly is a well-established solution-based technique for controlling the size of nanostructures in one and two dimensions.2 Herein, we will discuss the synthesis, self-assembly and application of all-conjugated block copolymer micelles into the active layer of a field-effect transistor.

1 R. Zhang, B. Li, M. C. Iovu, M. Jeffries-El, G. Sauvé, J. Cooper, S. Jia, S. Tristram-Nagle, D. M. Smilgies, D. N. Lambeth, R. D. McCullough and T. Kowalewski, J. Am. Chem. Soc., 2006, 128, 3480–3481.

2 Z. M. Hudson, C. E. Boott, M. E. Robinson, P. A. Rupar, M. A. Winnik and I. Manners, Nat. Chem., 2014, 6, 893–8.

**P250**

**Dr Liz Williams**

CSIRO

*Strategies for Targeted RNAi delivery*

We recently reported the synthesis and optimisation of a polymeric ABA-triblock copolymer siRNA delivery vehicle made from oligo(ethylene glycol) methyl ether methacrylate (OEGMA 475) and N,N-dimethylaminoethyl methacrylate (DMAEMA). This polymer demonstrated good siRNA knockdown in green fluorescent protein cell lines, serum stability and acceptable toxicity profiles. Given this success, we were interested in installing a) glycosyl targeting groups in the outer block to direct siRNA delivery to organs of interest, and b) cell penetrating peptides to improve cellular uptake of the polyplex. In this presentation, the design and synthesis of a bis-RAFT agent, and it's use to construct a novel ABA-triblock will be described. Based on their evaluation within relevant cell lines for siRNA transfection, concluding remarks will be made on their performance as targeted delivery vectors.

**P252**

**Mr Manuel Hartweg**

Queen Mary University of London

*Synthesis of sequentially functionalised peptide-peptoid hybrid macromolecules*

The creation of synthetic macromolecular motifs with sophisticated structures and biologically active functions remains a major goal in bio- and polymer chemistry. Peptoids, peptide-mimetic macromolecules with functional groups at the amide nitrogen, exhibit excellent biocompatibility and potent biological activities. However, we report the facile solid-phase synthesis of peptide-peptoid hybrids via isocyanide-based Ugi multicomponent reaction. Sequentially functionalised hybrid structures were manufactured with different architectures: (i) precise peptoid insertion in a peptide chain, (ii) alternating and (iii) block architectures, as well as (iv) functionalised polypeptoids. The introduced peptoid sequences carry diverse R-groups, such as functionalised amides, as well as more sophisticated glycosylates or polymeric structures. This method extends the classical Merrifield peptide synthesis and bears the potential for simple and diverse side chain modifications of peptoid sequences.

**P253**

**Dr Maria Chiara Arno**

University of Warwick-Department of Chemistry

*Design of new nanoparticles for bio applications*

Nanotechnology has gained a growing interest in the field of drug delivery, for its potential to solve issues related to conventional therapeutic agents, including lack of targeting capability, nonspecific distribution, and systemic toxicity1. An example of intelligent drug delivery system is illustrated by polymeric micelles, which should serve as targeted delivery vehicles2.

Polycarbonates are of particular interest in medical applications as they can be easily modified via synthesis of monomers with specific functionalization or post-polymerization. We synthesized a novel polycarbonate, functionalized using click chemistry, and subsequently assembled into micelles, which cytotoxicity and fate was investigated in cells. We also focus on the synthesis of new fluorescent micelles with the aim to investigate their behaviour in cells using fluorescence lifetime imaging.

1 Clinical Cancer Research, 2008, 14:1310-1316

2 Nanomedicine, 2012, 7(8):1253-1271

**P254**

**Mr Matthew E. Robinson**

University of Bristol

*Functional Nanomaterials via Controlled Self-Assembly of Planar Pt(II) Coordination Complexes*

Crystallization-driven self-assembly (CDSA) of block copolymers with a crystallizable core-forming block has proven to be a versatile method of producing micelles with low interfacial curvature, such fibers and platelets.(1) Square planar d8 metal complexes exhibit a strong preference for one-directional crystal growth and have attracted considerable attention due to their optoelectronic and physical properties.(2) We demonstrated the ability of polyethylene glycol ligated Pt(II) complexes to form high aspect ratio supramolecular polymeric nanofibers with tunable lengths and relatively narrow length distributions up to ca. 400 nm.(3) In this presentation, we will report latest results concerning access to different morphologies and a level of control previously unseen in these systems.

References: 1) Gaedt, T., et al., Nature Mat., 2009, 8, 144; 2) Aliprandi, A., et al., Nature Chem., 2016, 8, 10 3) Robinson, M., et al., Chem. Commun., 2015, 51, 15921

**P255**

**Dr Matthias Haussler**

Clariant Produkte (Deutschland) GmbH

*RAFT Polymers for Specialty Polymer Applications*

Controlled radical polymerisation protocols such as RAFT and ATRP give access to unprecedented control over the structure of the target polymer material allowing to optimise products and their performances. This talk will give an industry perspective on important factors such as cost and production requirements to be met for a wide industrial implementation. Example of some specialty polymer applications will be given as well.

**P256**

**Mr Matthias Worm**

Institute of Organic Chemistry, Johannes Gutenberg-University Mainz, Duesbergweg 10-14, D-55128 Mainz, Germany.

*Novel Acetal- and Ketal-Functional Lipids for pH-Sheddable Stealth Liposomes*

In tumor therapy, ‘stealth liposomes’ with poly(ethylene glycol) (PEG) chains attached to their surface have proven particularly advantageous. A major challenge, however, arises from hampered cellular uptake and drug release in the presence of a PEG stealth layer. To overcome this drawback, we present a novel class of pH-labile PEG-lipids with a dialkyl glycerol anchor containing acetals or ketals to ensure liposome shedding inside the tumor cells or tissue. A prototype synthesis to ketal-functional lipids is introduced utilizing a dialkyl glycerol species as an initiator for the AROP of ethylene oxide. This strategy provides access to well-defined structures (D = 1.05 – 1.07) with tailorable molecular weights of PEG (Mn = 2 – 4 kg/mol). Online 1H NMR kinetics and in vitro studies on pH-triggered liposome shedding reveal highly promising cleavage profiles in acidic media (pH 5.5 – 6.5) reported for tumor tissues. The novel lipids represent a promising innovation to liposomal research.

**P257**

**Mr Mattias Tengdelius**

Linköping University

*Fucoidan-Mimetic Glycopolymers: Multi Tools for Biomedical Applications*

The marine polysaccharide fucoidan has demonstrated many interesting biological properties such as being anti-inflammatory, anticoagulant, anticancer, antiviral and platelet aggregating. Many of these properties are desirable in functionalized biomaterials and other biomedical applications, yet scarcely used due to the chemical heterogeneity of fucoidan. A possible solution to this problem is the synthesis of chemically controlled fucoidan-mimetics.

We have reported the synthesis of fucoidan-mimetic glycopolymers, through various radical polymerization techniques, mimicking the platelet aggregating and antiviral properties of fucoidan. The former by interaction with C-type lectin-like receptor 2, a receptor involved in thrombosis, tumour metastasis and HIV-1 capture. We have also applied fucoidan-mimetic glycopolymers in the synthesis of fucoidan-mimetic glycopolymer coated gold nanoparticles, who displayed good colloidal stability and selective anticancer properties.

**P258**

**Ms Megan R. Hill**

University of Florida

*Responsive polymeric nanoparticles designed for site-specific delivery in agriculture*

While stimuli-responsive polymers have been extensively studied in medicine and materials, less attention has been given to the use of responsive polymers in agriculture. We demonstrate the synthesis of biodegradable and stimuli-responsive nanoparticles designed to specifically deliver within the phloem of plants, tissue that aids with transport of organic nutrients made during photosynthesis. Polysuccinimide (PSI) was synthesized from both traditional condensation polymerization of L-aspartic acid, and from a novel method utilizing N-carboxyanhydride (NCA) ring-opening polymerization (ROP), to serve as a pH-responsive scaffold. Copolymers of PSI were shown to form stable nanoparticles in aqueous medium, encapsulate model hydrophobic molecules, and hydrolyze to release its cargo within an environment similar to plant phloem. Lastly, toxicity studies showed little to no toxicity to plant tissue at moderate concentrations.

**P259**

**Dr Michael Kaupp**

Karlsruhe Institute of Technology (KIT), Institut fuer Technische Chemie und Polymerchemie

*Wavelength Selective and Lambda-Orthogonal Network Formation on the Macroscopical and Microscopical Scale*

The combination of two different photo-induced ligation reactions, namely the photo-enol technique based on ortho-methylbenzaldehyde and the nitrile imine mediated tetrazole ene coupling (NITEC) reaction employing diversely substituted tetrazoles enables wavelength selective as well as lambda-orthogonal network formation. The employed wavelength region starts in the ultraviolet and reaches the visible light area. The network forming species are photo-reactive polymers generated via controlled polymerization techniques such as reversible activation fragmentation chain transfer (RAFT) polymerization, allowing the networks to be based on almost any vinylic monomer. Thereby the chemical and physical properties of the network can be easily adjusted via the choice of monomer and chain length. Networks can be formed on a macroscopic scale and - when direct laser writing (DLW) is applied - in the micrometer range. DLW furthermore allows the networks to form complex three-dimensional structure.

**P260**

**Mr Mohammad Alauhdin**

School of Chemistry, University of Nottingham

*Single Step Synthesis of Block Copolymer-Silver Nanoparticles Hybrid by RAFT Dispersion Polymerisation in Supercritical CO2*

Synthesis of block copolymers loaded with silver nanoparticles has been carried out in supercritical CO2 in a single pot and single step reaction. An organometallic silver complex is thermally decomposed during RAFT dispersion polymerisation of DMAEMA; the second block which is added to a PMMA macro-RAFT agent. The reaction resulted PMMA-b-PDMAEMA microspheres which are internally decorated with silver nanoparticles. Our studies focus on determining the location of the silver nanoparticles, and the effect they have upon the block copolymer morphologies obtained.

**P262**

**Miss Natalie Boehnke**

UCLA

*Hydrogels and Nanogels for Protein and Cell Delivery*

Biodegradable polymer-based hydrogels are often used as scaffolds for biomedical applications. Controlled degradability allows for targeted and selective release of growth factors and cells. We have previously shown that oxime cross-linked PEG can be used to create stable, biocompatible hydrogels. We have created hydrogels with tunable degradation by adding mixed imine cross-links. Hydrazide-functionalized PEG reacts with aldehyde-functionalized PEG to form hydrazone hydrogels that degrade in cell culture conditions, which can be controlled by changing the hydrazide group structure or by introducing hydroxylamine functionalized PEG to form nonreversible oxime cross-links. This mixed imine cross-linking approach can be used to modulate the degradation characteristics of 3D cell culture supports for controlled cell release. Degradation, biocompatibility, and self-healing properties of the gels, and application in the production of nanogels for targeted protein delivery will be discussed.

**P263**

**Mrs Neomy Zaquen**

Hasselt University

*Precision Design of Highly Fluorescent Poly(phenylene vinylene) Block Copolymers for Biomedical Application*

Poly(p-phenylene vinylene)s (PPVs) are an important class of highly fluorescent semiconductor materials. Despite their declining use in optoelectronic applications, PPV synthesis routes were in recent years significantly improved and implementation of well-defined PPV structures in advanced polymer materials has only recently become accessible.

In here, focus is put on controlling PPV polymerizations via novel (so-called sulfinyl route) radical and anionic polymerization techniques for the synthesis of complex di- and triblock copolymers. To improve the polymerizations, flow reactors are employed for fast screening of the reaction kinetics, which gives insight into mechanistic details of the polymerization. As a result more sophisticated structures and new applications in the biomedical field are opened, for which first results are discussed.

**P264**

**Dr Nicolas Zydziak**

Karlsruhe Institute of Technology (KIT)

*Photochemical Synthesis of Multiple Sequence Defined Linear Macromolecules*

The use of UV-triggered photoreactions represents an efficient strategy for the synthesis of artificial sequence defined polymers. The absolute control over the monomer order within the polymer chain demonstrates the power of our photochemical approach: perfect monomer order, monodispersity (D = 1.00) and chain-end fidelity. The versatility of the photoreaction is highlighted by several examples based on a photocaged diene (photoenol) for the synthesis of sequence defined linear homopolymers, copolymers and block-copolymers. In particular, we evidence the incorporation of any compatible function at any arbitrary position into the polymer sequence (writing) and the subsequent characterization (reading) of the encoded functional sequence information.

**P266**

**Miss Océane LAMARZELLE**

LCPO

*Fully bio-based NIPU via cyclic carbonate/amine route*

The conventional alcohol-isocyanate route leading to classical polyurethanes can be replaced by the cyclic carbonate-amine pathway, avoiding the use of phosgene and isocyanate. For that purpose, a new route to access bio-based diamines using mild and green conditions has been set up through an optimization of aliphatic alcohol oxidation into corresponding nitriles. Additionally, a large platform of reactive glycerol and fatty acid-based cyclic carbonates as poly(hydroxyurethane) (PHU) precursors has been synthesized. Polymerization of these new cyclic carbonates with synthesized diamines leads to interesting results in terms of kinetics. Thus, the optimization of alcohol oxidation into nitrile leading to lipidic amines will be discussed. The synthesis of highly active cyclic carbonates will also be detailed; the kinetic of their model reaction with hexylamine and their subsequent polymerization with diamines leading to fully bio-based thermoplastic PHUs will finally be developed.

**P267**

**Dr Olga Koshkina**

Radboud University Medical Center, Radboud Institute for Molecular Life Sciences, Department of Tumor Immunology

*Perfluorocarbon-loaded Polymeric Nanoparticles for Cell Tracking Using Multimodal In Vivo Imaging*

Cell therapy holds vast promise for the treatment of cancer. Optimizing this therapy requires long-term tracking and in vivo quantification of the cells. Multimodal in vivo imaging has great potential, but suffers from a lack of clinically applicable imaging agents.

We synthesized perfluoro-15-crown-5-ether loaded poly(lactide-co-glycolide) nanoparticles (NPs) of 100 nm radius (light scattering), suitable for 19F MRI and ultrasound. These NPs are highly stable allowing for long-term in vivo imaging.

The acoustic contrast and high stability appear to be linked to the unusual internal structure of NPs. Thus, we characterized our NPs by cryogenic electron microscopy, solution 2D NMR (HOESY, HSQC), solid state NMR, X-ray scattering, and calorimetric methods, and compared this to various NP controls. The structure of our NPs is different from fluorocarbon containing colloids known thus far.

Finally, clinical application of the NPs has started in melanoma patients.

**P269**

**Miss Quynh N Mai**

Monash Institute of Pharmaceutical Sciences

*Designing Strategies to Probe Endosomal Signalling*

Mounting evidence indicates that internalised G-protein coupled receptors (GPCRs) induce signals that are spatially and temporally distinct from cell surface signals, leading to disease relevant outcomes. Our studies on the Neurokinin 1 receptor (NK1R) exemplifies how endosomal signals are critical for pain transmission and chronic inflammation. Therefore, delivering drugs to endosomal GPCRs may improve targeting to disease-relevant locations and therapeutic benefit. Two methods will be presented that we are currently investigating for the selective inhibition of endosomal signals: 1) Lipid conjugated compounds consisting of a cholestanol membrane anchor and PEG spacer conjugated to Cy5 (reporter) or drug (NK1R antagonist Spantide); and 2) pH-responsive nanoparticles loaded with antagonists or fluorophores.

**P270**

**Miss Rahmet PARILTI**

University of Nottingham

*Synthesis of cross-linked nanoparticles in supercritical carbon dioxide for protein delivery*

This project aims to develop a novel one-pot strategy to obtain well-defined cross-linked nanoparticles able to carry peptides/proteins in their core, as along with targeting and/or imaging agents on their surface. In addition to this objective, the polymerisations will be carried out in supercritical carbon dioxide (scCO2), which confers environmentally benign features to the process(1). Here, we investigate the feasibility of free radical dispersion polymerizations of 2-hydroxyethyl methacrylate (HEMA) in scCO2. In order to ensure the successful dispersion in scCO2 novel diblock CO2-philic surfactants are employed. These diblock surfactants (2,3) are formed from two different segments, a CO2-phobic block which has an affinity to the growing particles and a second CO2-philic block that ensures surfactant solubility.

**P271**

**Mr Ravindra Kumar**

Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India

*Fabrication of Polyaniline (PANI) - Poly-vinyl alcohol (PVA) nanocomposite Thin Film based Humidity Sensor*

The nanocomposites of PANI and PVA-PANI were successfully synthesized via sol-gel method for humidity sensing applications. The XRD revealed the average crystallite sizes of PANI and PVA-PANI as 128.40 and 35.28 nm. The SEM images of PVA-PANI nanocomposite showed porous surface morphology, wherever, agglomerated structures was observed for PANI. UV visible spectra showed the presence of different rings which is consistent with the earlier reported data. The average sizes of PANI and PVA-PANI calculated by particle size analyzer were 149.30 and 44.42 nm comparable to the XRD results. Sensing results demonstrate that the fabricated porous PVA-PANI nanocomposite thin film has a better sensitivity than PANI at elevated temperature.

**P272**

**Dr Rebecca Williams**

University of Warwick

*Cyclic vs linear graft copolymers: Differences in self-assembly and thermoresponsive behaviour*

Polymer topology is known to affect the properties of polymeric materials, in particular cyclic polymers possess unique physical properties in comparison to their linear analogues. In this study the solution properties of amphiphilic graft copolymers with either a cyclic or linear backbone are compared to elucidate the effect of cyclisation on self-assembly and thermoresponsive behaviour. The graft copolymers were found to form unimolecular micelles in aqueous solution where differences between the morphologies of cyclic and linear graft copolymer particles were observed. Furthermore, the cyclic and linear graft copolymers were found to exhibit significantly different cloud point temperatures. This study highlights how subtle changes in polymer architecture can dramatically influence a polymer’s nanostructure and properties.

**P273**

**Mr Reece Lewis**

Monash University

*Systematic study of high molecular weight acrylamide polymerisations using aqueous REDOX initiated RAFT*

Due to the industrially relevant properties of high molecular weight (Mw) polyacrylamides, developing controlled polymerisation strategies which deliver significant livingness to high Mw (>500 kDa) has received increasing interest.

In this work, we used a systematic approach to optimise conditions for the polymerisation of acrylamide to a target Mw = 500 kDa. We employed an automated parallel synthesiser (Chemspeed SWING XL) to quickly scan a range of temperatures, trithiocarbonate RAFT agents, redox initiator systems, CTA to initiator ratios and monomer concentrations.

Preliminary results have allowed for the identification of a RAFT agent which delivers excellent conversion (&#8805;90%) and controlled polymerisation (&#393;M = 1.22 – 1.44) across a range of polymerisation conditions over 24h. Additionally the APS/NaFS (Ammonium persulfate/ Sodium formaldehyde sulfoxylate) redox couple gave the most consistent and controlled polymerisation when using the Chemspeed synthesiser.

**P274**

**Mr Renjie Liu**

Queen Mary University of London

*Designer polymer composite tapes for surgical tendon repair*

Tendons connect muscle to bone enabling movement. However, people are still suffering from tendon injuries to the hands, like laceration which can lead to the loss of dexterity and fine control of the hand. Aim at reducing adhesion formation of tendons in hand, which restricting motion of the hands after repair, we proposed to use biodegradable copolymer membranes of different hydrophobicity to minimize this.

A series of block copolymers were synthesized by combination of PCL, PS and PNIPAM which have distinct hydrophobicity. Then live/dead assay, cytoskeleton assay and proliferation assay was used to characterize the toxicity as well as attachment of tenocytes to polymer membranes made up by electron spun.

As the results shown, the activity and adhesion of tenocytes can be adjusted by changing the hydrophobicity of the membrane while containing good biocompatibility with cell lines which shown the potential of the membrane to be used in tendon adhesion prevention.

**P275**

**Mr Resat Aksakal**

Queen Mary, University of London

*Pentablock core-first star shaped polymers in less than 90 minutes via aqueous SET-LRP*

The synthesis of multi-block star-shaped copolymers via aqueous SET-LRP has been reported for the first time. This technique allows rapid and direct access to acrylamide based star-shaped polymers. It is possible to synthesize an A-B-A-B-C penta-block copolymer in <90 minutes. To achieve this, a water-soluble 3-arm initiator based on a glycerol structure was investigated for the first time. Using NIPAM, 3-arm star-shaped polymers were prepared with DP = 60-240 with full conversions in <30 minutes (PDI<1.11). The scope of the reaction was demonstrated by synthesizing diblock copolymers using a combination of NIPAM, DMA and HEAm in different ratios. In addition, a sequence controlled 3 arm penta-block copolymer has been obtained with excellent control over MWD (PDI < 1.14) as evidenced by GPC, 1H NMR, and MALDI-ToF MS.

**P276**

**Dr Richard d'Arcy**

University of Manchester

*Oxidation-Responsive Polysulfides: Tailored Sensitivity to Reactive Oxygen Species for Cancer Drug Delivery*

Reactive oxygen species (ROS) are known to play a significant role in the activation of both chemoresistance and anti-apoptotic pathways in cancers through NRF-2 and NF-kappa-beta pathways. Due to the high concentrations of ROS found in disease loci, materials responsive to ROS have been developed. Polysulfides are one class of these materials and can be oxidized by ROS to the higher oxidation state sulfoxides leading to a hydrophobic to hydrophilic transition; accordingly, this transition has been exploited to release a drug payload. Herein, we evaluate novel PEG-polysulfides with regards to their response to ROS; polysulfides composed from a new monomer with reduced hydrophobicity was found to oxidize up to 10x quicker than poly(propylene sulfide). The rate of oxidation was entirely tuneable within this range by copolymerization of the two monomers. PEG-polysulfide micelles were then evaluated in the context of drug delivery and chemosensitization of chemoresistant cell lines.

**P277**

**Mr Richard Whitfield**

University of Warwick

*Controlled polymerisation of functional methacrylates via Cu(0)-RDRP.*

The polymerisation of methacrylates via Cu(0) RDRP is challenging with Percec and Haddleton reporting high dispersities when compared to the acrylate analogues. [1, 2]

Herein, we investigate the effect of different initiator structures on the controlled polymerisation of methyl methacrylate, demonstrating enhanced control utilising a more stable initiating radical. Further studies were carried out investigating the effect of different ligands, solvents and temperatures on the molecular weight distribution of the polymer. This optimisation gave enhanced control, furnishing a range of methacrylate polymers, including the epoxide functional glycidyl methacrylate with high conversions (>99%) and narrow dispersities (&#272; < 1.15). Furthermore high end group fidelity was maintained allowing for multiple in situ chain extensions.

References

[1] N. H. Nguyen, V. Percec, Polym. Chem., 2013, 4, 2760–2766.

[2] A. Simula, D. M. Haddleton, Polym. Chem., 2015, 6, 5940–5950.

**P278**

**Miss Rime Ganfoud**

University of Nice Sophia Antipolis

*Progressive substitution of phenol by a bio-based analogue for the preparation of polybenzoxazines thermosets*

Polybenzoxazines (PBZ) resins are a new class of thermoset polymers that are an alternative to commercial epoxy resins prepared with Bisphenol A diglycidyl ether, known to be a toxic compound. PBZ resins have also the potential to overcome the shortcomings of conventional phenolic thermosets while keeping clear assets like: near zero volumetric change, no catalyst needed and no release of by-products during curing.

The aim of this study is to progressively replace the petro-based phenol by a renewable derivative in the synthesis of benzoxazine monomers (BZ). Cardanol is a bio-based phenol derivative and possesses a long alkyl side chain which can be a potential source of flexibility in the final polymer. Thus, two novel monomers were synthetized by a progressive substitution of the phenol by cardanol.

After evaluation of the reactivity by Differential Scanning Calorimetry, thermo-mechanical properties were studied by Thermogravimetric Analysis and Dynamical Mechanical Analysis.

**P279**

**Dr Robert Göstl**

Technische Universiteit Eindhoven, Molecular Science and Technology, group Supramolecular Polymer Chemistry

*Highly sensitive detection of mechanical stress in polymers*

In the field of smart materials (macro-)molecules are elevated beyond their bulk properties to adapt to external stimuli thereby initiating chemical reactions, self-healing processes, performing mechanical work, or reporting on their state. Mechanical stress is one of the most interesting stimuli as it is ubiquitous in man-made materials as well as governing various processes in biological tissues. Hence its detection and exploitation to induce function is of importance for materials science.

Here, we implemented Diels-Alder adducts into polymers that generate highly fluorescent pi-extended anthracenes with high quantum yields upon mechanical cleavage thus allowing for the sensitive detection of mechanical stress. Moreover, we could incorporate hexaarylbiimidazole into polymers that generate triphenylimidazolyl radicals enabling the activation of radical reactions. Currently, we are advancing these motifs to hydrogels and nanoparticles for biocompatible mechano-optical sensing.

**P280**

**Dr Samarendra Maji**

Ghent University

*Polymer coated metal/metal oxide nanoparticles and their advantages in specific application*

Metal or metal oxide nanoparticles have received much attention as potentially useful materials owing to their distinct physicochemical properties. In particular gold nanoparticles (AuNPs) have received popularity in research based on their responsive surface plasmon resonance band, resulting in wide applications ranging from optoelectronics to biology. Thermoresponsive polymer coated AuNPs open up a new area of intense research due to their response to external stimuli, such as temperature, pH and salt.

In the current contribution we report our recent efforts on thermoresponsive polymer coated AuNPs and MnO2 nanoparticles that are responsive to temperature and salt. In the first part of the presentation we will demonstrate the preparation of poly(N-isopropyl acrylamide) coated AuNPs for the development of tunable colourimetric temperature and salt-sensors. In the second part we will discuss the preparation of the PNIPAM coated MnO2 nanoparticles and its thermoresponsive behavior.

**P281**

**Mr Samuel R Lowe**

University of Warwick

**P282**

**Mrs Sara Malmir**

A Coruña University

*Bio-nanocomposites of Poly(3-hydroxybutyrate-co-3-hydroxyvalerate)(PHBV)/cellulose nanocrystals: morphological and thermal study*

Possibility of replacement of conventional plastics for food packaging with bio based polymers with the aim of reducing environmental harmful effects is followed in this research works. Poly(3-hydroxybutyrate-co-3-hydroxyvalerate)(PHBV) were used as a polymer matrix and cellulose nanocrystals with 2, 4 and 6 wt% were used as a filler. The effect of concentration of nanoparticles on thermal and morphological properties of the final products was studied. Samples were prepared via cast film method. After that, scanning electron microscopy (SEM), differential scanning calorimeter (DSC) and X-ray diffraction test were used for morphological, structural and thermal studies respectively.

**P283**

**Miss Sarah Stace**

University of New England, Australia

*Application of Switchable Chain Transfer Agents For RAFT Polymerization*

Reversible Addition-Fragmentation Chain Transfer (RAFT) polymerisation is used to access functional polymers with targeted molar mass, narrow molar mass distributions and defined molecular architecture. RAFT agents are selected based on the reactivity of the monomer, with monomers being characterised either as more active (MAMs) or less active monomers (LAMs). Inappropriate selection of a RAFT agent for a given monomer leads to poor control, typified by either high dispersity, inhibition of polymerisation or both.

We are currently exploring the development of new multifunctional switchable RAFT agents based on pyridyl dithiocarbonates, polymerisation of a variety of MAMs and LAMs and strategies for effective end-group removal post-polymerisation. We also explore the block copolymerisation of MAMs and LAMs for previously inaccessible polymeric materials with both mono- and bis-switchable RAFT agents. Recent results obtained in these areas will be presented.

**P284**

**Ms Shiqi Wang**

Imperial College London

*Amino Acid-Based Hydrogels with Dual Responsiveness for Oral Drug Delivery*

Hydrogels with dual responsiveness are prepared by EDC coupling of pH-responsive anionic pseudo-peptides as backbones and disulfide-containing L-cystine dimethyl ester as crosslinkers. These hydrogels show high loading efficiency, rapid but complete triggered-release and good biocompatibility. The dual-responsiveness of these carriers made them promising candidates for oral drug carriers.

**P285**

**Ms Shyeni Paul**

Imperial College London

*Switchable Polymerization Catalysis for Multi block Copolymer Synthesis with Block Sequence Selectivity*

Block copolymers are used in applications ranging from medicine, sealants, elastomers and coatings. Although block copolymers can have exquisite nanostructures, there are many difficulties associated with the synthesis of more complex structures, such as those that go beyond di- and triblock materials. There is also an increased interest in synthetic routes which can be applied to a mixture of monomers and enable block sequence selectivity. This presentation addresses these challenges using a switchable polymerization catalyst for both the ring-opening copolymerizations (ROCOP) of epoxides and anhydrides/CO2 and the ring-opening polymerizations (ROP) of lactones.

The presentation will describe the application of a di-zinc catalyst in combined ROCOP and ROP processes, using a mixture of anhydride, epoxide, lactone and CO2 to selectively prepare well-defined block copoly(ester-carbonates). The chemistry enabling the switchable polymerizations will be described in detail.

**P286**

**Dr Sofie Sannen**

**P287**

**Miss Sophie Larnaudie**

University of Warwick

*Supramolecular nanotubes as efficient drug carrier systems*

The use of functional drug carrier systems is an effective method for improving the potency of drugs and reducing the occurrence of side effects. Among the variety of possible delivery vectors, organic nanotubes are of particular interest due to their biocompatibility and anisotropic shape. Here, the synthesis, characterisation and early in vitro tests of cyclic peptide-polymer nanotubes are described. Cyclic peptide-poly(2-hydroxypropyl methacrylate) (pHPMA) conjugates were synthesized, loaded with an anticancer drug, and assembled in solution. A comonomer was used to provide a reversible ligation handle for the drug. The self-assembled structures were characterized by small angle neutron scattering (SANS) which proved an elongated cylindrical shape. In vitro testing of the nanotubes on the ovarian cancer cell line A2780 reveals that the conjugates themselves were non-toxic, but the drug-loaded nanotubes are more potent than both the free drug and the drug-loaded polymers.

**P288**

**Mr Stefan Oelmann**

Karlsruhe Institute of Technology (KIT)

*Controlling Molecular Weight and Polymer Architecture during the Passerini Three Component Step-Growth Polymerization*

The use of multicomponent reactions represents a current trend in macromolecular chemistry, allowing many straightforward synthetic approaches to highly defined macromolecules. In this contribution, we could demonstrate, for the first time, that the Passerini reaction allows for molecular weight control during step-growth polymerization, which is very rarely achieved using classic polyaddition or polycondensation approaches. Apart from molecular weight control, our results demonstrate an easy tuning of side-groups and high end-group fidelity. The approach relies on the use of a monocarboxylic acid as an irreversible and selective chain transfer agent in combination with a bifunctional monomer and an isocyanide to achieve control over the molecular weight. The thus resulting carboxylic acid end-group subsequently allows for the synthesis of block copolymers. Moreover, the use of a tricarboxylic acid as core unit results in the formation of star-shaped homo- and copolymers.

**P289**

**Mrs Stefanie Deike**

Martin Luther University Halle-Wittenberg

*Helical and Linear Beta-Turn Mimetic Polymer-Conjugates*

Folding of polymer chains is of interest to obtain higher ordered structures, achieved e.g. by reversible hydrogen bonding or covalent bonds [Barner-Kowollik, Macromol. Rapid Commun. 2014, 35, 45]. Beta-turns can act as folding elements in proteins and can be mimicked by low molecular weight analogues.

We here report on the synthesis of an amphiphilic beta-turn mimetic structure containing linear or helical polymers, both linked to hydrophilic beta-turn mimetic elements [Binder, ACS Macro Lett. 2014, 3, 393]. Thus, the two attached polymer blocks are forced into a restricted space, folding the chains into a lipid bilayer membrane. Chiral helical polyisocyanates and linear PIBs were synthesized by living polymerization techniques. The helical and linear polymers were linked to a bicyclic beta-turn structure via a combination of “click”-chemistry and amidation reactions. The final beta-turn mimetic polymer-conjugates were investigated via CD-spectroscopy and Langmuir-film measurements.

**P290**

**Mrs Suzan Aksakal**

queen mary, university of london

*Expanding the toolbox for CRP with novel thioacrylate monomers*

A series of novel thioacrylate monomers; ETA, TPA, PTA and IPTA were designed and efficiently synthesized to investigate their controlled living radical (CRP) polymerization. Thioacrylate monomers showed a high polymerizability and were readily converted to corresponding homo- and blockpolymers with moderate high molecular weights (~13000 Da) via reversible addition-fragmentation chain transfer (RAFT) polymerization utilizing dithiobenzoate-based chain transfer agent. The resulting polymers were characterized by 1H NMR, GPC, thermal analysis and also their water contact angles. The polymers resultant from RAFT in toluene were amorphous and displays a high hydrophobicity. Polythioacrylates can be prepared within short times using RAFT polymerization with good control over generated molecular weight and polydispersity (Ð ~ 1.1) and makes them a promising candidate for a new class of monomers for CRP.

**P291**

**Mr Swapnil L. Sonawane**

Polymer Science and Engineering Division, CSIR-National Chemical Laboratory, Pune-411008, India

*Polystyrene Microbeads with Tunable Solid State Light Emission and Control Particle Size by Dispersion Polymerization*

Monodispersed lightly-crosslinked Polystyrene-Perylenebisimide-Oligo(p-phenylenevenylene) (PSt-PBI/OPV) beads with high fluorescence emission in both solid state and solution, thermal stability and good solubility was developed by dispersion polymerization. The controlled addition of chromophores as cross-linkers enabled solid state white light emission with CIE color coordinates (X= 0.33, Y= 0.32) and good solid state quantum yields. The ethanol dispersion of polymer beads were applied as component of fluorescent ink that has wide emission range from blue to green and orange which can be used for writing for security purposes. The synthetic approach is very facile and can be extended to other fluorescent cross-linkers also thereby enabling the fine-tuning of emission colors.

**P292**

**Miss Tammie Barlow**

The University of Warwick

*Manipulating the self-assembly of polyelectrolyte-cyclic peptide conjugates by adding a pinch of salt.*

Self-assembling peptide nanotubes formed by the stacking of cyclic peptides (CPs) offer a versatile scaffold for formation of nanotubular structures.

Conjugating polyelectrolytes to the CP building block will result in nanotubes with an external surface charge. The high charge densities of these polymers cause inter-chain repulsion, which competes with CP H-bond assembly and prevents self-assembly in water. By adding salt to the solution of polyelectrolyte conjugates, the charge on the polymers are effectively shielded, diminishing inter-chain repulsion and allowing assembly.

Using RAFT, amide coupling and post-polymerisation substitution, we have developed novel polyelectrolyte materials with remarkable self-assembly properties that we have analysed by small angle neutron scattering.

**P293**

**Miss Tanja Claus**

Karlsruhe Institute of Technology

*Encoding of 3D structures via light-induced modular ligation and advanced characterization methods thereof*

We report highly efficient strategies for the surface encoding of 2D and 3D microscaffolds fabricated by Direct Laser Writing (DLW) and their in-depth analysis via various characterization methods. The combination of a network former with novel and readily synthesized photo-reactive molecules, yields new ways for the creation of microstructures exhibiting a photo-reactive surface. By well chosen design of the photo-reactive groups a large variety of functionalization patterns, e.g. with halogenated markers, polymers and even proteins can be obtained in one simple irradiation step. In addition, we introduce new characterization methods for the obtained microstructures, which feature mild conditions as well as an improved lateral resolution.

**P294**

**Mr Thibaut Soulestin**

Arkema - CNRS - ICGM - ENSCM

*Functionnalization of Fluorinated Elecroactive Copolymers*

Electroactive VDF-based (VDF = vinylidene fluoride) fluoropolymers are an area of intense research. This active development is motivated by the wide variety of applications for these light weight flexible materials (i.e. sensors, artificial muscles and actuators). Developing new families of functional electroactive fluoropolymers based on poly(VDF-co-TrFE) copolymers(TrFE = trifluoroethylene), is a crucial yet still unmet challenge. The difficulties lie in introducing chemical functional groups into fluorinated backbone, since only few monomers copolymerize efficiently with VDF. Different strategies have been elaborated considering the scalability of the process and the improvement of the properties for the final electrical device. The study will present innovative and industrially relevant functionalization strategies to prepare functional PVDF-based electroactive fluoropolymers. Emphasis will be put on establishing the structure-properties relationship of the new fluoropolymers.

**P295**

**Mr Thomas McAllister**

University of Nottingham

*Improved Size Control for Dispersion Polymerisation in Supercritical Carbon Dioxide*

Dispersion polymerization is a well established method of producing polymer particles that are easily handled and processed. With careful choice of the reaction conditions this technique can yield well defined, spherical particles with a wide range of applications. The use of supercritical carbon dioxide as a reaction medium offers a route to performing these syntheses in the absence of conventional organic solvents. This technique avoids drying and solvent clean-up or disposal steps. However, particle size and morphology control remains limited.

Here we present control of particle size and morphology over an unprecedented range in supercritical carbon dioxide by the application of multiple approaches. Further, we show that a multi-stage approach can be applied to greatly improve the quality of the dispersion leading to reduced aggregation and greater batch to batch reproducibility.

**P296**

**Dr Tim Dargaville**

Queensland University of Technology

*Hydrogels Containing Hierarchical Structures Based on Poly(2-oxazoline)s and Related Polymers*

Biomaterials based on hydrogels are ideal substrates for extra-cellular matrices due to their high water content. However, one of the great challenges hindering the use of hydrogels is reproducing the transport properties found in natural tissue with hierarchical features such as vascularisation. To address this, we have used a process of melt electrospinning writing using polycaprolactone to create 3-dimensional layers of sacrificial fibres and encapsulated these within hydrogel networks. Subsequent dissolution of the fibres results in a network of porous channels in the image of a negative copy of the sacrificial template and not achievable using other methods for introducing porosity. The hydrogels used for this study are based on poly(2-alkyl-2-oxazoline) synthesized from copolymerization of methyl-2-oxazoline and unsaturated alkyl-2-oxazolines followed by thiol-ene photocrosslinking under aqueous conditions.

**P297**

**Mr Timo Stukenkemper**

Dublin City University, Ireland; DSM, Geleen, The Netherlands

*A novel way to synthetic polypeptides: Photobase generator initiates ring-opening polymerization of N-carboxyanhydride*

Photobase generators bear high potential for photolithography, imaging and coating. The first photo-initiated ring-opening polymerization (ROP) of N-carboxyanhydrides (NCA) was successfully performed in presence of photobase generators, 2,6-dinitrobenzylcyclohexylcarbamate and 4,5-dimethoxy-2-nitrobenzylcyclohexylcarbamate. Photo cleavage was achieved by irradiation in UV wavelengths leading to the resulting primary amine that initiates the NCA polymerization, undergoing the nucleophilic amine mechanism (NAM). Polymerization of benzyl-L-Glu and Tfa-L-Lys NCA were performed. Polymerization reactions were monitored by RT-IR revealing initiation of polymerization and monomer consumption when light irradiation is applied. MALDI-Tof MS confirmed the covalent attachment of the desired initiator at the polymer chain end, confirming the nucleophilic initiation mechanism NAM. As a result NCA-ROP initiation can be controllable “switched on” via photo cleavage of the photobase generator.

**P298**

**Dr Victor R. de la Rosa**

Ghent University

*Poly(2-oxazoline)s synthesis optimization and development of nanocarriers based on poly(2-oxazoline)-b-polycarbonate block copolymers*

Poly(2-alkyl-2-oxazoline)s (PAOx) constitute a versatile polymer platform that allows the construction of complex polymeric architectures with tunable properties in a defined manner. In addition, their biocompatibility and stealth-behavior makes PAOx ideal for biomedical applications.

In the present talk, I will present our latest optimizations for the polymerization of 2-ethyl-2-oxazoline (EtOx) yielding highly defined PEtOx polymers with high end-group fidelity. The obtained PEtOx will be used as macroinitiators for the polymerization of a range of different cyclic carbonates yielding PEtOx-b-PC block copolymers with low dispersities. The self-assembly and micellization behavior of these amphiphilic block copolymers, as well as cell-uptake studies, will also be shown. The results obtained represent a promising opportunity for the use of PEtOx-b-PC block copolymers as drug/gene nanocarriers or in other biomedical applications such as in imaging.

**P299**

**Miss Victoria Cunningham**

University of Sheffield

*Synthesis, characterisation and Pickering emulsifier performance of poly(stearyl methacrylate)-poly(N-2-(methacryloyloxy)ethyl pyrrolidone) diblock copolymer nano-objects via RAFT dispersion polymerisation in n-dodecane*

A poly(stearyl methacrylate) macromolecular chain transfer agent (PSMA macro-CTA) was utilised as a stabiliser block for the RAFT dispersion polymerisation of a highly polar monomer, N-2-(methacryloyloxy)ethyl pyrrolidone (NMEP), in n-dodecane at 90 °C. 1H NMR confirmed that the rate of NMEP polymerisation was significantly faster than that of a non-polar monomer (benzyl methacrylate) under the same conditions. The resulting PSMA-PNMEP diblock copolymer chains undergo polymerisation-induced self-assembly during growth of the insoluble PNMEP block to form either spherical micelles, anisotropic worms or polydisperse vesicles, depending on the target DP of the PNMEP chains. Systematic variation of this latter parameter, along with the solids content, allowed the construction of a phase diagram. High NMEP conversions were achieved in all cases and GPC analysis indicated relatively high blocking efficiencies. Finally, PSMA14-PNMEP49 spheres were evaluated as Pickering emulsifiers.

**P300**

**Dr Vien Huynh**

KCPC, The University of Sydney

*Polymer Coating of Hybrid Magnetic Nanoparticle-Reduced Graphene Oxide Composite via RAFT-mediated Emulsion Polymerization*

Magnetic nanoparticle (MNPs)/reduced graphene oxide (rGO) composites were prepared when iron salts were used to reduce GO. This process led to high loadings of chemically anchored MNPs on the rGO sheets. MNP loadings could be varied by changing the amount of ion salts added. Successful polymer coating of the composites via RAFT-mediated emulsion polymerization was achieved. Poly(allylamine hydrochloride) was initially used to alter the charge on the surface of the composites and enhance the adsorption of negatively charged macro-RAFT copolymers onto the surface. Macro-RAFT copolymers of acrylic acid, butyl acrylate and sulfonated monomer stabilized MNP/rGO was coated by starve feeding a mixture of methyl methacrylate and butyl acrylate. The process yielded uniform polymer-coated MNP/rGO with a shell thickness that could be tailored by varying the amount of monomer fed. The polymer coated MNP/rGO maintained their magnetic character and formed stable dispersions in a range of solvents.

**P301**

**Mr Yunqing Zhu**

Imperial College London

*Shape Memory Behaviour of an Amorphous Multi-block Polyester Elastomer from Sustainable Sources*

Environmental concerns have driven the quest for ‘green’ polymers-degradable or recyclable polymers completely from renewable sources. So far, progress has been achieved in developing packaging materials, textiles and TPEs. However, ‘green’ shape memory polymers are rarely reported due to their sophisticated nature. Owing to the new catalytic routes (chemo-selective polymerization) developed by us, block copolyesters can be prepared from various oxygenated renewable monomers, including cyclic anhydrides, epoxides and lactones, in ‘one step; one pot’. By choosing the right renewable monomer mixture, phthalic anhydride cyclohexene oxide and &#949;-decalactone, strong nano-scale phase separation can be induced. This talk will focus on the shape memory and thermoplastic elastomer properties of the degradable/renewable block copolyesters and the possibility of changing the properties from thermoplastic elastomers to shape memory materials by simply varying the block composition.

**P302**

**Mr Yutao Zhou**

*TBC*

**P303**

**Dr Richard d'Arcy**

Manchester University

*Polysulfides, a ‘breakthrough’ for osteoporosis?*

Osteoporosis is a disease resulting in the brittling of bones; it affects 2 million people in the UK and costs the NHS £2 billion per year. It is the result of increased activity of (bone adsorbing) osteoclasts and a reduction of (bone making) osteoblast activity. Reactive Oxygen Species (ROS) are known mediators in the differentiation of osteoclast-progenitor cells into osteoclasts through the RANKL pathway. Herein, we have developed star-polymer micelles composed of a PEG-corona and a polysulfide core capable of inhibiting this differentiation process. Polysulfides can be considered anti-oxidants as they are capable of reacting with and removing ROS with this also resulting in a hydrophobic-to-hydrophilic transition; in turn this can be used as a drug-release trigger. We have therefore also demonstrated that the polysulfide micelles could be loaded with rapamycin (anti-osteoclastic drug) and release its payload at an appropriate rate.

**P304**

**Dr Guillaume Delaittre**

Karlsruhe Institute of Technology

*Making the Best of It: Nitroxide-Mediated Polymerization (NMP) of Methacrylates in the Presence of a Small Amount of Functional Styrenics*

To date, NMP carried out with readily available reagents does not allow to control plain homopolymerizations of methacrylic esters. Nevertheless, it is possible to exert acceptable control over the SG1-mediated polymerization of methacrylates through a so-called copolymerization approach. By introducing a low amount (1–9 mol%) of a comonomer with a significantly lower NMP equilibrium constant and a relatively lower polymerization rate constant, good control over the molar mass distribution and high end-chain fidelity could be achieved. The most commonly employed comonomer is styrene. We therefore set out to make the best of it by evaluating various commercially available styrenics bearing reactive substituents in order to not only control the polymerization but also to impart useful properties to the resulting polymers. Most of them with only 5 mol% enabled a good control up to 60 % conversion (for MMA and OEGMA polymerizations), while enabling the synthesis of reactive nanomaterials.

**P305**

**Dr Guillaume Delaittre**

Karlsruhe Institute of Technology

*Solid-State Self-Assembly of Reactive Block Copolymers*

Chemical patterning in the sub-50 nm range is a challenge which has so far only been achieved by a few methods, e.g., dip-pen nanolithography, scanning near-field photolithography. Despite being sophisticated, these techniques can present some disadvantages in terms of costs and throughput due to their top-down nature. Our aim is to organize molecules on synthetic solid surfaces by making use of block copolymer (BCP) self-assembly in the solid state. Our methodology relies on the introduction of a low percentage of reactive groups into well-known self-assembling block copolymers. We select from the toolbox of modular ligation methods for anchorage of single molecules in close proximity. We will present our results on the synthesis and the self-assembly behavior of these reactive block copolymers derivatives and introduce our first attempts at utilizing them as nanostructured immobilization supports.

**P306**

**Mr Jue Wang**

Fudan University

*Glycopolymer-Induced Crosslinking of Peptide Amphiphile via Dynamic Covalent Bond*

In this work, for the first time, glycopolymer is employed to crosslink peptide amphiphile assembly into hydrogel via dynamic covalent bond (DCB) and the accurate binding mode of DCB is characterized by 2D NMR spectroscopy. This DCB is achieved by the interaction between mannopyranoside from glycopolymer and benzoboroxole (BOB) from peptide amphiphile (PA), which first self-assemble into nanofiber. The obtained hydrogel shows satisfactory biocompatibility with cell line A549, indicating this hydrogel is promising in biological studies.

**P307**

**Mr Zhen Li**

Fudan University

*Shape Effect of Glyco-nanoparticles on Macrophage Cellular Uptake and Immune Response*

The shells of various poly(*dl*-lactide)-*b*-poly(acrylic acid) (PDLLA-*b*-PAA) spherical micelles and poly(*l*-lactide)-*b*-poly(acrylic acid) (PLLA-*b*-PAA) cylindrical micelles were gooding

functionalized with mannose to yield glyco-nanoparticles (GNPs) with different shapes and dimensions. All of these GNPs were shown to have good biocompatibility (up to 1 mg/mL). Cellular uptake experiments using RAW 264.7 have shown that the spherical GNPs were internalized to a much greater extent than the cylindrical GNPs and such a phenomenon was attributed to their different endocytosis pathways. It was demonstrated that spherical GNPs were internalized based on clathrin- and caveolin-mediated endocytosis while cylindrical GNPs mainly depended on clathrin-mediated endocytosis. We also found that longer cylindrical GNPs (*L*n × *W*n = 215 × 47 nm) can induce an inflammatory response (specifically interleukin 6) more efficiently than shorter cylindrical GNPs (*L*n × *W*n = 99 × 50 nm) and spherical GNPs (*D*n= 46 nm).

**P308**

Paul Clarke\*1, Gerhard Heinzmann\*1, Florian Meier1, Silvia Spek2, Klaus Langer2, Thorsten Klein1

*1 Postnova Analytics GmbH*

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*Characterization of Biopolymers and Synthetic Polymers using AF4 and TF3 coupled with MALS*

Centrifugal Field-Flow Fractionation (CF3) is a reliable analytical tool for the separation and comprehensive characterization of nano- and microparticles. CF3 separates according to the hydrodynamic size and density and then online Dynamic Light Scattering is used as detection technology to measure the hydrodynamic size directly after separation.

In this presentation CF3 is used to characterize PLGA (poly(lactic-co-glycolic acid)) nanoparticles. The PLGA nanoparticles that are used as biodegradable substrates in pharmaceutical applications are dissolved in cell media and incubated for defined time durations at 37 °C to investigate the behavior of these nanoparticles under physiological conditions.

**P309**

Andrea Lotierzo

University of Warwick

*Investigating mechanistic aspects of Pickering Emulsion Polymerization*

Pickering emulsion polymerization represents a versatile method of fabricating hybrid core-shell particles in one step, in aqueous medium, without using surfactants and high shear emulsification steps. The addition of the stabilizer to the system increases the stability of the latex against coagulation and plays a key role in the kinetics of the process that can be tuned by varying the stabilizer content. However, to date an overall understanding of the principles of this heterophase Pickering-type polymerization technique is absent. The aim of this research project is to shed light on mechanistic aspects of this process and ultimately optimizing it according to the desired application.

**P310**

Guillaume Moriceau

University of Warwick

*Lubrizol’s CTA-Ester performances for RAFT polymerization of styrene and methacrylates*

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