



WARWICK

PHYSICS

**Knowledge Transfer Partnership (KTP) helps Infineum address transportation and environmental challenges.**

**BACKGROUND**

Infineum is a specialty chemicals company whose purpose is to create a sustainable future through innovative chemistry.

A joint venture between Shell and Exxon Mobil, Infineum is one of the world leaders in the formulation, manufacturing and marketing of petroleum additives for lubricants and fuels with operations and production facilities worldwide. Infineum products feature in 1 in 3 vehicles globally, ranging from lightweight motorcycles to marine super-tankers.

The global headquarters located in Milton Hill, the UK, hosts a new multi-million-pound Global Centre of Innovation and employs over 400 people at this site alone.

**THE CHALLENGE**

Changes to the transportation sector have occurred at a faster pace than at any time over the past 100 years. Many challenges are environmentally driven, such as the need to reduce emissions from vehicles through improved performance and increasing the lifetime of engine oil. This in turn, necessitates reductions in friction and wear, better fuel economy, improved combustion efficiency and a mitigation of the effects of more extreme temperature and pressure conditions encountered in hybrid powertrains.

## Using Solid State Nuclear Magnetic Resonance to address short-term and long-term challenges

Solid state Nuclear Magnetic Resonance (NMR) is a materials characterisation technique. Its true value lies in its ability to provide short-range chemical information with high chemical specificity and accuracy; this information is highly complementary to longer-range structural information provided by diffraction and microscopy techniques. The ability to generate multi-technique approaches to studying the structure/function relationship in contemporary functional systems is key to modern research and development (R&D) in Materials Science. Infineum UK Ltd has thoroughly investigated the applicability and value of the solid state NMR technique in addressing technical, research and problem-solving areas of development. This range of applicability is recognised as extending from short-term 'here and now' requirements through to long-term strategic research in numerous product development streams.

### Aim of the KTP

Infineum UK Ltd has always possessed a significant skills base in the synthesis of fuel and oil additives, and in the structural analysis of these chemical systems and products. This is a core element that exists throughout the company. However, with increasing complexity of systems, and the challenges mentioned above, there is an increasing need for more advanced characterisation methods, to provide more in-depth structural information at the molecular level. These new insights are key enablers in the development of new, differentiated products. Specific solid state NMR methodologies have been developed recently by the Knowledge Base (the Materials Solid State NMR Group at Warwick) for studying the structure of several key chemistry families within the Infineum portfolio. The high-level aim of the KTP was to determine whether the solid state NMR technique could be added as a valuable tool within the Infineum commercial R&D materials characterisation suite, and if it could be introduced across a broad platform of implementation ranging from short-term applications through to long-term strategic research associated with product development.

## Solution: The Road to Knowledge Transfer - The KTP Award

The KTP proposed was a three-year project locating the Knowledge Base at the University of Warwick (the Materials Solid State NMR group) with the KTP Associate (Dr Sam Page) expected to deliver knowledge transfer to Infineum UK Ltd on a number of levels, including: -

- (a) delivery of the solid state NMR technique into the materials/chemistry characterisation mindset so that it could be recognised as an integrated approach alongside existing techniques that have underpinned Infineum R&D for many years. This involved the design and implementation of appropriate programmes of solid state NMR research within many product development and problem solving/troubleshooting groups within the Company.
- (b) the KTP Associate becoming a recognised partner and participant in many Infineum groups. This involved the KTP Associate spending large amounts of time at Infineum's Milton Hill premises so that constant dialogue could be established, and updated progress (or problems) be regularly reported in group meetings.
- (c) the Knowledge Base at Warwick and the KTP Associate acting as formal teachers of the fundamentals and basic theory of the solid state NMR technique to relevant groups at the Milton Hill site. This was achieved with regular seminars delivered at the appropriate level to engage the maximum number of Infineum employees needing to learn and embrace this new technique.

Upon the delivery of these differing aspects of knowledge transfer, an even more advanced understanding of the action and efficiency of Infineum products was achieved, which in turn has equipped Infineum for the new challenges ahead.

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## IMPACT

The University of Warwick/Infineum UK Ltd KTP project was awarded 'Outstanding' for its recognised achievements spanning the three-year period covering the funding. These impacts have embraced numerous aspects of the Knowledge Base / Company relationship.

The KTP has been pioneering in actively involving external collaborators in addressing shorter term research scenarios. During the project, the KTP Associate developed skills in translating complex scientific data and findings into key outcomes for non-experts in the company. For example, solid state NMR studies of new prototype chemistries yielded the chemical structures present in these products.

Through the characterisation methods development achieved within the KTP framework, the company has acquired the ability to perform chemical interrogation of most solid systems. This has proved extremely valuable and has been applied across a wide range of applications. This latter example has resulted in follow-on Impact Accelerator Account (IAA) funding for the University of Warwick, facilitating the development of new internal R&D projects with Infineum UK Ltd as collaborative partners.

The impact on the KTP Associate was huge, with Dr Sam Page stating that, "the KTP was a fantastic opportunity for me to develop and grow. The courses provided an excellent introduction to Management, Finance and Marketing and my Knowledge Transfer Advisor pushed

and challenged me to develop my communication skills, overcoming an area I was always reluctant to improve. Throughout the whole project, I was placed in situations where I was challenged to place myself out of my comfort zone and become more confident. By the end, I was happy to be in meetings with senior members of the business and freely offer my opinions. I'm extremely grateful to have the opportunity to have completed a KTP, I feel more confident to achieve my goals in the future."

## Longer term benefits

As a result of the KTP framework, the Company's collaborative and partnership-driven culture has been further enhanced through its relationship with the University of Warwick, with external partners becoming integral members of internal project teams. The KTP has showcased increased partnership between external academic partners through common research aims.

The KTP has involved Infineum working in close partnership with the University of Warwick across different teams and business areas. Partnership with the University of Warwick has acted as a blueprint for the collaborative model Infineum is now adopting with partner academic institutions, a key element in the evolution that will see Infineum UK Ltd evolve from a leading transportation additive company into a global speciality chemical company.

“The KTP Programme was a tremendously successful way to strengthen all aspects of industrial engagement between UK Higher Education Institutions and the small, medium and large-scale enterprises comprising UK industry. Industry engagement is a critically important indicator determining how well an institution is functioning, and the KTP Programme offers a highly structured and effective portal through which the initiation and development of long-term relationships between company and institution can be stimulated.”

**Professor John Hanna, Knowledge Transfer Academic Lead, Department of Physics, University of Warwick.**

“The KTP was a true relationship for all parties involved. The structured programme provided an efficient and effective vehicle for industry to work collaboratively with academia, applying academic capabilities to real-world systems and problems and then effectively integrating such capabilities back into the company. Infineum feels the KTP has been extremely successful, and the technique (and approach) is now embedded within the company R&D culture. Based on the outputs of the KTP, it is our intention to take the partnership with the University of Warwick forward for a long-term strategic relationship based on advanced analytical techniques to enhance research and commercial activity.”

**Professor Peter Dowding, Knowledge Transfer Company Lead and Principal Scientist at Infineum UK Ltd.**



**Gerry O’Hagan, Knowledge Transfer Advisor from the Knowledge Transfer Network added:**

“This KTP was a prime example of the immediate impact and the long-term value that can be harnessed for all stakeholders through the interdependent knowledge exchange which emerges from committed engagement and extensive collaboration. To be graded ‘Outstanding’ is appropriate recognition of the relationship established through the KTP and the ongoing achievements anticipated.”