Advanced Materials 1 Project Equipment

University of Birmingham

Equipment Item as described in the AWM application	Equipment facility	Description	Application / Uses	Location	Contact	Booking system
Equipment item procured	*Name given to the group of items which make up the operational equipment for use*	*Description of machine and what it does. Also add in any features or additions above basic specification*	*For non experts, provide example applications or uses of what it can do/be used for/used to measure etc*	*Where the machines will be located*	*Person to contact for further information / use the machine*	*Whether equipment has a booking system, it is online and regulated by specified person*
Xray powder diffractometer Lot 1	Bruker D8 diffractometer 1	High resolution powder X-ray diffractometer operating in transmission mode with automatic sample changer, monochromatic Cu radiation, LynxEye position-sensitive detector	Routine measurement of powder X-ray diffraction patterns for identification of crystalline phases, purity estimation and/or determination of crystal structure	Chemistry Room 512	Jo Hriljac, Louise Male	Booking system but currently not on line. Non group members will need to contact Louise Male.
Xray powder diffractometer Lot 2	Bruker D8 diffractometer 2	High resolution powder X-ray diffractometer operating in reflection mode with MRI high-temperature stage, monochromatic Cu radiation, LynxEye position-sensitive detector	Routine measurement of powder X-ray diffraction patterns for identification of crystalline phases, purity estimation and/or determination of crystal structure, measurement of powder X-ray diffraction patterns up to 1200 °C in air or 1600 °C in vacuum	Chemistry Room 512	Jo Hriljac, Louise Male	Booking system but currently not on line. Non group members will need to contact Louise Male.
Upgrade to existing XRD Lot 1	Bruker D5000	High resolution powder X-ray diffractometer operating in capillary mode with low temperature cryostream, monochromatic Cu radiation, Braun position-sensitive detector	Routine measurement of powder X-ray diffraction patterns of samples in capillaries from 80 to 500 K. This system will be of most interest to those looking at organic samples such as pharmaceuticals	Chemistry Room 512	Jo Hriljac, Louise Male	Booking system but currently not on line. Non group members will need to contact Louise Male.
Upgrade to existing XRD Lot 2	Bruker D5005	Powder X-ray diffractometer for examining flat-plate samples using Cu or Mo radiation. This diffractometer has the flexibility to be equipped with a high-temperature stage that operates up to 1200 °C in air or a low-temperature stage that operates to 10 K in vacuum.	Routine measurement of medium resolution powder X-ray diffraction patterns using Cu or Mo radiation.	Chemistry Room 512	Jo Hriljac, Louise Male	Booking system but currently not on line. Non group members will need to contact Louise Male.
Raman spectrometer	Renishaw Raman spectrometer	The inVia Raman microscope is fitted with two lasers (532 nm and 633 nm) and a variety of objectives. Spectral analysis of a wide variety of materials is therefore possible. The microscope can provide variable temperature information using a Linkam stage (77 K to 873 K).	The Raman spectra of crystals consist of bands associated with local structural vibrations (internal modes), and extended lattice itself (lattice modes). Crystals with the same chemical composition – such as the various forms of TiO2 – exhibit different Raman spectra. The different symmetries involved govern whether vibrations are Raman active whereas the precise local structure will determine the frequency. Raman microscopy is therefore useful for differentiating between different polymorphs. Also, Raman microscopy has high spatial resolution that allows analysis of very small regions and crystals (a few microns).	Chemistry Room 503	Colin Greaves	Currently no booking system
TG/DSC	Netzsch thermal analyser	The Netzsch analyser allows thermal analysis of materials up to temperatures of 1500°C in controlled atmospheres. Mass change and calorimetric effects can be monitored simultaneously. The equipment is linked to a mass spectrometer which allows immediate analysis of evolved gases.	The thermal analyser can provide a variety information including: • temperature and composition of evolved gases; • mass change for analysis, eg of oxygen content in materials; • information on phases changes (DSC) even when no mass change occurs.	Chemistry Room 612	Colin Greaves	Currently no booking system
FTIR spectrometer with ATR, powder cell, environmental chamber and TGA accessory.	FTIR spectrometer for solids	Records infrared spectra. Optimized for powder samples. Environmental chamber for the measurement of air sensitive samples. TGA accessory for the analysis of evolved gases.	Records vibrational spectra. Capable of providing information on the chemical constitution of samples and the nature of bonds present.	TBC	Paul Anderson	Currently no booking system
Praying Mantis accessory **for use with AM2 UV-visible spectrometer.**	Praying Mantis accessory	Permits the recording of UV-visible spectra from power solids.	Measures light absorption in the UV and visible parts of the electromagnetic spectrum. Provides information on electronic transitions involving valence electrons.	TBC	Paul Anderson	Currently no booking system
Wavelength Dispersive X-ray Fluorescence Spectrometer	Wavelength Dispersive X-ray Fluorescence Spectrometer	Wavelength Dispersive XRF system to facilitate the elemental analysis of materials, predominately inorganic solids and powders. The system is optimised for detecting and quantifying elemental components ranging from oxygen through to uranium at major, minor and trace (ppm) levels. It is capable of handling small sample sizes (<1g) and is capable of qualitative, fully quantitative and standardless analyses	This system is capable of determining the elemental composition of samples, including solids, powders and liquids. It is able to detect elements from oxygen through to uranium. The system is not optimised for elements lighter than oxygen and therefore not suitable for purely hydrocarbons or organics. Sample sizes can range from powders below 1g, to solids with diameters of up to 3cm (flat surface required). The measurement is non-destructive in most cases.	Chemistry Room 503	A J Wright	Booking system but currently not on line. Non group members will need to contact Louise Male.
Size selected cluster beam (Ultra High Vacuum (UHV) cluster deposition source and High Vacuum (HV) cluster deposition source)	Small Particle deposition	This equipment can produce small particles of a very well defined size, which are then deposited onto various samples (glass, metal, semi-conductor etc). Samples produced using Item 1 are done so in a very clean environment with the provision for transferring the small particle samples into other vacuum systems using a "vacuum suitcase". Item 2 is focused on producing a larger number of particles in a shorter time with its samples simply being exposed to air when removed from the instrument. Both of these instruments use a novel "time-of-flight" mass filter that can separate small particles of different sizes generated from a material source (metal or semiconductor).	Small particles of very well defined sizes have many potential applications, with many of them being explored at the moment in the scientific community. From an industrial perspective, one application that is that of catalysis. The properties of small particles (including chemical reactivity) are very different to their bulk counterparts. Such particles could lead to a catalyst (either for the automotive industry or for bulk chemical production) that is produced from much less material in total.	Pending delivery	James Lawton 0121 414 4613 jjl274@bham.ac.uk	Currently no booking system. Refer to contact person for booking / use of equipment.
Scanning Probe Energy Loss Spectrometer (SPELS)	Instrument Development	This instrument allows sub-micron spectroscopic (chemical) information to be obtained from sample surfaces (small samples, 1 cm^3). Next generation improvements to the instrument will allow such spectroscopic information to be mapped out in sub-micron images of the surface.	This laboratory facility focuses on the design and development of new analytical instrumentation and techniques. A present example being the SPELS; an instrument patented by the University of Birmingham (UK patent No. 0002367.1). A previous example of an instrument developed is the novel "time-of-flight" mass filter that is used to separate small particles of different sizes generated from a material source (metal or semiconductor). The mass filter is also patented in the UK and internationally. Our extensive experience with instrumentation development allows us to provide services and consultancy.	Pending delivery	James Lawton 0121 414 4613 jjl274@bham.ac.uk	Currently no booking system. Refer to contact person for booking / use of equipment.

JEOL Aberration-corrected Transmission Electron Microscope (JEM-2100F)	Transmission Electron Microscopy Facility	The JEM-2100F is a JEOL field emission gun transmission electron microscope with an ultra-high-resolution pole piece and operates at 200kV. The machine is equipped with a CEOSCOR illumination Cs corrector and an acquisition-scanning-image-device (ASID). It is also fitted with a Gatan Enfina parallel detection Electron Energy Loss Spectrometer (EELS) for acquiring chemical information of the specimen. A piezo stage allows very fine control of the specimen position and a special cooling/heating holder allows multifunctional materials characterization providing temperature variation around the specimen area between -150°C to 250°C. The microscope was installed in June 2009 and has capabilities of high-resolution 3D structural analysis at atomic-scale.	High resolution imaging, Materials qualification, Chemical analysis, Particles detection/characterization, Defects analysis, Microstructural characterization	LG8a, Physics East Building, Edgbaston Campus, University of Birmingham	Dr. Ziyou Li (z.li@bham.ac.uk) or Prof. R.E. Palmer (r.e.palmer@bham.ac.uk)	Currently no booking system. Refer to contact person for booking / use of equipment.
low temp scanning tunnelling microscope (STM)	Scanning tunnelling microscopy	The scanning tunnelling microscopy (STM) facility contains a suite of three ultra-high-vacuum STMs: Omicron low-temperature; Omicron variable temperature; and RHK room temperature. These three microscopes cover a range of sample temperatures from +1000 ℃ to -268.3 ℃ (4.7 K). They can image and prepare metallic and semi-conductor surfaces and deposit a range of molecules and gasses. The facility has state-of-the-art control electronics and lockin-amplifiers to facilitate a range of microscopy and spectroscopy techniques as well as the development of novel scanning probe microscopy procedures	The key to STM is that it can image and probe individual atoms. This allows electronic and vibrational spectroscopy with atomic-scale spatial resolution. They can also image larger areas of surfaces (~ 2 ㎛2) still with high spatial resolution. Possible applications range from probing the fundamentals of surface induced catalysis to arranging individual atoms in pre-designed structures, e.g., writing words and letters using individual atoms.	Room LG16, Physics East Building, School of Physics and Astronomy, the University of Birmingham, Edgbaston, Birmingham, B15 2TT	Dr. Peter A. Sloan p.a.sloan@bham.ac.uk	Currently no booking system. Refer to contact person for booking / use of equipment.
Oxford Instruments Plasmalab 80+ Deep Reactive Ion etching machine Disco 321 Wafer Dicing machine	Microfabrication Facility	The Microfabrication Facility can be used to create micron sized devices and structures in silicon. The provision of an Electron Beam Lithography tool allows arbitrary patterns to be created on the silicon wafer, and is particularly suited to small prototyping runs where differing structures can be explored. Using the sputter coating equipment, thin high quality films of metals such as gold and aluminium, and dielectrics such as Hafnium Dioxide can be selectively deposited. The newly acquired Oxford Instruments Plasmalab 80+ allows the etching of patterned silicon with a high level of control – isotropic and anistropic etching are possible together with sputter etching of metals. Of particular interest is the new facility to perform ultra-high aspect ratio etching with the Bosch process. The new wafer dicer machine allows the accurate separation of multiple devices from a single wafer.	In addition to the new equipment provided under Science City, the Microfabrication Facility hosts the necessary equipment for small scale microfabrication prototyping, including silicon cleaning and resist preparation facilities, an Electron Beam Lithography tool with 10 nm resolution, thin film sputter coating, thermal processing, and metrology. With this suite of facilities we can create arbitrary patterns on a wafer, we can then coat the unpatterned areas with thin films of metal or insulator, or etch the unprotected material away. Typical applications include MEMS devices such as microfabricated cantilevers, patterned surfaces for biological applications, electrical contacting of nanowires, optical surfaces such as gratings, and other microdevices. We have developed a resist material in house that is particularly suited for high resolution, high speed, high aspect ratio patterning.	G4 – Cleanroom, Physics East	Alex Robinson	Currently no booking system. Refer to contact person for booking / use of equipment.
Park high resolution AFM, Park Near Field Optical Microscope (NSOM), Kretschmann configuration optical setup , Leica confocal system, Digital Instuments STM system, SC400 Fianium white laser source, Tsunami laser, monochromator..	Next generation surface metrology	The facility permits to analyse in an advance modality the morphological and local optical properties of samples and materials. The tunable Tsunami laser, the Fianium white laser source and the monochromator provide a high configurable way to pump the samples and the materials. Advance optical analysis could be done using the confocal system and the Near Field Optical Microscope. The optical table could be configured for many different optical experiments like for the Kretshmann set-up implemented in the lab. Morphological analysis could be done with the STM system and with two high resolution AFMs.	With NSOM is possible to obtain optical imaging with better resolution than the optical microscope since the Rayleigh limit is overcome. The AFM permits to achieve morphological analysis of the samples with a resolution less than 1Å. Confocal system permits to achieve 3D optical images of the samples and to analyse their fluorescence properties. White laser source provide broadband excitation of the samples.	G7 and G8 laboratory. Physics East, University of Birmigham	Vito Errico Jorge Barreto	Currently no booking system. Refer to contact person for booking / use of equipment.
Ti:Sapphire Femtosecond laser system	Optical measurements and characterisation	The lab specialised in time-resolved measurements of optical constants and electron emission properties of solid materials – metals, semicondustors, organic films and dielectrics. The lab is equipped with the state-of-art femtosecond laser producing 800 nm, 30 femtosecond optical pulses and Optical Parametric Amplifier with capabilities to produce tunable pulses in the range between 250 and 20000 nanometers. The bulk of measurements is based on the pump-probe technique which allows time resolved measurements of optical contants, i.e. complex dielectric function, with time resolution comparable to the pulse duration. Another aspect of the research is investigation of a surface response in ultra high vacuum to the irradiation with these ultrashort pulses by means of analyzing electron emission.	Measurements of materials reflectivity and absorption properties, determination of excitation decay dynamics, determination of real and imaginary parts of dielectric constants by means of static and time resolved ellipsometry, design and implementation of advanced optical set-ups, optical measurements automation and optimisation.	Physics East G6, Nanoscale Physics Research Lab, School of Physics & Astronomy, University of Birmingham, B15 2TT.	Andrey Kaplan 0121 414 4690 a.kaplan.1@bham.ac.uk	Currently no booking system. Refer to contact person for booking / use of equipment.
FIB-SEM	FEI Quanta 3D FEG FIB-SEM	The Quanta 3D FEG is a versatile high-resolution, low vacuum SEM/FIB for 2D and 3D material characterization and analysis. The Quanta 3D FEG's field-emission electron source delivers clear and sharp electron imaging. Increased electron beam current enhances EDS and EBSP analysis. Featuring three imaging modes – high-vacuum, low-vacuum and ESEMTM Quanta 3D FEG's high-current FIB enables fast material removal. Automated FIB sectioning recipes enable accurate cross-sectioning. Electron beam resolution • High-vacuum (0.8 nm at 30 kV (STEM); 1.2 nm at 30 kV (SE); 2.5 nm at 30 kV (BSE); 2.9 nm at 1 kV (SE)) • Low-vacuum (1.5 nm at 30 kV (SE); 2.5 nm at 30 kV (BSE); 2.9 nm at 3 kV (SE)) • Extended low-vacuum mode (ESEM) (1.5 nm at 30 kV (SE)) Ion beam resolution • 7 nm at 30 kV at beam coincident point (5 nm achievable at optimal working distance) Electron optics • High-resolution field emission – SEM column optimized for high brightness/ high-current * optional • 60 degree objective lens geometry with through-the-lens differential pumping and heated objective apertures • Accelerating voltage: 200 V – 30 kV (optional down to 100 V)	There are two important applications: 1) 3-D SEM. Produces 3_d images from 100x100x100 µm. Images can be secondary electrons or X-rays (chemical images) 2) TEM (transmission) specimen production from any selection or combination of materials (e.g. polymers, ceramic etc)	Centre for Electron Microscopy, Materials & Metallurgy School	Ian Jones / Paul Stanley	Online booking system currently operational. Only registered people can use. Address: http://www.cem.bham.ac.uk/quanta.htm

Cold Atoms lab refurbishment	**MUARC** (Midlands Ultracold Atom Research Centre)	Provide a suitable laboratory environment to enable cold atom experiments aiming at the creation of artificial materials. The creation of this facility was partially funded by EPSRC and the University, who will also provide funding for experimental setups and staff to complete the facility. Completion is in progress, once finished, the facility will enable the creation and study of artificial 2D materials with many degrees of freedom in parameters, e.g. tunnelling, interaction, lattice geometry.	Study the underlying physics of novel materials or of quantum phenomena underlying material properties by the creation of well defined artificial materials. Examples would be the creation of artificial superconductors, magnetically frustrated systems or conductors with well defined impurities or disorder causing resistivity or localization.	Physics East LG22, LG23, LG31, LG32, LG33, LG34 and G29	Prof. K. Bongs Phone: 0121-414-4585 k.bongs@bham.ac.uk	Currently no booking system. Refer to contact person for booking / use of equipment.

Advanced Materials 1 Project Equipment

University of Warwick

Equipment Item as described in the AWM application	Equipment facility	Description	Application / Uses	Location	Contact	Booking system
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Laser assisted MBE with in situ analysis facilities for growth of novel materials				Pending delivery	Chris McConville	
Lasers				Pending delivery	Chris McConville	
Surface and interface analysis system with high resolution XPS				Pending delivery	Chris McConville	
Single crystal growth facility for multifunctional materials	Single Crystal Growth Machine	A Czochralski crystal growth system is being designed (custom built) and manufactured by Cyberstar (France). This system will be used in two modes: 1) as a crystal growth system using 4 arcs (tetra arc) melting material on a copper hearth 2) a crystal growth system using a crucible and susceptor linked to the r.f. induction generator for the heating. This system can be used to produce crystals of intermetallic materials and some oxides can be grown using crucibles made out of precious metals such as platinum and iridium.	This equipment will be used to melt binary and ternary intermetallic compounds in polycrystalline form. Rods of these compounds can also be made using this method in preparation for crystal growth by the floating zone technique.	Physics	Geetha Balakrishnan	Booking available via academic (Martin Lees or Geetha Balakrishnan) which is indictaed on webpage. No on line system or booking calendar available.
Radio frequency power generator	Generator for Single crystal growth facility	A new radio frequency power generator (Huttinger Trumpf), capable of delivering 40kW has been acquired to be used in conjunction with an existing cold boat system.		Physics	Geetha Balakrishnan	
PPMS Magnetic Measurement System	Quantum Design Physical Properties Measurement System (PPMS)	**Thermodynamic Measurements** One system has a P650 heat capacity option. Measurements of heat capacity can be made between 0.4K and 400 K in magnetic fields of up to 9 T. Samples with masses of between 5 and 500 mg can be measured with a resolution of 10 nJ/K @ 2.0 K. The system uses a 2 tau heat pulse-relaxation technique. **Transport measurements** Our second system can be used to carry out AC and DC resistivity measurements (300 mK base) and collect 4 and 5 wire balanced Hall effect and I-V curves (1.8 K - 400 K). The thermal transport option allows measurements of thermal conductance, K, and Seebeck coefficient, S		Physics	Martin Leese	
SQUID magnetometer and high-pressure cells	MPMS SQUID magnetometer	Quantum Design MPMS SQUID magnetometer and to upgrade our existing MPMS unit. The new system has a 7 T solenoid with both longitudinal and transverse pick up coils and vertical and horizontal sample rotation. Our existing system (with a 5 T solenoid) is now capable of measuring ac and dc susceptibility and is equipped with an ultra low field option. An easyLab Mcell pressure cell which can be used in both systems allows magnetisation measurements to be carried out at pressures of up to 10 kbar. An i-Quantum He‖3 system extends the base temperature of the magnetometers from 1.8 K down to 480 mK while a QD oven increases the maximum operating temperature from 400 K to 800 K.		Physics	Martin Leese	
Moorfields Electron beam evaporator	Metal deposition and photolithographic equipment	Enables the production of microscale devices through simple photolithographic processing	Typical equipment found in a clean room for photolithographic production of devices – for example equipment can be used to pattern electrical contacts on surfaces, define microscale electrodes, coat surfaces with a thin film of a metal of interest	In A block Chemistry, University of Warwick	Prof. Julie V. Macpherson j.macpherson@warwick.ac.uk	
Suss Microtec MJB4 Mask Aligner						
Upgrade to a Moorfields MiniBox thermal evaporator and sputtering system						
High resolution, high flux diffractometer for epilayer and multilayer diffraction		The Panalytical X'Pert Pro MRD is a high resolution single crystal X-ray diffractometer. In its standard configuration, the MRD is equipped with a Cu Kα1 hybrid monochromator as the incident beam optics and a receiving slit / analyser crystal as the diffracted beam optics. This offers the best combination of counts to resolution for most routine applications. The optics can be interchanged relatively quickly to tailor the diffractometer to the application required. For highest resolution measurements, a mirror & monochromator combination can be used. For reflectivity measurements, a parallel plate collimator is	High resolution X-ray diffraction is an important technique for studying individual Bragg peaks of single-crystal and thin-film materials. This machine is suitable for the study of single crystals, thin films (including multilayers) and polycrystalline materials (e.g. ceramics). Typical materials include semiconductors (SiGe, GaAs etc), Magnetic Multilayers, Ferroelectrics (PZT, LiNbO3), Photovoltaic thin films and metallic rods / sheets. Techniques available include:	X-ray Diffraction Facility	Dr David Walker	

High pressure chamber for high resolution, high flux diffractometer	Panalytical X'Pert Pro MRD	available on the diffracted beam optics enabling measurements out to larger angles than possible with the standard optics. Additionally, the optics can also be reequipped to allow stress and texture measurements to be undertaken in point focus. The MRD is equipped with a PiXcel solid state detector enabling better counting statistics, high linearity and eliminating the need for a beam attenuator. An Anton Paar DHS900 domed hot stage, allowing non-ambient studies on thin-films and ceramics at temperatures of up to 900C. Software is ava	• Rocking curve analysis and reciprocal space mapping – Crystalline quality, accurate lattice parameters, strain & misorientation. • Reflectometry and thin film phase analysis – Layer thickness & composition • Residual stress and texture analysis • Diffuse scatter measurements • In-plane and grazing incidence diffraction • Non-ambient diffraction – phase transitions, layer annealing studies	– Ground Floor Physics at Warwick	Dr David Walker Professor Pam Thomas	
Materials Chemistry Diffractometer with an environmental cell	Bruker D8 Advance Powder X-Ray Diffractometer	The Bruker D8 Advance Powder X-ray diffractometer is optimised for high-throughput in-situ gas reaction measurements. For maximum intensity and throughput, the Bruker D8 is equipped with unmonochromated Cu radiation and a Ni filtered VÅNTEC-1 solid state detector with a maximum active length of 12° 2θ. This allows very quick static (~ 10s) measurements to be made, particularly useful for kinetic studies. The sample is held in an Anton Paar XRK 900 reaction chamber, a chemical reaction cell for studies in the presence of reactive gases (oxidising and reducing) at up to 10 bar. Software available includes Bruker EVA for data analysis and Topas for structural refinement. The latest ICCD powder diffraction database is also available which includes over 100K patterns.	X-ray powder diffraction is a powerful technique for phase identification and structural determination. Applications of this environmental diffractometer include: • Catalysts under real reactive conditions - Oxidising or reducing gases. • Kinetic studies of solid state reactions – Thermal decompositions, gas solid reactions, phase changes. • Solid gas reactions at elevated pressure (10 bar) and temperature (900C) • Structural changes under redox reaction conditions • High temperature material stability with fast data collection – phase separation and collapse. • Gas uptake by porous materials – H, CO2	X-ray Diffraction Facility – Ground Floor Physics at Warwick	Dr David Walker Dr Richard Walton Professor Pam Thomas	Online booking system. Must be a registered user to acces booking. Address: http://www2.warwick.ac.uk/fac/sci/physics/research/condensedmatt/ferroelectrics/x-ray/
Single crystal Xray diffractometer with low temperatuire attachment	Oxford Diffraction Gemini R CCD Diffractometer	The Oxford Diffraction Gemini R CCD X-ray diffractometer is a powerful tool for the measurement of single crystals. The Gemini R is a Kappa geometry goniometer equipped with dual wavelength (Cu/Mo) fine focus X-ray sources, graphite monochromators and Enhance optics . The detector is a Ruby Charge Coupled Device area detector, which allows for extremely fast data collection of the entire Ewald sphere. The Oxford Diffraction CrysAlisPro software enables data collection, data integration and absorption corrections to be performed, and is used in conjunction with refinement software such as ShelX or Jana. For low temperature experiments (80K-400K) an Oxford Cryosystems Cobra is attached to the system. Additionally, an optical stereomicroscope is used for mounting and alignment of samples.	X-ray diffraction is an important tool for structural determination of single crystals, both organic and inorganic. Usage spans from routine structural work on organic and metal-organic small molecules (Chemistry) to highly detailed investigations of heavy metal oxides that can include twins, modulated structures or diffuse scattering (Physics).	X-ray Diffraction Facility – Ground Floor Physics at Warwick	Dr Guy Clarkson (Chemistry) Dr David Walker Professor Pam Thomas (Physics)	
GATAN ORIUS® CCD camera - large format (11 Megapixel) retractable and fiber-optical coupled CCD camera. Attached to a JEOL 2000FX TEM	Transmission Electron Microscopy	The SC1000 offers a high speed (>14 fps - frames per second) image viewing mode. This allows the user to search areas within the sample quickly and efficiently. Another benefit of the high frame rate of the SC1000 is the capability of TEM in-situ observations. The SC1000 can output high quality (dark and gain corrected) LIVE images via a digital video stream.	Viewing and recording images and electron diffraction patterns The high speed viewing mode also allows the user to replace the traditional TEM viewing screen. Operations such as microscope alignments, stigmation, and focus can be performed with high precision using the camera display instead of the TEM viewing screen.	ROOM435, Physics Department, University of Warwick	Steve York or Richard Beanland	
Zeiss Axioimager microscope and Zeiss Stemi2000 stereo microscope	Optical Microscopy	Microscope can offer: 50 - 1000 times magnification Reflective/Transmitted light source Bright field imaging Dark field imaging Differential Interference Contrast imaging 3.2 megapixel camera	Axio Imager from Carl Zeiss, designed for quality control, quality assurance, materials analysis, and for the development of new materials. Ideal for routine applications and research. Darkfield illumination reveals unevenesses in the surface (such as phase boundaries between graphite and matrix or break-outs). C-DIC (color contrast): The matrix is contrasted because of the relief. Hard and soft grain components as well as polishing inconsistencies (exclusively mechanically polished) are visible.	ROOM 434 , Physics department, University of Warwick	Steve York or Richard Beanland	
GATAN PIPS Ion miller	TEM Sample preparation	The PIPS™ is a user-friendly precision ion polisher designed to produce high quality, TEM specimens with minimal effort. The muiller has a Liquid Nitrogen cooled specimen stage and CCD zoom camera to view milling progress.	For the thinning of samples such as silicon, ceramics, glass ceramics etc for viewing in the Transmission Electron Microscope	ROOM 436, Physics Department, University of Warwick	Steve York or Richard Beanland	
JEOL 2000FX TEM	Microscope (not a Science City purchase)			ROOM 436, Physics Department, University of Warwick	Steve York or Richard Beanland	

UV/Vis/NIR optical spectrometer	Lambda 1050 spectrophotometer for optical absorption measurements over the wavelength range 190 nm to 3000 nm	The LAMBDA 1050 is a high sensitivity and high resolution spectrophotometer for a wide range of demanding applications, such as high absorbing glass, optical coatings or thin film filters over the wavelength range 190 – 3300 nm. It also features two large sampling compartments and polarizing optics. It is equipped with an Oxford Instruments Optistat cryostat enabling measurements in the range 3.7 to 300 K.	Architectural and Specialty Glass: Energy conservation is more important now than ever before. Analysis of coated glass provides important information on thermal efficiency and other key design considerations. Solar Energy Research: The LAMBDA 1050's capability in the NIR region allows full characterization of not only the active solar cell materials but also the reflective protective covering.	Millburn House	Dr Mark Newton, Department of Physics, University of Warwick, Coventry CV4 7AL (m.e.newton@warwick.ac.uk)	
Multi frequency FT EPR / associated	Multi-frequency Fourier Transform EPR spectrometer	This is a highly versatile multi-frequency (9.5 and 34 GHz) Fourier Transform Electron Paramagnetic Resonance (EPR) spectrometer equipped for all FT-EPR and Electron Spin Echo techniques including ESEEM and 2D-HYSCORE to measure spin density distribution and distances through the hyperfine interaction between electron and nuclear spins, SECSY and EXSY to measure correlations and exchange rates, Pulse-ELDOR and DEER to measure long range distances by electron-electron spin dipolar coupling, pulse-ENDOR to measure hyperfine interactions and nuclear spin relaxation, and laser triggered experiments to investigate chemical reactions and triplet states.	Perhaps surprisingly a large number of materials have unpaired electrons. These include free radicals, many transition metal ions, and defects in materials. Free electrons are often short-lived, but still play crucial roles in many processes such as photosynthesis, oxidation, catalysis, and polymerization reactions. Hence EPR applications span a wide range of areas from quality control to molecular research in fields such as material research, structural biology, and quantum physics. For example EPR is able to provide information on long-range interactions (1 to 8 nm) between paramagnetic centres and extract conformational information which are difficult to obtain by other technologies (such as NMR, X-ray crystallography).	Millburn House	Dr Mark Newton, Department of Physics, University of Warwick, Coventry CV4 7AL (m.e.newton@warwick.ac.uk)	
NMR 100MHz and 200MHz				Millburn House	Radek Kowalczyk	No online system apparent from website. Investigate with radek
NMR 300MHz						
NMR 400MHz						
NMR 600MHz						
Components of high field 850MHz NMR						