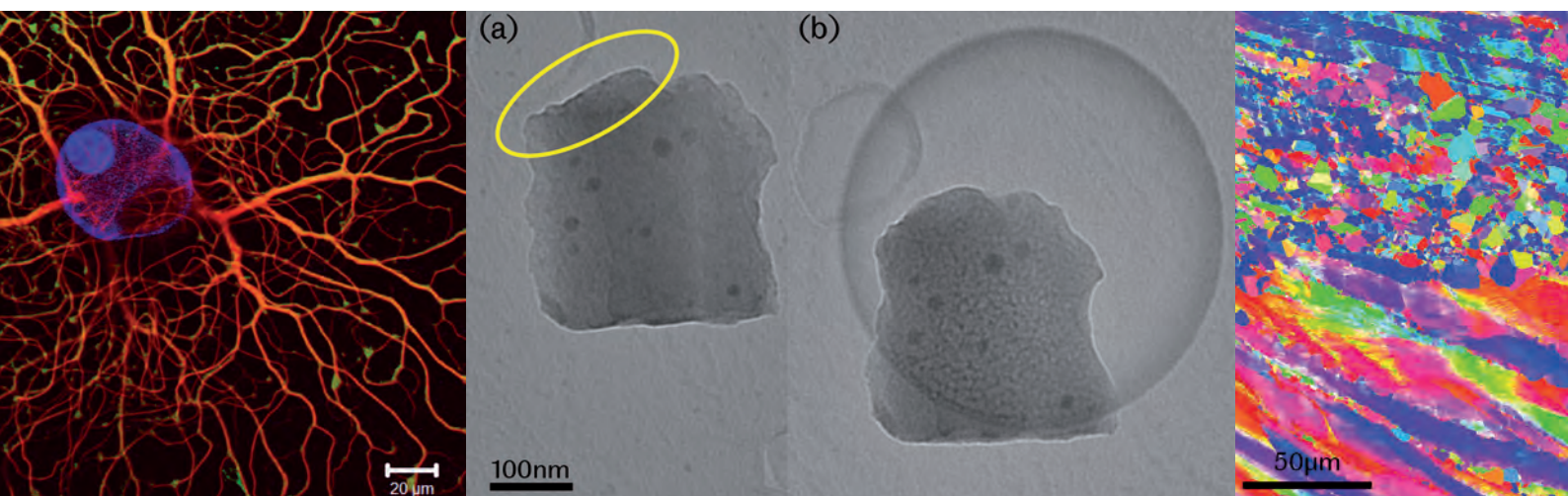


The
University
Of
Sheffield.

Research in Progress Supplement 2011



**Department of Materials
Science & Engineering**

The University of Sheffield

Department of Materials Science & Engineering

Research in Progress Supplement 2011

INCORPORATING

RESEARCH PUBLICATIONS AND GRANTS AWARDED IN 2010

April 2011

Cover Photography:

Background Image (left)

Nerve cells growing on a defined surface forming a neural network. This work is being conducted to investigate methods for repairing injuries to the nervous system (Image – C Murray-Dunning and J W Haycock).

Background Image (middle)

Electron irradiation induced surface rounding (see region encircled at top left) in parallel to nanoscale phase separation of an alkali-borosilicate fragment on carbon support. JEM 3010, 300kV. Electron beam exposed region is visible by circular carbon-deposited ring. The glass outside the beam is unaffected by both phenomena.

Background Image (right)

Inverse pole figure coloured electron backscatter diffraction map shows microstructure in a Fe-30%wtNi model austenitic alloy hot deformed to large strain. In the elongated deformed grains, well developed substructure consists of wavy microbands separated by dislocation sub-boundaries. Very fine equiaxial recrystallised grains nucleated on deformed grain boundaries and dislocation sub-boundaries.

Production Team:

Wendy Dutton and Mike Cooper.

Editor:

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1. Preface

Welcome to the latest Research in Progress Supplement, covering research activities in the Department during 2010. This was yet another successful year for the Department, on all fronts. A significant development was that we changed our name from Engineering Materials to Materials Science & Engineering; a name which better reflects our breadth of coverage in both research and teaching. The name change was agreed after extensive consultation with staff, students, industrial collaborators, those who support our research and of course our Industrial Liaison Committee.

During the year several members of our staff received personal accolades for their research achievements. Emeritus Professor Mike Sellars was awarded the IoM³ Bessemer Gold Medal for 2010. This is the premier award in the Metals discipline and recognises Mike's hugely important contribution to the steel industry over many years. Another colleague whose work has been acknowledged with an award during 2010 is Emeritus Professor Peter Wright. He received a Galileo Galilei Award for his ground-breaking discoveries in the field of polymer electrolytes.

We are delighted to see three of our younger staff promoted to Professorships. Neil Hyatt was appointed to the Chair in Radioactive Waste Management and became Director of the Immobilisation Science Laboratory; Beverley Inkson was promoted to a Personal Chair in Nanomaterials and John Haycock was promoted to a Personal Chair in Bioengineering. In addition Dan Allwood was promoted to Reader in Materials Physics.

During the year we recruited Dr Ihtesham Rehman as Reader in Biomedical Materials. Also Dr Patrick Theato joined the Department as Prize Senior Lecturer in Synthetic Polymer Chemistry. We warmly welcome Ihtesham and Patrick.

The Department has again achieved considerable success in obtaining grants for research projects. The three largest ones are described below:

Professor John Harding was awarded an EPSRC Programme Grant with the title "Hard-soft interfaces: from understanding to engineering" together with researchers at UCL, Cambridge, Warwick, York and Leeds (total value £5.3 million). John has also been awarded a European Grant with the title "Modelling of interfaces for high performance solar cell materials" (Acronym: HiperSol), together with SINTEF, Trondheim; The Energy Research Centre of The Netherlands, Petten; International Solar Energy Research Center, Sunways, Konstanz; Isoton, Andaluca; Universität Wien, Vienna; KTH Kungliga Tekniska Högskolan (Royal Institute of Technology), Stockholm; (total value 4,548,000 EUR).

The Mercury Centre for Innovative Materials and Manufacturing is an exciting new Centre created in the Department through a £5 million investment by the European Regional Development Fund (ERDF) and awarded to Prof Mark Rainforth and Dr Iain Todd. Project Mercury will boast the highest equipment investment in Europe for powder based near net shape manufacturing of industrial scale components. Equipment includes Additive Layer Manufacture, Deep Repair, Aerosol Jet Deposition, Spark Plasma Sintering, Metal Injection Moulding and Advanced Materials Characterisation. These innovative materials manufacturing techniques are applied in applications involving advanced metals, ceramics, coatings, functionally graded materials and biomaterials. Project Mercury is focused on transferring these technologies to regional industry and to developing the fundamental understanding of the processes.

This year, we are also pleased to welcome two new members to our Industrial Liaison Committee: Mr Gordon Bridge from AESSEAL plc and Dr John Hicks from Smith and Nephew Wound Management.

Finally, since my period of tenure as Head of Department will end in 2011, I'd like to take this opportunity to thank all colleagues and students for their tremendous efforts over the past 4 years in further raising the Department's research profile through many excellent publications, research discoveries and technology breakthroughs. The Department is at the leading edge in all key areas of materials research. Its work in the area of advanced manufacture is particularly pertinent at this time, as the nation and the region seek to bring the economy out of a severe recession. As ever, this Department is making a significant contribution to economic recovery, via its innovations in product development and advances in materials processes and also through its role as a leading centre for the training of highly capable engineers and scientists.

Allan Matthews

April 2011

2. Staff in the Department of Materials Science & Engineering

Head of Department:

Prof A Matthews a.matthews@ 0114 222 5466 Surface Engineering

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 Prof J H Harding j.harding@ 0114 222 5957 Materials Simulation
 Prof J W Haycock j.w.haycock@ 0114 222 5972 Cell and Tissue Engineering
 Prof N C Hyatt n.c.hyatt@ 0114 222 5470 Nuclear Materials Chemistry
 Prof B J Inkson Beverley.inkson@ 0114 222 5925 Nanomaterials
 Prof S MacNeil s.macneil@ 0114 222 5995 Cell and Tissue Engineering
 Prof W M Rainforth m.rainforth@ 0114 222 5469 Materials Science and Engineering
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 Prof D C Sinclair d.c.sinclair@ 0114 222 5974 Materials Chemistry
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 Prof A R West a.r.west@ 0114 222 5501 Electroceramics and Solid State Chemistry

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 Dr R J Hand r.hand@ 0114 222 5465 Glass Science and Engineering
 Dr G Möbus g.moebus@ 0114 222 5512 Microscopy and Materials Science
 Dr M I Ojovan m.i.ojovan@ 0114 222 6033 Waste Immobilisation and Materials Science
 Dr E J Palmiere e.j.palmiere@ 0114 222 5978 Metallurgy
 Dr I U Rehman i.u.rehman@ 0114 222 5946 Biomedical Materials
 Dr I Todd i.todd@ 0114 222 6011 Metallurgy
 Dr S Zhang s.zhang@ 0114 222 5958 Structural Ceramics and Refractories

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 Dr A Leyland a.leyland@ 0114 222 5486 Surface Technology
 Dr S J Matcher s.j.matcher@ 0114 222 5994 Biomedical Engineering
 Dr P Theato p.theato@ 0114 222 5490 Polymers
 Dr K P Travis k.travis@ 0114 222 5483 Modelling
 Dr B P Wynne b.wynne@ 0114 222 6026 Metallurgy

Lecturers:

Dr F Claeysens f.claeysens@ 0114 222 5513 Biomaterials
 Dr R Goodall r.goodall@ 0114 222 5977 Metallurgy
 Dr S A Hayes s.a.hayes@ 0114 222 5516 Aerospace Materials and Engineering
 Dr H Kinoshita h.kinoshita@ 0114 222 5930 Materials Chemistry and Geochemistry
 Dr N A Morley n.a.morley@ 0114 222 5935 Materials Physics
 Dr G Reilly g.reilly@ 0114 222 5986 Tissue Engineering
 Dr R P Thackray r.thackray@ 0114 222 5963 Steelmaking
 Dr X Zeng x.zeng@ 0114 222 5948 Polymers

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 Prof M Cable
 Prof H A Davies
 Prof F G F Gibb
 Prof G W Greenwood
 Prof P V Hatton
 Prof F R Jones
 Prof H Jones
 Prof J M Parker
 Prof C M Sellars
 Prof J H Sharp
 Prof R van Noort

Associate Professors:

Associate Senior Lecturer:

Dr D H Kirkwood

Associate Lecturer:

Dr J Devlin

Visiting Staff:

Prof N A Chapman	ITC, Switzerland
Prof P Curtis	DSTL
Prof S Franklin	Philips, The Netherlands
Prof A A Howe	Tata Steel
Prof P T McGrail	Composites and Polymers Consultant
Dr D Porter	Department of Zoology, University of Oxford
Prof W Smith	CCLRC Daresbury Laboratory
Prof Susan Stipp	University of Copenhagen
Prof J L Thomason	University of Strathclyde
Prof S Van der Zwaag	Delft University of Technology
Prof B Yilbas	KFUPM, Saudi Arabia

Senior Experimental Officer:

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Sorby Centre Manager:

Dr M I Highett	0114 222 5981
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SUMAC Consultants:

Dr J M Devine	0114 222 5497
Dr D A W Taylor	0114 222 5497

Short Courses Director:

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Departmental Superintendent:

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Financial Administrator:

Mr D M Binns	0114 222 5979
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Programme Manager, E-Futures DTC:

Dr N J Lowrie	0114 222 5506
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CCL Manager:

Mr G Brown	0114 222 5971
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Learning Technologist, Metals DTC:

Mrs K Thomson	0114 222 5475
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Project Manager, Metals DTC:

Dr C Hinchliffe	0114 222 5478
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Nanolab Project Administrator:

Mrs J Simpson	0114 222 5947
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IMMPETUS Administrator:

Miss M Szofer	0114 222 6018
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Research Fellows and Research Assistants:

Mr A Ahmed	Ms P Deshpande	Dr M Krzyanowski	Dr J Pokorny
Dr A J Beck	Dr R Dost	Dr O Latinwo	Dr N Reeves-McLaren
Mr L Ben	Dr J W Eichler	Dr M Li	Dr F Sefat
Mr U Bhatta	Mr R Evans	Dr F Liu	Dr J Sharp
Dr P A Bingham	Dr M Faraji	Mr Y Liu	Dr W Shen
Dr M A Shcherbina	Dr J P Foreman	Dr Z Liu	Dr A Sidambe
Mr M L Blackmore	Dr H Foxhall	Dr A Lockwood	Dr M C Stennett
Mr K Briston	Dr C L Freeman	Dr M Lopez-Pedrosa	Miss I Sterianou
Dr M Bryan	Mr J Ghatak	Mr Z Lu	Mr T Swait
Dr A J Bullock	Mr T Ghnanavel	Mr A Mangera	Mr H Uppal
Dr K Butler	Dr W Guan	Dr N Maso Carcasses	Dr C Utton
Dr D Cumming	Dr T Hayward	Dr S Miao	Dr A L Yerokhin
Dr J Dean	Dr J W Hinton	Dr K Muszka	Dr P Zeng
Mr F Derguti	Dr J N Kok	Dr I Ortega	Mrs W Zhang

Visiting Scientists:

Dr K Asano	Ms M Ricca	Ms A Vancostenoble	Dr Q Zhang
Mr M Kawakami	Mr N Schreven	Dr P M Vilarinho	Ms L Zhong
Dr E Krajewska	Dr C Stone	Dr D Xie	Dr N Zhu
Dr M Lahirigoyen	Prof J-B Sun	Dr X Yuan	
Ms Y Lei	Mr P Svara	Ms C Zhang	

KTP Associates:

Dr M Darby	Mr L Jiranek	Dr P Travaglia	Miss B Zalinska
Mr R Defley	Dr Z Mirza	Mr A T Winder	
Mr W S Flores Roman	Miss R Peachy	Dr X Xu	

Secretarial/Clerical Staff:

Mrs V M Dalton	PA to Head of Department, WMR/PT, Secretary to Advanced Metallic Systems DTC
Mrs K A Burton	PGR/PGT Admissions, Monitoring and Progress, ISL
Ms W Dutton	Exam Preparation and Monitoring/Prizes, FRJ/GU, Out of Hours, Research in Progress, Short Courses, Dept List
Miss R Fearon	Purchasing and Accounts, General Enquiries
Miss K L Heard	Secretary to SMN, Kroto Institute
Miss F E Kirk	Research Secretary to E-Futures DTC Director
Mrs L C Mason	Undergraduate Secretary/Support/DTQC Secretary/Enquiries/Exam Results
Mrs A Newbould	PG Monitoring and Progress, Secretary to HAD/JHH/DCS/MRJG
Miss E Noble	Support Secretary, Kroto Institute
Mrs T V Sampson	Teaching Databases, Taught Courses, UG Admissions (with UG Tutors)
Mrs A E Sargent	Purchasing and Accounts, JWS

Technical Staff:

Mr S Bater	Materials Processing
Miss D Bussey	Nanoindentor, STM
Mr M Carter	Teaching Laboratories, IT
Mr M G Cooper	Graphics, DTP, Web Pages, Audio Visual
Mr F G Fletcher	Electronics, Computing, IT
Mr P J J Hawsworth	Surface Engineering, Magnetic Materials
Mr D Haylock	Mechanical Testing, Materials Processing
Miss C Johnson	Tissue Engineering
Mr R I Kangley	Electrical, PAT, IT
Ms B C Lane	Materials Characterisation, Safety Officer
Dr L Ma	Electron Microscopy
Mr A G Mould	Electroc ceramics, Waste Immobilisation
Mr B G Palmer	Stores
Mr P Staton	Metallography, Materials Processing
Mr M J Wagner	Cleanroom Manager, Tissue Engineering
Mr I P Watts	Materials Processing
Dr P Zeng	Electron Microscopy

Turner Museum Staff:

Mrs A Marquis	Coffee Bar, Turner Museum of Glass
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3. Industrial Liaison Committee

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4. Academic Staff Profiles

Dr Dan A Allwood

BSc PhD MInstP CPhys

Reader in Materials Physics

Research centres on the understanding, analysis and application of patterned magnetic nanostructures and, in particular, magnetic domain walls in nanowires. Research uses both experiment and modelling, and consists of four main themes. Nanowire devices for information technology (e.g. memory) and biological applications (e.g. cell templating) are being developed. The study of how magnetic structures can interact with laser-cooled atoms hopes to lead to new stable platforms for quantum computation. New magneto-optical analytical techniques are being developed to improve the resolution and sensitivity of measurements of magnetic nanostructures.



Prof Michael Cable

**BScTech PhD DScTech TkDhc
HonFSGT**

*Emeritus Professor of Glass
Technology*

Current projects concern the history of glass technology as revealed by authorities of earlier times. Five books, three translated from French or German, covering the period from 1662 to 1868 have been published. The translation of the sixth, a long book by Eberhard Zschimmer, one of Schott's early scientific collaborators, (which Schott suppressed on its publication in 1912) is nearing completion. The seventh, a reprint of Rosenhain's "Glass Manufacture" of 1918, is also completed.



Dr Chuh K Chong

BSc PhD

*Senior Lecturer in Biomedical
Engineering*

Main research interest centres on cardiovascular fluid mechanics, focusing on understanding the role of haemodynamics in the pathogenesis of arterial diseases in normal and reconstructed vessels, the pharmacokinetics of drug-eluting stents, with the aim of designing better-performing customised vascular implants and bypasses. Another interest is in tissue engineering, particularly the cardiovascular system, focusing on the mechanics of soft tissues, developing functional cell-seeding device and bioreactors, scaffolds and matrices with desired architecture and material properties, with the aims of understanding the effects of materials, mass transport, biochemical cues and mechanical stresses on cell activities in purpose-designed bioreactors to develop better tissue constructs.



Dr Frederik Claeysens

Licentiate PhD Member RSC MRS

Lecturer in Biomaterials

Current research is focussed on biomaterials manufacture with laser based techniques. This research broadly falls into three categories: Coatings for biology: Biocompatible surface coatings of semiconductors to be integrated into cell-silicon interfaces for biosensors. Bioprinting: Laser based techniques for printing biomolecules/cells for producing biomolecule arrays and biosensors. Biomaterials manufacture via microstereolithography: Production of microstructured biomaterials for usage as tissue engineering scaffolds, via a laser based photocuring technique. Via scanning the laser through a photocurable resin, user-defined microstructures can be produced from a biocompatible polymer. This technique can be combined with self-assembly approaches to achieve hybrid biomaterials as 3D scaffolds for implants, tissue engineering and pharmaceutical testing.



Prof Hywel A Davies

**BSc PhD ARSM DIC CEng CPhys
MInstP FIMMM FEng**

*Emeritus Professor of Physical
Metallurgy and Magnetic Materials*

Research has concentrated mainly on the science and technology of solidification at ultra high cooling rates. The areas covered include: (i) the mechanisms of formation of metastable microstructures, with particular emphasis on amorphous and nanostructured alloys; (ii) the structures, properties and development of several classes of materials, including metallic glasses, novel nanophase hard and soft magnetic alloys and microcrystalline ferrous and non-ferrous alloys; (iii) the principles and applications of rapid solidification processing of advanced alloys, including the direct casting of thin strip and wire and powder atomisation followed by consolidation.



Prof Fergus G F Gibb

BSc PhD FGS

*Emeritus Professor of Nuclear
Decommissioning Agency Professor
of Petrology and Geochemistry*

Areas of expertise are in geological materials (minerals and rocks) and the geological disposal of radioactive waste, especially the concept of very deep borehole disposal on which he is an international research leader. Specific interests and activities in the context of this research currently focus on high pressure and temperature experimental mineralogy (especially nucleation, crystal growth and reaction kinetics) and modelling of heat flow in and around deep borehole disposals of heat-generating nuclear wastes. Career-long interest in (i) the electron probe microanalysis of minerals, glasses and other materials and (ii) the mineralogy and petrology of igneous rocks, particularly geochemical processes relating to the origins of basic/ultrabasic intrusions led to recognition as an international authority on the petrogenesis of basic sills.



Prof Michael R J Gibbs

BSc PhD CPhys FInstP MIEEE

Professor of Materials Physics and Director of the Centre for Advanced Magnetic Materials and Devices

Current research includes: the study of magnetoelastic materials, bulk and thin film; the study of permanent magnet thin films; the study of magnetic microelectromechanical systems (MagMEMS); the application of magnetic materials in sensors and actuators; the study of materials for applications in spintronics; the study of the principles and application of magnetic force microscopy.



Dr Russell J Hand

MA PhD MEd CPhys CEng FSGT

Reader in Glasses and Ceramics; Sub-Dean for Undergraduate Affairs, Faculty of Engineering

Research interests focus on the mechanical properties of ceramics and glasses. He has on-going research on the vitrification of radioactive and toxic wastes using borosilicate and other glasses. He is also interested in the use of glassy wastes in secondary applications. Other work includes the development of chalcogenide glasses for sensor applications, glass ceramics for dental applications and mechanical property-composites relations in silicate glasses.



Dr Russell Goodall

MEng PhD

Lecturer in Metallurgy

Principal research interests are in the processing, mechanical and thermal properties and applications of open-celled porous metals. This includes aluminium, which with a relatively high thermal conductivity, combined with low density and low cost is interesting for applications requiring heat transfer from or to a fluid medium. Open-cell foams made from other metals such as titanium can have applications as electrodes or as surgical implants, amongst many others. As well as foams (with pores or cells in random locations), he is also interested in porous structures with varying degrees of order, such as 3D lattice structures. Current challenges are the assessment of the suitability of processes for practical fabrication of foam parts, the development of methods to allow production of novel foam architectures, the characterisation of both the mechanical and thermal performance of the material and the further optimisation of the properties for certain applications.



Prof John Harding

MA PhD CPhys FRSC FInstP

Professor of Materials Simulation

Current research includes the development of methods to simulate atomistic processes with long timescales and their application to problems in bulk ceramics and at interfaces; simulation of the structures of interfaces of ceramics; simulation of organic/inorganic interfaces, nucleation and self-assembly (particularly in the context of biomineralisation and biomimetics); simulation of nanomaterials; mesoscale simulation of plasma-sprayed coatings. He is the organiser of an annual Summer School in Molecular Simulation.



Prof Geoffrey W Greenwood

BSc PhD DMet CPhys CEng FIMMM FInstP FREng FRS

Emeritus Professor

Interests are centred on atomic movements, especially in relation to microstructure and to the flux paths under mechanical, chemical and thermal driving forces. The applications relate to microstructural evolution, properties of interfaces and transitions between different modes of deformation and fracture.



Dr John W Haycock

BSc PhD

Professor of Cell and Tissue Engineering

Research interests in bioengineering which span 3 key areas: 1) Bioactive surfaces - controlling the behaviour of skin and nerve cells with adhesive, migratory and anti-inflammatory peptides; 2) Nerve tissue engineering - the integration of bioreactors and nerve guidance channels for repairing nerve injury, and the use of stem cells for glial cell differentiation and 3) Skin tissue engineering - the use of synthetic fibre scaffolds and human skin cells for 3D in vitro models to detect toxic and inflammatory compounds as an alternative to animal models.



Dr Simon A Hayes**BEng PhD***Lecturer in Aerospace Engineering*

Research interests encompass smart materials, nanocomposites and nanomechanical property determination. He is involved in the development of sensors for damage detection, cure monitoring and through-life environmental condition monitoring in polymer-matrix composites. He has also developed a patented technology for the healing of damage within composite structures. He has projects examining the mechanical properties of clay and nanotube-based nanocomposites. He is also involved in the development of nanoindentation for the analysis of soft viscoelastic materials.

**Dr Neil Hyatt****BSc PhD MInstP***Professor in Materials Chemistry*

Research is focussed on the understanding of structure – property relationships in the solid state and the application of diffraction techniques under extreme (high pressure/temperature) conditions.

Current areas of research interest include the synthesis and characterisation of dielectric and ferroelectric materials; the immobilisation of high level nuclear waste in glass and ceramic matrices; structural studies of the vitreous state; pressure induced spin state transitions in perovskite related oxides; and the synthesis of new materials under extreme conditions.

**Prof Andy Howe****MA PhD FIMMM CEng***Visiting Professor, Tata Steel plc*

Research interests cover micro-structural evolution in steels including solidification and microsegregation, solid state phase transformation and recrystallisation. Current research includes the streamlined modelling of solidification at the micro-scale for coupling with macro-models, and the development of ultra-high strength steels.

**Dr Beverley J Inkson****MA PhD***Professor of Nanomaterials*

Research interests focus on the mechanical and electrical properties of metals and ceramics at the nanoscale, with an emphasis on how nanostructures and surface films behave differently from conventional bulk materials. Current projects include tribology and surface wear of structural nanocomposites, mechanical stability of nanowires, reliability of MEMS devices, nanoprocessing of surface structures using focused ion beams (FIB), nanocharacterisation (3D TEM/SEM/FIB, tomography, in-situ TEM), and nanoindentation.

**Dr Gino Hrkac****Dr techn Dipl ING***Royal Society University Research Fellow*

Main research area is computational and theoretical magnetism, and especially the development of a numerical model to investigate and predict the behaviour of magnetic spin valve systems and the effect of eddy currents in nano-scale materials. He is working on the theoretical and numerical description of spin electronic devices on a length scale ranging from the computation of the local spin current density and magnetization dynamics with a sub-nm resolution in micron size devices (magnetic nano pillars and Magnetic Tunnel Junctions). A prominent example for his work is the theoretical explanation of the angular dependency of phase locking phenomena in point contacted spin valves and his work on the simulation of spin current induced magnetization dynamics that explained the low frequency oscillations found in point contact devices that were explained by vortex oscillations. His latest research includes ab initio simulations of atomic structures, solid state molecular dynamics for the simulation of the transition of amorphous to crystalline grain boundaries in NdFeB magnets within the framework of an industrial funded project on permanent magnets (European-Japanese consortium).

**Dr Martin Jackson****MEng PhD DIC***Royal Academy of Engineering/ EPSRC Research Fellow and Lecturer Elect*

Research interests centre on solid state processing, microstructural/textural evolution and phase transformations in light alloys. Major research focus is development of low cost non-melt consolidation routes for particulate titanium-based feedstock from emerging reduction processes. Current research in titanium also includes; (i) microstructural evolution during isothermal forging of high strength alloys used in airframe forgings; (ii) alpha case formation/crack initiation in alloys used in aeroengine gas turbine compressors. Other research interests include the superplastic behaviour of aluminium and magnesium alloys during processing for automotive applications.



Prof Frank R Jones

PhD FIMMM CEng FRSC CChem CSci

Emeritus Professor of Polymers and Fibre Composites

Research centres around correlations between molecular aspects and macroproperties of polymer matrix composites using micro-mechanical and surface analytical techniques. He has extensive research programmes on interfacial molecular engineering using plasma polymerisation; development of phase-stepping photoelastic techniques for quantifying adhesion; environmental effects specifically mechanisms of moisture absorption and thermal and hygrothermal degradation of advanced high temperature matrix systems. Group Interaction modelling of resin properties for understanding the durability of a composite from a full knowledge of the matrix performance.



Prof Howard Jones

BSc PhD CEng FIMMM

Emeritus Professor of Metallurgy and Materials

Research interests include mechanisms and modelling of solidification in general and especially, the mechanism of dendritic and eutectic growth in alloys. He has a longstanding interest in the high temperature behaviour of materials, in particular the stability of microstructure and mechanical properties. Other areas of interest include: consolidation of particulate rapidly solidified materials, together with the development of intermetallics as engineering materials, the fundamentals of ceramic/metal bonding, metallic matrix composites and wettability studies.



Dr Hajime Kinoshita

BSc MSc DSc

Lecturer in Materials Chemistry and Geochemistry

Main interest of research is in thermodynamic aspects of environmental materials for waste treatment. Research interests include: electrochemical aging of durable materials for prediction of long-term stability in geological environments; CO₂ immobilisation in recycled cementitious materials; decontamination of alloys with molten salts; influence of thermodynamic parameters on O²⁻ ion conductivity in stabilised zirconia; molten state processing of ceramic materials for waste immobilisation; thermodynamic modelling and phase diagram calculation.



Dr Adrian Leyland

BSc PhD MInstP

Senior Lecturer in Surface Technology

Research interests are focused on Surface Engineering and Tribology, specialising in plasma-assisted Physical Vapour Deposition (PVD) of nanostructured ceramic coatings (for wear resistance and/or adaptive behaviour in extreme environments), metallic nanocomposite/glassy-metal coatings (for combined wear and corrosion protection), duplex plasma-diffusion/PVD-coating treatments (to improve the load-bearing capacity of light alloys and stainless steels in sliding wear applications) and the development of tribological testing/property evaluation techniques for coatings.



Prof Sheila MacNeil

BSc PhD

Professor of Tissue Engineering

Primary research interests are the production of tissue engineered skin and oral mucosa and corneal tissues for clinical application. Additionally, research has led to the development of a wide range of 3D tissue engineered epithelial models which are being used to investigate a range of normal and disease conditions. Some of the groups' current tissue engineering challenges for translation to the clinic are developing a carrier for delivery of cultured corneal epithelial cells for diseases of the cornea, developing tissue engineered materials for repair of the pelvic floor in women suffering from stress incontinence and developing new approaches to a one stage in theatre approach to producing split thickness skin for elective surgery applications.



Dr Stephen J Matcher

BSc PhD Member SPIE OSA BMS ESM

Senior Lecturer in Biomedical Engineering

Current research interests: development of optical imaging and spectroscopy to characterize bioengineered tissues in vitro and in situ. Main techniques are optical coherence tomography and microscopy, elastic scattering spectroscopy, second-harmonic and two-photon microscopy. He is particularly interested in the collagen structure of connective tissue and how this is altered in disease, in techniques to assess tissue perfusion and cellular bioenergetics in vivo and in Doppler techniques to study the microcirculation.



Prof Allan Matthews**BSc PhD FIMMM FIMechE FIET FIMF***Head of Department and Professor of Surface Engineering*

Main research interests involve plasma-based surface coating and treatment processes, and techniques for surface characterisation and evaluation. Current projects include the deposition of nano-composite tribological coatings by sputter-deposition, the surface modification of lightweight metals by plasma electrolytic oxidation, low-temperature deposition of phase-stabilised oxide ceramic coatings, and plasma diagnostics and control studies. He is also involved in the development of computer-based coating selection systems.

**Dr Günter Möbus****DiplPhys Dr rer nat (PhD)***Reader in Microscopy and Materials Science*

Research is focussed on the characterisation of materials on the atomic and nano-scale, including development of quantitative electron microscopy techniques for 3D-mapping of microstructure, composition, strain, and retrieval of crystal defect structures. Within the context of immobilisation science, modern characterisation techniques, such as tomography, 3D reconstruction, and fine structure spectroscopy are used to detect the local composition and microstructure in glasses and ceramics, and to determine local coordination and oxidation states of cations.

**Dr Nicola Morley****MPhys PhD MemInstP***Lecturer in Material Physics*

Current research includes: manipulating the anisotropy and magnetostriction of thin Fe-based magnetic films and multilayers; novel spintronic devices, which include organic polymer spacer layers; spin-interface investigations at organic-magnetic interfaces; organic intrinsic magnetoresistance of conjugated polymers and small-molecules; using muons to measure the intrinsic transport properties of polymers.

**Dr Michael I Ojovan****MSc PhD DSc FRANS FMRS MSGT***Reader in Materials Science and Waste Immobilisation*

Research interests focus on physics of metastable states, structure and properties of disordered systems and Rydberg matter, radiation-induced effects in solids. Recent work has included analysis of durability and long term performance of nuclear waste immobilising glasses and glass-composite materials, development of nuclear waste processing techniques including thermochemical decontamination and self-sustaining immobilisation.

**Dr Eric J Palmiere****BSc MSc PhD CEng***Reader in Metallurgy*

Research involves the microstructural evolution, and the subsequent development of mechanical properties, during the thermomechanical processing of both ferrous and non-ferrous alloys with a primary focus on ferrous alloys such as stainless, microalloyed steels and associated model alloy steels. He is particularly interested in developing a basic understanding between those softening (i.e. recovery, recrystallisation) and strengthening (i.e. solid solution formation, precipitation) mechanisms which occur either in austenite or in ferrite.

**Prof John M Parker****MA PhD FIMMM CEng FSGT***Emeritus Professor of Glass Science and Engineering*

Research has included a number of themes based around structure, crystallisation and optical properties. Current major topics are glass colour and how specific ions can act as probes for local structure associated with segregation such as complex formation or fictive temperature behaviour. A particular interest is the modelling of absorption spectra as an aid to composition design for glass makers particularly when using high fractions of recycled glass. An ongoing interest is how the formation of nanocrystals within a matrix can influence the environment of dopant ions and produce specific optical effects.

**Prof W Mark Rainforth****BMet PhD FIMMM CEng FInstP CPhys***Professor of Materials Science and Engineering*

Research focuses on developing a mechanistic understanding of microstructural evolution as a basic pre-requisite to the development of physically based modelling of both metals and ceramics. Huge gains have been made in the quantification of microstructure across the length scales, including field emission gun TEM techniques for determining chemical and physical structure at the atomic scale, focussed ion beam (FIB) microscopy for the determination of surface structure (e.g. oxides) and high resolution backscatter electron diffraction (EBSD) for texture and phase distribution analysis. Such techniques are applied to the structure of nanoscale coatings, the evolution of deformation and precipitation substructures during hot working, and surface structures developed through friction and high temperature exposure.



Prof Ian M Reaney

BSc MSc PhD MInstP CPhys CEng FRMS

Professor of Ceramics

Main research theme is the use of transmission electron microscopy and Raman Spectroscopy to study the structure and microstructure of electroceramics as well as the development of new or improved materials for commercial applications. His research activities are mainly concerned with dielectric resonators for microwave communications as well as materials for sensor and actuator applications. He also has interests in glass ceramics for biomedical applications.



Prof Thomas Schrefl

DI Dr Techn

Professor of Functional Materials

His expertise is in materials and device modelling using finite element and fast boundary element methods. The primary goal of his modelling is to obtain a better understanding of the influence of the microstructure on the properties of the materials and the application of this knowledge to simulate the functional behaviour of devices over multiple length scales. Current research includes: the simulation of hard disk recording, finite element micromagnetics, nanostructured magnetic materials, spin electronic devices, magnetic memories (MRAM), and magneto-elastic sensors.



Dr Ihtesham ur Rehman

BSc MSc PhD

Reader in Biomedical Materials

The focal point of his research has been the identification and understanding of the fundamental mechanisms by which chemical responses are mediated by nan- to micro-scale variations in biomaterials, with the main emphasis on the development of synthetic inorganic bone analogue materials and characterisation of natural tissues.

Current research covers the following themes:
Analysing Cancer with Spectroscopy: FTIR and Raman spectroscopy of cancer tissues and cells with the aim of developing diagnostic techniques for cancer. Polymers and Bioactive Composites: Development of an auxetic biodegradable drug-eluted stent-graft in the palliation of oesophageal cancer. Bioactive composite materials: Development of improved ceramic/polymer composites for osteological and dental applications. Dental Materials: Glass-ionomers, nano-ceramics and nano-composites for dental restoration.



Prof C Michael Sellars

BMet PhD DMet HonCMechD FREng FNAE (India) FIMMM

Emeritus Professor of Metallurgy

Current research interests centre on thermomechanical processing of metals and alloys, with emphasis on the microstructural changes produced and their effects on properties. The work is based on basic laboratory studies using plane strain compression testing, laboratory scale rolling, extrusion and forging, which have been used to provide data required to develop computer models of microstructural evolution and to validate the predictions of the models. Experimental studies have been carried out on a wide range of alloys including high strength low alloy (HSLA) steels, stainless steels, aluminium alloys, nickel-based superalloys, IF steels and iron aluminides.



Dr Gwendolen Reilly

BSc DPhil

Lecturer in Tissue Engineering

Background: bone biomechanics; transduction of mechanically induced signals in bone cells; bioactive glasses as a scaffold for bone tissue engineering; skeletal cell differentiation. Research aims: investigating the use of mechanical stimuli to enhance strength of tissue engineered bone and cartilage; examining the effect of biomaterial scaffolds on skeletal cell mechanical responses; mechanical manipulation of tissue engineered matrix structures. Our laboratory is particularly interested in using tissue engineering to create 3D bone models for use as an alternative to animal experiments in the testing of orthopaedic pharmaceuticals and devices.



Prof John H Sharp

BSc PhD CEng FIMMM

Emeritus Professor of Ceramic Science

Major on-going interest is in the chemistry of cements. Current topics include the hydration reactions and durability of Portland cement and composite cements (involving the partial replacement of Portland cement by waste materials or mineral products) used for nuclear waste management, and durability studies into the formation of delayed ettringite and thaumasite in Portland cement systems. In particular, the effects of pH, temperature and carbon dioxide on the thaumasite form of sulfate attack.



Prof Derek C Sinclair**BSc PhD CChem MRSC***Professor of Materials Chemistry*

Research interests are primarily involved with the synthesis and characterisation of oxide-based electroceramics. Current work includes investigating composition-structure-property relationships in important electroceramics, explorative phase diagram studies and speculative synthetic work on 'new' materials with superior electrical properties. The latter approach is being used to discover new mixed ionic/electronic conductors, proton conductors, microwave dielectrics, ferroelectrics, piezoelectrics and low temperature cofired ceramics.

**Dr Richard Thackray****BEng PhD DIC***Tata Steel Lecturer in Steelmaking*

Research interests are in continuous casting of steel, in particular the role of mould powders in the processing route, where models have been developed which relate the viscosity, break temperature, and crystallinity of the powder to the successful performance of the casting operation. New research into evaluating the suitability of F-free fluxes to replace existing fluxes will also be carried out in the near future. In addition, work to understand the complex flow of metal during the casting process, and the associated heat transfer effects and product quality implications, using process modelling techniques is also ongoing.

**Dr Patrick Theato****PhD***Senior Lecturer in Synthetic Polymer Chemistry*

Research interests include the defined synthesis of reactive polymers, design of multi-stimuli-responsive polymers, bioconjugates, versatile functionalization of interfaces, inorganic-organic hybrid polymers, polymers for electronics and templating of polymers. The focus of the research is synthesis of polymers, especially functional polymers. Over the last year his group has developed an expertise to prepare highly functionalised polymers and block copolymers with a precisely defined architecture. This has led to a series of new research projects within various areas. Based on the synthesis of functional polymers one of the primary interests has been the behaviour of functional polymers on surfaces and/or at interfaces. The behaviour of ultra-thin polymer films on surfaces and the respective influence on surface properties can be understood and controlled in a very elegant manner. The synthetic strategy of applying controlled polymerisation methods (e.g. controlled radical polymerisation, ring opening metathesis polymerisation, etc.) has expanded into different research areas, most recently light-responsive polymers.

**Dr Iain Todd****BEng PhD***Reader in Metallurgy and Research Director of the Innovative Metals Processing Centre*

The development of novel processing technologies and metallic materials forms the core of his present research activity. Current work includes: the development of novel processes for the production of titanium components by powder metallurgical routes; modelling microstructure evolution during additive manufacturing processes; the manufacture of Ti components for biomedical applications and the kinetics of Bulk Metallic Glass formation and their physical properties. Work is conducted through the Innovative Metals Processing Centre and in collaboration with Industry and the Advanced Manufacturing Research Centre with Boeing at the University of Sheffield.

**Dr Karl P Travis****BSc PhD CChem MRSC***Senior Lecturer in Modelling Materials*

Research interests cover Theoretical and Mathematical Physics, particularly of condensed phases; structure-property relationships of materials; and the thermodynamic behaviour of nano-confined fluids. Research is currently focussed on applying atomistic, mesoscale and continuum modelling techniques to problems connected with the storage of nuclear waste. Some current topics under investigation include: modelling radiation damage in ceramic wasteforms, modelling the conductive flow of heat in very deep geological disposal scenarios and developing Dissipative Particle Dynamics for predicting phase behaviour and rheology in complex mixtures.

**Prof Panos Tsakiroopoulos****D Eng Mining Eng - Metallurgy
MMet PhD***Professor of Metallurgy and POSCO Chair of Iron and Steel Technology*

Research interests are in the design and development of ferrous and non-ferrous alloys and composites for the energy, transport and aerospace industries via process-microstructure-property studies. His research includes materials that are suitable for airframe and landing gear applications as well as materials for high and ultra high temperature applications in gas turbines. Materials processing is also researched as part of the alloy development. The emphasis of the research is on establishing (i) the effects of processing on the microstructure and properties of structural engineering materials and (ii) how processing can be tailored to particular engineering requirements for desirable microstructures and properties. An essential part of the research is the study of nucleation in under-cooled alloy melts and solid state phase transformations in alloys and in situ composites to generate the underpinning science in the development of metallic materials. Currently, alloys of Fe, Mo, Nb, Ti and Zr are under investigation.



Prof Goran Ungar

BSc PhD CPhys

Professor of Polymers and Organic Materials

Research interests include structure, phase behaviour and properties of liquid crystals (LC), polymers and supramolecular systems, as well as inorganic-organic hybrids and metamaterials, based on LC in nanopores and LC-modified nanoparticles. Our speciality are highly complex structures with 2D or 3D order in dendrimers and amphiphilic compounds, and soft quasicrystals. We use X-ray (synchrotron) and neutron scattering, as well as different electron, scanning probe and optical microscopy techniques. Another research area is structure and morphology of semicrystalline polymers. This includes monodisperse model polymers in the form of ultra-long chain n-alkanes, biodegradable polymer fibres, and new crystallization mechanisms (e.g. "self-poisoning" crystallization).



Prof Anthony R West

**BSc PhD DSc CChem CPhys FRSC
FInstP FIMMM FRSE**

Professor of Electroceramics and Solid State Chemistry

Current research includes: the development of new spinel cathode materials such as LiCoMnO_4 for lithium batteries; synthesis and characterisation of new ferroelectrics and relaxor ferroelectrics with tetragonal tungsten bronze structure; new Li^+ ion and O^{2-} ion conducting solid electrolytes; structures of Mn-based complex perovskites and Bi pyrochlores; probing the structure-property correlations that control the performance of zinc oxide varistors, barium titanate PTCR devices and CaCu titanate barrier layer capacitors. He is also well-known for his books on Solid State Chemistry.



Prof Peter V Wright

BSc MSc PhD

Emeritus Professor of Polymers

Best known as the inventor in the mid-1970s of polymer electrolytes. His main research activities are now involved with electroactive polymeric materials, particularly low dimensional crystalline and liquid-crystalline systems with enhanced conductivities. Another major area of research is the development of novel 'large-area' polymer films with switchable impedances, in particular for the control of microwave transmission ("microwave smart windows"). Other areas of interest include: the interaction of ions with water soluble polymers in aqueous solutions and ring-chain equilibria, particularly in polysiloxane systems.



Dr Bradley P Wynne

BEng PhD

Senior Lecturer in Metallurgy

Research interests focus on the thermomechanical processing of metals and alloys, particularly the interrelationship between the constraints imposed by the deformation conditions and the constraints on flow behaviour generated by crystal structure and crystallographic texture, which in turn determines deformation microstructure evolution. Currently his major focus is on the effects of non-linear strain paths on microstructure evolution. The overall aim of this research is to develop true internal state models for microstructure evolution to replace our current empirically based models which are often inadequate when deformation conditions are complex.

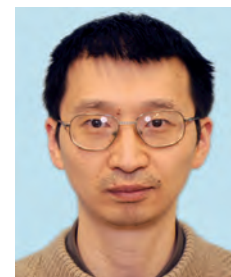


Dr Xiangbing Zeng

BSc MSc PhD

Lecturer in Polymers

Current research concerns 1-d, 2-d, 3-d ordered nano-structures (1-100 nm) in macromolecular and supramolecular systems, with potential applications for molecular electronics, photonics etc. The main methods used are small angle x-ray and neutron scattering (SAXS and SANS). These experiments are often carried out in real-time in order to catch transient structures and rapid transformations such as occur in real-life, industrial processing of polymers.



Dr Shaowei Zhang

BSc MEng PhD

Reader in Structural Ceramics and Refractories

His main research interests are in the processing, microstructures and properties of structural ceramics and refractories. Current research topics include development of next generation carbon-containing refractory composites, improvement of hydration resistance of lime-based refractories, molten salt synthesis of ceramic powders, and preparation of oxide nanoparticles. Other work includes fabrication of carbon nanotube-based composites, development of ultrahigh-temperature ceramics and *in-situ* generation of carbide/oxide nanotubes/nanorods.



5. Publications, 2010

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- 228. N Zhu and A R West** "Formation and stability of ferroelectric BaTi₂O₅", *J Am Ceram Soc*, **93(1)** (2010) 295-300.

6. PhD Awards, 2010

1. **Nayef Mohsen M Al-Anazi** "Plasma electrolytic oxidation treatment of ion vapour deposition aluminium and aluminium-magnesium alloy coatings". Supervisors: Dr A Leyland/Prof A Matthews.
2. **Peter Bailey** "Through life monitoring of composites using embedded evanescent wave spectroscopy". Supervisors: Dr S A Hayes/Dr R J Hand.
3. **Swaraj Basu** "Magneto-static interactions in ferromagnetic nanostructures". Supervisors: Dr D Allwood/Prof M R J Gibbs.
4. **Liubin Ben** "Synthesis and characterisation of rare-earth and calcium doped BaTiO₃ ceramics". Supervisor: Prof D C Sinclair.
5. **Karima Bertal** "Study of newly synthesised thermo-responsive triblock copolymers for potential wound dressing applications". Supervisors: Prof S MacNeil/Prof S Armes.
6. **Rahul Bhattacharya** "Hot deformation studies on magnesium AZ31 alloy using plane strain compression". Supervisors: Dr B P Wynne/Prof W M Rainforth.
7. **Kevin Briston** "Functional testing of individual nano-objects using in-situ electron microscopy". Supervisors: Prof B J Inkson/Prof T Cullis.
8. **Richard Collins** "Stability of thickwalled tubes under torsion and their use as a novel control valve". Supervisors: Dr S A Hayes/Dr S J M Beck.
9. **Raelene Gowie** "The effect of high frequency, low intensity vibration on mesenchymal cells in vitro". Supervisors: Dr A M Scutt/J M Riglesford.
10. **Dhanalakshmi Dhandapani** "Spin dependent transport in organic materials". Supervisors: Dr N A Morley/Prof M R J Gibbs.
11. **Tamer Elsayed** "Modelling the strengthening of glass using epoxy based coatings". Supervisor: Dr R J Hand.
12. **Simon Foster** "Plasma polymerisation of PDMS-based microfluidic devices: production and application". Supervisors: Dr S L McArthur/P C Wright/Dr G Battaglia.
13. **Thirunavukkarasu Gnanavel** "Nanofabrication techniques for ferromagnetic nanostructures". Supervisors: Dr G Möbus/Prof M R J Gibbs.
14. **Oliver Hannant** "Structural characterisation of vitrified wastes". Supervisors: Dr R J Hand/Dr P A Bingham and Dr S Forder (Sheffield Hallam University).
15. **Vanessa Hearnden** "Developing tissue engineered models of oral mucosa and oral cancer to study novel therapeutic and diagnostic techniques". Supervisors: Prof S MacNeil/Dr G Battaglia/M H Thornhill.
16. **Oliver Hernandez-Silva** "The effect of strain path on microstructure". Supervisors: Dr B P Wynne/Prof W M Rainforth.
17. **Jordi Jacas Biendicho** "Impedance characterisation of different olivine-based compositions". Supervisor: Prof A R West.
18. **Athar Javed** "Magnetic properties of Fe-Ga thin films". Supervisors: Prof M R J Gibbs/Dr N A Morley.
19. **Hannah Lomas** "Biomimetic polymer vesicles for gene delivery". Supervisors: Prof S MacNeil/Dr G Battaglia.
20. **Le Ma** "Wear behaviour of biolox delta ceramic composite for joint replacements". Supervisor: Prof W M Rainforth.
21. **Claudia Marques** "Tissue engineered human skin models to study the effect of inflammation on melanoma invasion". Supervisor: Prof S MacNeil.
22. **Akemi Nogiwa Valdez** "Effect of ternary oxide additions on the hydrothermal degradation resistance of 3Y-TZP". Supervisor: Prof W M Rainforth.
23. **Mahaboob Pasha** "Raman spectroscopy of barium titanate based ceramics". Supervisor: Prof I M Reaney.
24. **David Randman** "Deformation mechanisms in magnesium alloy electron 675". Supervisor: Prof W M Rainforth.
25. **Lyubka Spasova** "Feasibility of acoustic emission testing and analysis applied to materials encapsulating nuclear wastes". Supervisor: Dr M I Ojovan.
26. **Timothy Swait** "Interfacial optimisation of glass fibre reinforced composites by plasma polymerisation". Supervisors: Prof F R Jones/Prof C Soutis.
27. **Damir Tadjiev** "Near surface mechanical properties and hydration of silicate glasses". Supervisors: Dr R J Hand/Dr S A Hayes.
28. **Chaou Choak Tan** "Suppression of semiconductivity in the B-site ordered perovskite BA₂Bi₃+Bi₅+O₆ by chemical doping". Supervisors: Prof D C Sinclair/Prof I M Reaney.
29. **Yi-Lin Tsai** "Phase relationships and electrical properties of undoped and Mn-doped ACu₃(Ti, Nb, Ta)₄O₁₂ perovskites". Supervisor: Prof D C Sinclair.
30. **Cheng Cheng Wang** "Study of interface between glass fibre and polyimide". Supervisor: Prof F R Jones.
31. **Beata Zalinska** "Bismuth-based glasses, glass-ceramics and composites for microwave applications". Supervisor: Prof I M Reaney.

7. Current Research Sponsors

The Department of Materials Science & Engineering is very grateful to the organisations listed below for their material support of our research. Our level of research activity would have been impossible without their generous contributions.

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White Rose Consortium
Worshipful Company of Ironmongers
WRAP (Waste and Resources Action Plan, UK Government)
Wuhan Iron and Steel Company (WISCO)

Yorkshire Forward
York Pharma

8. Grants and Contracts Awarded 2010

Awarding Body	Grant Holder	Project Title	Value of Award
Sellafield Ltd	Dr P A Bingham Dr R J Hand Prof N C Hyatt	Literature survey for Sellafield PCM	£24,000
European Commission	Prof J H Harding	HIPERSOL	£292,265
White Rose University Consortium	Prof J H Harding	Composite crystals; a key to understanding biomineralization and engineering superior materials?	£5,000
National Nuclear Laboratory	Prof N C Hyatt Dr H Kinoshita	Analysis of VTR glass	£18,355
University of Leeds	Prof J W Haycock	Fabrication of nerve guides for promoting neural integration and migration	£66,018
Timet UK Ltd	Dr B P Wynne	Microstructure and texture evolution during billet processing of Ti-6Al-4V	£77,000
Biotechnology and Biological Sciences Research Council	Prof J W Haycock	Construction of an immuno-competant and self-reporting human lung model using nanosensor-incorporated scaffolds	£27,289
EPSRC	Prof I M Reaney	Visiting Academic Fellowship	£23,799
EPSRC	Dr D Allwood	Magneto-optical Kerr effect with non-uniform beam polarisations	£149,064
EPSRC	Prof A Matthews Dr A Yerokhin	Breakthrough studies on the Plasma Electrolytic Oxidation (PEO) coating process	£601,156
National Nuclear Laboratory	Prof N C Hyatt Dr P A Bingham Dr H Kinoshita	HIP sample characterisation for>NNL	£985
Department of Health	Dr F Claeysens Prof J W Haycock	Micro-structured conduits for peripheral nerve repair	£79,668
Airbus UK Ltd	Prof F R Jones Dr S A Hayes	Airbus-Self-sensing and self-healing of damage in composites	£216,000
The Urology Foundation	Prof S MacNeil	Development of an autologous fibroblast impregnated tissue for use in urological procedures for stress urinary incontinence and prolapse repair	£54,648
EPSRC	Prof J H Harding	Hard-soft matter interfaces: from understanding to engineering	£1,351,374
University of Leeds	Dr D Allwood	Critical Mass	£11,041
European Commission	Prof P Tsakiroopoulos	H2-IGCC	£184,688
Rolls-Royce PLC	Prof A Matthews Dr A Leyland	DLC Coating Performance Evaluation	£120,000
The Wellcome Trust	Prof S MacNeil Dr F Claeysens	Development of a synthetic biodegradable cell carrier membrane for the transplantation of cultured cells or freshly excised autologous tissue (limbal segments or oral mucosa) for diseases of the cornea	£418,240
EPSRC	Prof N C Hyatt Dr M C Stennett Prof W M Rainforth	UK-India research collaboration	£217,384

EPSRC	Dr F Claeysens	NEURAL SCAFFOLDS - first grant scheme	£98,277
Sheffield Hospitals Charitable Trust	Prof S MacNeil	Scalds and superficial burns research	£24,870
EPSRC	Prof J H Harding	Environmental BioEngineering from first principles	£20,175
EPSRC	Prof J H Harding	Creativity@home	£11,250
Rolls-Royce PLC	Dr I Todd	IMPC Continuation	£37,308
European Regional Development Fund	Prof W M Rainforth Dr I Todd	MERCURY	£2,672,020
POSCO	Dr E J Palmiere	A study on improving plastic strain capacity of X80 linepipe steel	£22,952
European Regional Development Fund	Prof W M Rainforth Dr I Todd	MERCURY CAPITAL PROJECT	£2,472,266
Toyota Motor Cooperation	Dr G Hrkac	Temperature dependency of Coercivity in NdFeB magnets	£225,000
EPSRC	Dr S J Matcher	Next Generation OCT Sources_ResponsApp	£366,926
Rolls-Royce PLC	Dr R Goodall	Rolls Royce Research Associate	£93,759
National Institute for Health Research	Prof S MacNeil	Devices for Dignity	£12,000
Rolls-Royce PLC	Dr I Todd	Commercial	£45,328
KTP	Dr I Todd Dr R P Thackray Prof J H Harding	LPW Technology Ltd	£133,900
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Royal Society	Dr M Faraji	The Iron and Steel Technology Conference and Exhibition, AISTech 2010	£1,100
UK Resource Centre for Women	Dr N A Morley	SpinOS Conference, Amsterdam	£800
Royal Society	Dr A Yerokhin	12th International Conference on Modern Materials and Technologies (CIMTEC)	£1,250
Royal Society	Dr O Latinwo	7th International Symposium on Superalloy 718 and derivatives	£500
Royal Society	Dr R J Hand	ICG2010	£1,000
OVERALL TOTAL			£10,896,160

9. Department Highlights, 2010

9.1 Personal Highlights, 2010

Dr Dan Allwood

- Organised IEEE Magnetics Society meetings at the University of York, 7th May 2010 and at the University of Sheffield, 25th November 2010. The York meeting included a talk by Professor Claudia Felser (Johannes Gutenberg Universitat Mainz), who was one of the 2010 IEEE Magnetics Society Distinguished Lecturers, and five invited speakers from across the UK, including **Dr Gino Hrkac** presenting “*Current driven vortex oscillations/dynamics in nanopillars*”. The meeting had 70 participants, including 13 members of the Sheffield magnetics group. The Sheffield meeting focused on students and PDRAs, and was attended by 40 participants. At this meeting, Dr Allwood was also elected to Chair of the UK and RI Chapter of the IEEE Magnetics Society.
- Attended the Joint MMM-Intermag conference in Washington DC, USA, January 2010, where his group had five presentations, and gave an invited talk at the IEEE Magnetics and Multilayers conference in Berkeley, USA (Aug 2010).
- Gave a departmental seminar at the Department of Physics, University of Cambridge, November 2010.

Dr Alison Beck

- With Ayesha Sohail (Department of Applied Mathematics) and Dr Danny Law (Daresbury Laboratory) with the Scienta X-ray photoelectron spectrometer. **Dr Alison Beck** and **Prof Allan Matthews** were awarded 2 days analysis time on the high resolution X-ray photoelectron spectrometer at Daresbury Laboratory, May 2010.

Dr Paul Bingham

- Attended the Society of Glass Technology Annual Meeting in Cambridge, 8th-10th September with **Dr Russell Hand**, **Prof John Parker**, **Mr Nathan Cassingham**, **Mr Owen McGann** and **Ms Matthana Khanghamano**. The conference was well-attended academically and all of the above attendees gave oral presentations. The students took part in the New Researcher's Forum, which provides a friendly environment for students to present their research to colleagues. Science, Industry and History & Heritage sessions provided plenty of opportunity for more established researchers to give presentations and network, and a 1-day Workshop session on Experimental Techniques, organised and Chaired by Dr Bingham and with contributions from Dr Hand and Prof Parker, was highly successful. Dr Bingham, Dr Hand and Prof Parker were also closely involved in organising a number of aspects of the conference including the New Researcher's Forum and the Science sessions.

Professor Neil Chapman

- Awarded the James Watt Medal of the Institution of Civil Engineers in respect of his paper, “*A geological disposal facility for the UK's radioactive wastes*”, which was published in *Energy (Proceedings of the Institution of Civil Engineers)*, **162**, 183-192 (2009).

Dr Russell Goodall

- Was invited to CAMTECII, a conference on nano-mechanical testing held in Cambridge, where he presented “*Characterisation of Free Volume in Amorphous Metals by Nanoindentation*”.
- He was asked to join the Institute of Materials, Minerals and Mining Education Committee, which is concerned with increasing awareness of materials science in schools and encouraging larger numbers of students to consider the subject at university. This builds on his role coordinating Outreach and Schools activities in the Department, as part of which he organised several open days for local A-level students.
- He also obtained funding from both the Engineering Faculty and the UK Centre for Materials Education (UKCME) to develop undergraduate practicals and to incorporate Inquiry-Based Learning (where students have a measure of control over the direction they pursue in an investigation).
- He successfully completed the University's teaching qualification, gained Fellowship of the Higher Education Academy and upgraded his membership of the IoM³ to MIMMM CEng.

Emeritus Prof Geoff Greenwood

- Visited India, during the last week of October, at the invitation of the Materials Research Society of that country, to which he was elected an honorary member 13 years ago. The visit was centred on the International Conference on Materials Science and Technology (ICMST-2010) to inaugurate and celebrate the move to a new purpose built campus of the recently founded Indian Institute for Space Science and Technology (IIST) at Thiruvananthapuram (better known, and still often referred to, by its previous name Trivandrum, the capital of the State of Kerala). The campus is situated adjacent to the Vikram Sarabhai Space Centre near the shore of the Indian Ocean and bordering on Veli Lake. At the conference, **Prof Greenwood** chaired a Session and presented a Plenary Lecture on “*Materials at High Temperature*”.

Dr Russell Hand

- Presented a paper, “*Mechanical properties and surface hydration of glass*” co-authored by Damir Tadjiev at the European Society of Glass meeting in Magdeburg Germany, 30th May-2nd June. Whilst at the meeting he also participated in an Editors' meeting of the European Journal of Glass Science and Technology.

- Gave an invited paper, "Improving practical glass strength: myths and realities" as part of the session on Fracture Resistant Glasses at the XXIIth International Congress on Glass held in Salvador, Bahia, Brazil 20th-25th May. This session was very popular and Dr Hand participated in a number of associated side meetings designed to foster international collaboration on this topic. In addition he gave a 2nd talk, "Durability of simulant ILW glasses in a high pH environment" co-authored with Claire Utton, Neil Hyatt, Steve Swanton (SERCO) and Steve Williams (NDA) in the Waste Management session of the Congress and participated in an associated meeting of Technical Committee 5 (Nuclear and Hazardous Waste Vitrification).
- Presented a paper, "Mechanical properties of silicate glasses as a function of composition" at the Society of Glass Technology Annual Meeting held in Cambridge, 8th-10th September. He also gave a workshop presentation, "Measuring mechanical properties of glass".

Prof John Harding

- Was invited to speak at the Lake Tahoe (22nd Conference on Crystal Growth and Epitaxy – West; 6th-9th June) meeting and also give a Distinguished Visiting Lecture at the University of California, Lawrence Berkeley, 10th June.
- He was the overall organiser for the 2010 Summer School in Molecular Simulation (Belfast; July 2010). He attended the CCP5 Annual General Meeting (Sheffield, September 2010) and was co-author of papers presented by **Mr Hungru Chen** (*First principles study on local structure of LiNiO₂* also Dr Colin Freeman, Prof Tony West), **Mr James Dawson** (*A Computational Study into the Role of Defects in BaTiO₃* also B L Bin, Dr Colin Freeman and Prof Derek Sinclair).
- He organised a Symposium, "Biom mineralization and Bioinspired Inorganic and Inorganic/Organic Materials" at Fall MRS meeting, Boston, December 2010 and co-presented four posters:
 - "Modelling the nucleation and growth of calcium carbonate", with **Dr Colin Freeman**; Dorothy Duffy (UCL), Mark Rodger and David Quigley (Warwick), Mingyun Yang and Susan Stipp (Copenhagen).
 - "Modelling of Contacting Interfaces in Solar-Cells", **Dr Keith Butler**, Ole Martin Lovvik, Jesper Friis, Heidi Nordmark, Astrid Marie Mugggerud, Per Erik Vullum (SINTEF).
 - "First principles study on local structure of LiNiO₂, LiNi_{1-x}Co_xO₂ and LiNi_{1-y}Mn_yO₂", (**Hungru Chen**, Dr Colin Freeman, Prof Tony West), *A Computational Study into the Role of Defects in BaTiO₃* (**James Dawson**, B L Bin, Dr Colin Freeman and Prof Derek Sinclair).
 - "Voltage Dependence of Bulk Resistivity in BaTiO₃:Mg", **Dr Colin Freeman** and **Prof Tony West** and was co-author of a paper presented by **Dr Colin Freeman**, "The Significance of Entropy for Molecular Binding at Mineral surfaces"; also Mark Rodger (Warwick).

Prof John Haycock

- With group members **Celia Murray Dunning**, **Juliet Bell** and **Hayley Morris** attended and presented at the recent TERMIS-EU (Tissue Engineering and Regenerative Medicine International Society Meeting) annual conference in Galway, Ireland, 13th-17th June. Dr Haycock also chaired the session on Neural Tissue Engineering where the following were presented: "Adipose-Derived Stem Cells for Peripheral Nerve Repair" co-authored with **R Kaewkhaw**, **A M Scutt** and **J W Haycock**, "Aligned Polymer Microfibres for Peripheral Nerve Engineering" co-authored with **C Murray-Dunning**, **S L McArthur**, **A J Ryan** and **J W Haycock** and "Mechanotransduction in MLO-A5 Osteoid Osteocytes" co-authored with **H Morris**, **J W Haycock** and **G C Reilly**

Dr John Hinton

- Attended "How Science Works: Contemporary Science Conference" at the National Science Learning Centre in York, 21st-22nd June 2010. This conference was a two-day event held at the National Science Learning Centre, situated within the campus at the University of York. It brought together contemporary scientists from higher education with teachers from Key Stage 3, 4 and Post 16 education. The aim was to use today's science to engage and interact with teachers and then explore how they might be able to connect with learners back in the classroom. Over the course of the event, the researchers were engaged in a number of activities. During the second day, two parallel sessions allowed our researchers to present a 45 minute period based on their research. Dr Hinton delivered a workshop called "Living in a Material World".

Dr Plato Kapranos

- Attended the 3rd International Symposium for Engineering Education, ISEE 2010, 30th June-2nd July 2010, University College Cork, Ireland where he presented three papers: "Embedding Learning and Thinking Styles into Engineering Materials Courses"; "Cradle to P? Introducing 'Environmental Issues' into the teaching of Engineering Materials"; and "Entrepreneurship and Innovation in Materials Engineering".
- He also attended the workshop on "Engineering Education for Sustainable Development: A review of international progress" July 2010, and chaired a session on "Developing Skills and Learning Outcomes". Plato closed the conference by making a short acceptance speech to host the next ISEE 2012 in Sheffield.
- Has contributed the chapter on "Routes to Thixoformable Steel Starting Material", in the Thixoforming Steel book, ISBN 978-3-8322-9133-4, Shaker Verlag Publications (2010). The book is based on the work of a number of European partners working under COST Action541, "Semi-solid Processing of Steels: Thixosteel".

- Is a member of the Management Committee as well as the Coordinator of Short Term Scientific Missions within this action group. This is the second book he has contributed to in the area of semi-solid processing, building on the *"Semi-Solid Processing of Alloys"*, also published in 2010, in the Springer Series in Materials Science, Vol. 124, ISBN 978-3-642-00705-7.

Dr Zheng Liu

- Was invited to the School of Materials Science and Engineering in University of Jiangsu by Dr Xinhua Yuan, 14th May 2010, where he gave a talk, *"The quantification of interfacial stress-transfer around fibre ends and breaks using phase-stepped photoelasticity"*, which described the development of 4 and 6 phase-stepped photoelasticities for application to polymer composites. Dr Yuan spent a sabbatical year in Sheffield with **Prof Frank R Jones** and **Dr Zheng Liu**. Dr Xinhua Yuan hopes to strengthen the cooperation and have a technical exchange with the Department of Materials Science & Engineering of the University of Sheffield.

Prof Sheila MacNeil

- Gave the following invited presentations during 2010:
- *"Developing tissue engineered skin to benefit burns patients"*, Middlemore Hospital, Auckland, New Zealand, 21st January.
- *"Tissue engineering of skin from the lab to the clinic to commercialisation and back again"*, Institute of Vison Research, Auckland University Medical School, 22nd January.
- *"Tissue engineering and mathematical modelling of skin"*, Invited research seminar at the Institute of Bioengineering, University of Auckland, 26th January.
- *"Cultured cells and burns: Where have we got to and where next?"* British Burn Association, 22nd April.
- *"Tissue engineering and biomaterials approaches to the treatment of burns and chronic wounds – from concept to clinic to commercialisation and back again"*, Development of Dressings for Chronic Burns and Wounds, Aachen University, Germany, 26th-28th April.
- *"3D tissue engineered models for R and D"*, New Developments in Cell-Based In-Vitro Testing, Montpellier, France, (Kirkstall), 26th-27th May.
- *"Effects of gadolinium on skin cells and tissue engineered skin"*, Guerbet, Paris, 18th June.
- *"Practical tissue engineering to benefit patients"*, Joint Doctoral Training Centre Conference, Loughborough University, 1st July.
- *"Tissue engineering of soft tissues – laboratory and clinical experiences"*, Medical School Research Meeting 2010, Sheffield, 5th-6th July.
- *"Polymers for tissue engineering and wound management"*, MACRO2010, Glasgow, 11th-16th July 2010.
- *"Bug binding polymers – where next?"* Kroto/Krebs Joint Symposium, University of Sheffield, 2nd November.

- *"Achieving skin cell therapy which delivers benefits to patients"*, RESCUES 2010 Conference, Oxford, 8th-9th November.

Prof Allan Matthews

- Presented a paper, *"Reducing Wear Using Plasma-Based Processes"*, at the SMEA Conference 22nd June 2010.
- Presented an invited evening lecture to the East Midlands Materials Society (EMMS) on 29th June 2010, *"Surface Engineering: A Market Perspective"*. This was part of a one day event organised in conjunction with the IoM³, "Future Technologies, Applications and Opportunities for Surface Engineering". The presentations by Prof Matthews draw on data and information gathered for a report which he has been working on with Professor Richard Artley of the Alcan spin-off company 3A Composites. The report, shortly to be published, has been sponsored by the Surface Engineering Association, *"The UK Surface Engineering Industry 2010"*.
- Attended the 13th IFHTSE Conference in Rio de Janeiro, Brazil, 26th-30th July. This conference, organised by the International Federation for Heat Treatment and Surface Engineering, held a special tribute session in honour of the late Prof Tom Bell, an early pioneer of plasma thermomechanical processing and Prof Matthews gave an invited talk, *"Duplex and Special Engineered Coatings"*.
- Invited Keynote speaker at the International Vacuum Congress (IVC-18) in Beijing, China, 23rd-27th August. His presentation was entitled *"Plasma-based Surface Engineering for Tribological Applications"*.
- Presented an Invited paper at the 37th Leeds-Lyon Symposium on Tribology, held in Leeds, 10th September. His presentation discussed *"Surface Engineering Processes for Enhanced Tribo-Contract Performance and Extended Product Life"*.
- Attended the 12th International Conference on Plasma Surface Engineering (PSE2010) held in Garmisch-Partenkirchen, Germany, 13th-17th September. He participated in conference planning as a member of the International Scientific Committee and presented a one day short course on *"The Practice of Reactive Sputtering"*.

Dr Günter Möbus

- Attended the workshop "The logistic of small things" in Nottingham, 8th July, and gave an invited talk, *"3D Metrology of Tips and Probes by TEM"*.
- Gave an invited talk, *"Multidimensional Imaging: The Nanoworld in 3D"*, at the IoP Nanogroup Annual Meeting, Nottingham, 17th November.
- Organised the symposium "3D reconstruction in Materials Science" for the RMS Microscience2010 conference, London, June where he also gave an oral presentation in the symposium on aberration correction about *"Aberration Corrected TEM with the Sheffield JEM2200FS-AC"*.
- Initiated the workshop "Metrology of Nanoparticles" at the IoP, London, 28th June, organised by the EMAG group.

- Attended the Microscopy and Microanalysis conference 2010 in Portland, Oregon, August, and presented four papers:
 - “Surface Plasmon Electron Tomography Viewed as an Inverse Hough Transform”, co-authored with Z Saghi and W Guan; oral.
 - “A Piezoelectric Goniometer Inside a TEM Goniometer”, co-authored with W Guan, A Lockwood, and B J Inkson.
 - “A Simple Autofocus Technique for Aberration Corrected TEM”.
 - “Single Atom Motion on CeO₂ Nanoparticle Surfaces Imaged by Aberration Corrected HRTEM”, co-authored with Z Saghi; oral.
- Participated in the International Workshop “Reaching the Mantle Frontier: Moho and Beyond”, 9th-11th September at Carnegie Institution of Washington and presented an invited talk, “Self-sinking capsules to investigate Earth’s interior”.
- Attended the International Congress on Glass ICG2010, Salvador, Brazil, 20th-24th September and participated in the work of ICG Technical Committee TC05 on Nuclear and Hazardous Waste Vitrification, and gave an invited talk, “Twinkling fractals and Glass transition in amorphous oxides”.

Dr Nicola Morley

- Attended the SpinOS 2010 conference in Amsterdam, 31st August-4th September, and presented a poster “Polymeric Spin-valves at Room temperature”. This trip was funded by the UKRC for women in SET.
- Gave a talk, “Polymeric Spin-valves at Room temperature”, at the Sepnet workshop held in Queen Mary, University of London, 13th-14th September.
- Organised and chaired a session for a one-day workshop held in Cardiff on “magnetics in medicine”, in June.
- Went to PSI, Switzerland, November, to carry out muon measurements on multiferroic and organic semiconductor samples.

Dr Michael Ojovan

- Participated in the IAEA Consultancy Meeting on the development of “Generic Technical Guidance Documents in the area of Pre-Disposal Management of Radioactive Waste”, Vienna from 16th-19th February.
- Attended Waste Management Conference WM’10, Phoenix, USA, 7th-11th March and presented the paper “On spinodal decomposition of e-beam irradiated borosilicate glasses” co-authored with Günter Möebus. He has also co-chaired with Ned Bibler of Savannah River National Laboratory the WM’11 Session on nuclear waste vitrification.
- Participated in the IAEA Workshop, “Treatment/Processing of Problematic Waste from Decommissioning”, Ljubljana, Sloveni, 6th-8th April, and presented an invited talk, “Innovative methods for irradiated graphite treatment”.
- Attended the “UK-China Workshop on Nuclear Waste Management” supported by International Science and Innovation Unit (London), Beijing, 12th-14th April to discuss potential areas of collaboration.
- Participated in the IAEA technical expert mission to HLW vitrification facility VICHHR at NPP A-1 in Jaslovské Bohunice, Slovakia on 6th-11th July to assist Slovak specialist in identifying key areas on improving VICHHR melting system and operational safety.
- Attended the Regional Training Course for Waste Management Operators on Radioactive Waste Management – Pre-Disposal Technologies organised by the IAEA in cooperation with Environmental Protection Agency of Montenegro in Podgorica (earlier known as Titograd), 26th-30th July.

Prof John M Parker

- Attended the European Society of Glass meeting in Magdeburg Germany, 30th May-2nd June. While there he chaired sessions on Biomaterials and Glass History and also gave an invited presentation on “Ion Exchange Processes in Glass” to a student workshop (entitled Glasklar or Clear as Glass). While there he attended meetings of the ESG Steering Committee and Council and initiated discussions on an International Meeting to be hosted in Sheffield in 2016 to recognise the Centenary of the Society of Glass Technology and also as a part of celebrations of a hundred years of glass research in the University (from 1915).
- Visited Prof A Duran in Madrid, Spain, 11th-15th June, to discuss two books they are editing together. The first entitled “Making Glass Better” describes the results of a road mapping process to define the future directions of Glass Science and Technology and to identify possible bottlenecks in the process, the second a history of ICG from 1933 to 2010. Both of these books are to be made available at the next International Congress on Glass in Brazil.
- Organised a summer school in July and gave presentations at three conferences in September, followed by an invited seminar at Glafo in Sweden early in October. The summer school took place in Montpellier from 26th-30th July and attracted 26 Research Students from throughout the world; the lectures were presented by staff from various Universities in the UK, France and Germany. The first conference was the Annual Meeting of the British Society of Scientific Glass Blowers in Colchester, also their 50th Anniversary celebrations, and was a light-hearted demonstration around the question “Does stress lead to failure?”. The second was the Annual Meeting of the Society of Glass Technology in Cambridge where he made a presentation to the Student Workshop on “Introduction to optical absorption spectroscopy in glass”, as well as chairing one of the scientific sessions. Finally at the ICG XXII Congress in Salvador, Brazil, Prof Parker gave an invited plenary lecture on “The future of glass education” and chaired the ensuing session. This session proved surprisingly popular with standing room only and a total of 40 minutes spent on open discussion after lectures finished. Finally he visited Glafo at Växjö in Sweden to discuss a project that has started there on the prediction of glass colour for a given glass batch, and to lead a seminar on his work in this area.

Prof W M Rainforth

- Gave invited lecture at the 2010 HIPIMS conference, Sheffield, *"High temperature degradation mechanisms of multilayer coatings"*.
- Gave a plenary talk, *"The use of high resolution electron microscopy to bring new insight into wear mechanisms"* at the 10th Mexican National Conf on Microscopy, Morelia, Mexico (2010).
- Gave an invited lecture, *"Controlling grain size in oxide ceramics for optimization of strength and wear resistance"* and a contributed talk, *"New recrystallisation behaviour seen in magnesium alloy elektron 675"* at Recrystallisation and Grain Growth IV, Sheffield, July (2010).
- Gave an invited lecture, *"On the role of tribofilms in the wear of hard materials"* at the UK-China Summer School and 2010 Workshop on Tribology and Surface Engineering, Southampton, UK, 24th-25th August.
- Gave an invited seminar, *"EBSD Characterisation of the microstructure of metals following hot working"* at the Technische Universität, Graz, Austria, February 2010.
- Gave an invited seminar, *"Damage accumulation mechanisms in metal hip prosthetics"* at Queen Mary College, September 2010.

Prof Ian M Reaney

- Gave Invited/plenary talks –
 - *"Glass ceramics for Dielectrically Loaded Antennas"* at Electronic Materials and their Applications, January Florida, USA.
 - *"Structure property relations in RE-doped BiFeO₃"* at Solid state chemistry of materials science, February, Eindhoven, Holland.
 - *"Structure property relations in RE-doped BiFeO₃"* at the Symposium on the Structure and Properties of Materials, Dhaka, Bangladesh, February.
 - *"Structure property relations in RE-doped BiFeO₃"* at the University of Liverpool, May.
 - Czech/Polish Seminar, May, *"Structure property relations in RE-doped BiFeO₃"* (given by Iasmi Sterianou due to illness).
 - *"Circular Polarised dielectrically loaded antennas"* at CIMTEK, Montevideo, Italy, June.
 - *"Structure property relations in RE-doped BiFeO₃"* at MRS symposium, Cancun, Mexico.
 - University of Aveiro, Portugal, Intermediate structures in perovskite solid solution.
 - International symposium on ferroic domains 10, Intermediate structures in perovskite solid solution.
 - *"Circular Polarised dielectrically loaded antennas"* International Conference on Ceramics, Osaka, Japan.
- Study Visits –
 - University of Aveiro, April, September, November.
 - Programme Chair for International Symposium on Applied Ferroelectrics, Edinburgh, August.

Dr Ihtesham ur Rehman

- Gave the Plenary lecture at the 2nd International Symposium on Biomedical Materials: Current Research and Future Signposting, Pakistan, July 2010.
- Was invited to speak at south Asia regional dialogue meeting and conduct a workshop organised by British Council in Islamabad, Pakistan, December 2010.
- Gave the Keynote lecture at the 3rd International conference on "Assessing Quality in Higher Education", December 2010.
- Gave a live interview (one hour discussion forum) on Pakistan State TV, *"Higher Education in Pakistan"*, December 2010.

Dr Gwendolen Reilly

- Gave an invited seminar at Imperial College, London, *"Mechanical signal transduction in bone tissue engineering"*.
- Gave an invited seminar at Strathclyde University, *"Biomaterials and biomechanics for bone tissue engineering"*.
- Attended the 17th Congress of the European Society of Biomechanics, Edinburgh and chaired three sessions, took part in the management council meetings in her role as Chair of the Publication Committee of the Society. PhD Student, Louise Way also attended and presented a poster *"The effect of unloading on the migration of rat tail tendon cells"*.
- Attended the Bose UK user group meeting, London, with group members Jennifer Robertson and Robin Delaine-Smith, who gave a presentation, *"Simulating the physiological environment using electrospun scaffolds and tensile loading"*.
- Attended the UK Society for Biomaterials meeting, Glasgow, Scotland and presented the work of Robin Delaine-Smith, *"Response of collagen forming cells to dynamic tensile loading"*.
- Attended the Centre for Advanced Structural Ceramics Bioceramics meeting, Imperial College, London with visiting Student, Joanna Filipowska from Krakow, Poland who presented a poster on our collaborative work, *"Bioresorbable and bioactive PGLA-bioactive glass composites promoting in vitro bone formation and remodelling"*.
- Attended the final meeting of the ExperTissues EU Framework 6 Network of Excellence in Tissue Engineering, Braga, Portugal and gave a presentation, *"Materials to support mechanical simulation in bone tissue engineering"*.

Dr Conny Rodenburg

- Gave an Invited talk *"Energy Selective Secondary Electron Detection a solution to site specific SEM dopant mapping"* at the 12th Seminar of Recent Trends in Charged Particle Optics and Surface Physics Instrumentation in Skalský dvůr, Czech Republic, 31st May-4th June.
- Gave an Invited talk *"Subsurface imaging in SEM through energy selection"* at the MIDSEM meeting held in Birmingham, 9th June.

- Also gave two talks at the **MICROSCIENCE** meeting in London (28th June-1st July) “*Seeing through contamination and damage layers using Energy Selective Scanning Electron Microscopy*” and “*Helium Ion Microscopy for materials characterization*”.
- Gave an invited talk on Energy Selective Scanning Electron Microscopy at the Annual Meeting of the Microscopy Society of America held in Portland, Oregon, USA, August. At the same meeting Conny gave a talk on Helium Ion Microscopy on complex 3D structures on behalf of Z Zhou.
- Also gave a talk on “*Potential and limitations of secondary electron imaging for two and three dimensional dopant mapping of semiconductors*” at the 2010 E-MRS Fall meeting held in September in Warsaw.

Emeritus Professor Mike Sellars

- Received the IOM³ Bessemer Gold Medal at the Premier Awards Dinner, 6th July 2010, at the Institute of Materials which was also attended by **Prof Allan Matthews** and **Dr Richard Thackray** from the Department. The award is for outstanding services to the steel industry. Prof Sellars' expertise lies in microstructure changes and how hot working effects the properties of materials. This research, and by combining empirical equations and laboratory simulations, has led to several models of the rolling process which remain in use today. Prof Sellars has pushed forward educational courses in steel technology, including flat and section rolling, which are well supported by industry. His impressive career includes over 10 years as the Pohang Iron and Steel Company Professor of Iron and Steel Technology.

Prof Derek Sinclair

- Attended the Materials Science and Technology (MS & T) Meeting (American Ceramic Society meeting) in Texas USA, 17th October.

Emeritus Professor Peter Wright

- Attended the 12th International Symposium on Polymer Electrolytes (ISPE-12) in Padua, Italy, 29th August to 3rd September and was awarded a medal – the “Galileo Galilei Award for Energy Conversion by Ion Conduction”. This is a new “Galileo Galilei” award. The original one was given for optics. There were three other recipients on this occasion, Michel Armand and Bruno Scrosati (who took Prof Wright's earlier work and promoted the use of polymer electrolytes for lithium batteries) and Michael Graetzel, the well-known inventor of dye-sensitized electrolytic solar cells into which polymer electrolytes are now being incorporated. The citation reads “...for his unique range of groundbreaking discoveries in the field of polymer electrolytes. He pioneered research on the low-dimensional crystalline and liquid-crystalline systems”.

Dr Aleksey Yerokhin

- Attended the 12th International Ceramic Congress week commencing 7th June, which was organised as a part of the International Conference on Modern Materials and Technologies CIMTEC-2010 held in Montecatini Terme, Italy from 6th to 18th June 2010. This Congress is proven to be the major scientific event in the field. This year it comprised 15 specialised Symposia and 2 topical Conferences that have attracted over 700 papers and 1200 delegates from all across the globe. Aleksey has taken an active part in the Symposium on “*Ceramic Thin Films and Coatings for Protective, Tribological and Multifunctional Applications*” by delivering an Invited Lecture, “*New Horizons in Ceramic Coatings and Films Produced using Plasma Electrolytic Processes*” in the opening session and chairing another session within this convention.
- On the following week, **Dr Yerokhin** visited IO Paton's Electric Welding Institute in Kiev, Ukraine to attend the 2nd International Workshop on “*Plasma and Electron Beam Technologies for Protective Coatings*” organised by the European Joint Committee on Plasma and Ion Surface Engineering (EJC-PISE). There he delivered a Keynote Lecture over-viewing the “*Progress in Plasma Electrolytic Surface Treatments for Wear and Corrosion Protection of Lightweight Metals*”.

Dr Shaowei Zhang

- Gave an invited talk, “*Nanostructured Refractories*”, at the 12th European International Ceramic Congress (CIMTEC 2010, Montecatini Terme, Italy), 6th-18th June.
- Gave an invited seminar on “*Next Generation Carbon-Containing Refractories*” at The Priority Program's Autumn School, Aachen, Germany, 7th September.
- Co-organised the 5th International Symposium on “*Advances in Refractories for Metallurgical Industries*” (Vancouver, Canada 2010) and presented an invited paper, “*Water Wettability and Dispersivity of Titanium Carbide Coated Graphite Synthesised from Molten Salt*”, 3rd-6th October.
- Co-organised the Refractories Symposium at the 3rd International Congress on Ceramics (Osaka, Japan 2010) and gave an invited lecture, “*Microstructure and Properties of Novel Carbon-Containing Refractories*”, 14th-18th November.
- Gave an invited seminar, “*Novel Carbon-Containing Refractories*”, at the Tokai Branch Meeting of the Japanese Refractories Technical Association, 19th-20th November.
- Gave an invited lecture, “*Low Temperature Molten Salt Synthesis of Advanced Ceramics*”, at China University of Geosciences, China, 3rd November.

9.2 Events, 2010

From the 1st August 2010 the Department of Engineering Materials changed its name to **Department of Materials Science & Engineering**.

The Department evolved from an illustrious history of materials-related departments at Sheffield and was formed in its present guise in 1987 by the merger of the Department of Ceramics, Glasses and Polymers with the Department of Metallurgy. Since then the question of the Department's name has frequently been raised by its staff. With the increased diversity into (for example) functional ceramics, biomaterials and polymers, the name "Engineering Materials" has become increasingly inappropriate. Against this background, during 2009, departmental staff were asked for their views on a possible name change. It became clear that a majority of the staff wanted the name changed to one which better reflected the Department's activities in teaching and research. Further consultations, such as with our industrial collaborators, confirmed the desirability of a name change. Informal discussion and analysis of names used worldwide in our discipline showed that Materials Science and Engineering is by far the most favoured – with (for example) over 20 departments having that name in leading USA Universities. We therefore expect that the name change will be very well-received and will enhance our profile

9.2.1 4th International Conference on Recrystallization and Grain Growth

The University of Sheffield recently played host to the major international conference series, *Recrystallization and Grain Growth* during 4th-9th July 2010. The conference was organised by **Drs Eric Palmiere** (Chair) and **Brad Wynne** and **Profs Mark Rainforth** and **Mike Sellars**, and was attended by more than 200 delegates from 30 countries and 6 continents. Invited presentations were made by **Eric Palmiere**, **Mark Rainforth** and **Brad Wynne** on the following respective papers:

- "A Hybrid Modelling Approach Applied to the Evolution of Microstructure during Plane Strain Deformation", "Controlling Grain Size in Oxide Ceramics for Optimization of Strength and Wear Resistance", "Investigating Recrystallization in the High Temperature Titanium Beta Phase using Post-Mortem Electron Backscatter Diffraction Analysis".

Oral presentations were also given by **Dr Krzysztof Muszka** "On the effect of strain reversal on static RXN and strain induced precipitation kinetics in microalloyed steels" and by **Mr Lin Sun** "The effect of strain path reversal during austenite deformation on phase transformation in a microalloyed steel subjected to accelerated cooling". **Lin Sun** was also presented with an Outstanding Young Scientist Award. A poster presentation was made by **Dr John Hinton** on the paper "The Effect of High Temperature Grain Refinement on the Isothermal Ferrite Grain Growth Kinetics in Steel S460", which was selected as one of the Outstanding Poster Awards.

9.2.2 Centre for Biomaterials and Tissue Engineering

The **Centre for Biomaterials and Tissue Engineering (CBTE)** website was given a re-launch last month, under new director **Dr John Haycock**. The aim of the CBTE is to foster multidisciplinary interactions across the areas of Biomaterials, Tissue Engineering, Devices, Implants & Bioreactors, Imaging & Analysis and Computational Systems Biology. It has more than 40 academic members across the Engineering, Science and Medical faculties for bringing scientists, engineers and clinicians together who have interests in Bioengineering. A series of themed workshops is planned on topics such as:

- 3D processing of biomaterials
- Bone tissue engineering and stem cells
- Raman Microscopy / biomaterials
- Non-invasive imaging for medical applications
- Vascular biomechanics

For further information please visit the site (<http://www.cbte.group.shef.ac.uk/>) or contact John Haycock.

9.2.3 IoP Summer Physics Update

Prof Mike Gibbs & **Dr Julian Dean** were involved in lectures and workshops on the IoP Summer Physics Update for school teachers. Mike gave a lecture entitled "Green Magnets: the way of the world" and Julian ran workshops on "Materials in a School Context". The Worshipful Company of Armourers and Braziers support a strong materials content at these events in order to raise the profile of materials education and employment opportunity.

9.2.4 MESAS News

Science Education

Dr Julian Dean was invited to organise a workshop within "Inspirational Weekends for Practising Physics Teachers" run by the IoP. He demonstrated his highly successful schools outreach project and demonstrated the fracture properties of chocolate. The Teachers and IoP were very impressed and are seeking to use this as part of future education programmes.

For all MESAS news please see www.mesas.co.uk

9.2.5 Polymers and Liquid Crystals Group

Prof Goran Ungar gave a plenary lecture at the Annual British Liquid Crystal Society Meeting in Hull, 29th-31st March 2010, entitled "Through Packing Frustration to Structural Diversity". **Dr Feng Liu** gave an oral presentation at the same conference, entitled "GISAXS in the study of supramolecular and hybrid liquid crystals". **Ruibin Zhang**, **Timur Tadjiev**, **Xiaobin Mang**, **Jitrin Praipapa** and **Feng Xue**, all members of the Polymers and Liquid Crystals Group, all presented their posters at the conference. **Xiaobin Mang** received the First Prize for the Best Poster at the conference. The titles of the posters: "Self-assembly of Mesogen Coated Gold

Nanoparticles”, “Hexagonal Close Packed Phase in Supramolecular Dendrimers”, “Crystalline Structure of *N,N*-Di-3,4,5-tridodecylphenyl perylene” and “Columnar Liquid Crystals in Cylindrical Alumina Nanopores”.

Dr Feng Liu was chosen by the 6 participating laboratories of the European Science Foundation’s project SCALES to represent the Project at the event “Frontiers in Chemistry: From Molecules to Systems” held in Paris, 21st May with a poster entitled “Complex Mesophases and Tiling Patterns in Self-Assembled Polyphiles”. Speakers at this prestigious event included four Nobel laureates.

Dr X B Zeng, Dr F Liu, Prof G Ungar and Mr X Mang attended the Nanogold workshop in Aegina, Greece, 19th-22nd May. They all presented their work within the project.

Prof Ungar and Dr Liu attended the International Liquid Crystal Conference ILCC2010 in Krakow, Poland, 11th-16th July where Prof Ungar presented an invited lecture “Colour – Monochrome Tiling Transitions and Critical Phenomena in Honeycomb Liquid Crystals”. Dr Liu presented the posters “Complex Mesophases and Tiling Patterns in Self-Assembled Polyphiles” and “Honeycomb Liquid Crystals in Cylindrical Alumina Nanopores”.

Prof Goran Ungar

Attended the ACS Fall Meeting of the American Chemical Society in Boston, 22nd-26th August 2010, and presented an invited lecture entitled “Arranging Nanoparticle Superlattices with Liquid Crystals”. Gave a keynote lecture at the 6th IUPAC International Symposium on Novel Materials and their Synthesis, Wuhan, China, 11th-14th October entitled “Multicolour Tiling and Curie-Type Transitions in Honeycomb Liquid Crystals”. He also chaired a session at the conference. Spent 2 weeks in China in October where, in addition to attending the above conference, he also gave talks at four universities: University of Nanjing, Jiao Tong University and Donghua University in Shanghai, and Hangzhou University.

Dr Liu attended the Fourth International Congress on Advanced Electromagnetic Materials in Microwaves and Optics (Metamaterials 2010), Karlsruhe 12th-16th September.

Dr X Zeng and Dr F Liu attended the Nanogold first year review meeting at Karlsruhe 17th September.

9.2.6 UKCME

Prof Mike Gibbs aided by **Katrin Thomson** and PDRAs and research students is spending time this summer preparing on-line learning and teaching material for students in research techniques in magnetism. The UK Centre for Materials Education (UKCME) has provided £2.5k of funding for this, and filming will start shortly! The aim is to provide basic training on equipment for project and research students, and material to illustrate technique content of taught modules.

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