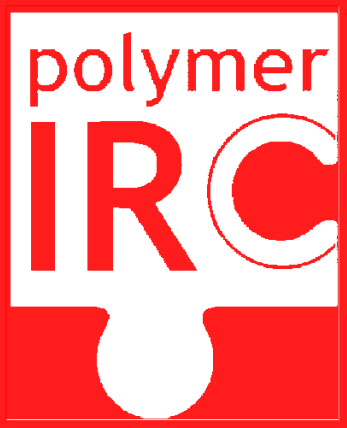
09

Annual Review

and IRC Directory



Polymer IRC Universities

Leeds, Bradford, Durham, Sheffield

www.polymerirc.org

Contents

Director's Introduction

On November 1st 2008 I became the Director of the Polymer IRC, following the departure of Tom McLeish to become Pro-Vice Chancellor for Research at Durham University. I took on the role on a part-time basis for a limited period to assist in the restructuring of the Polymer IRC and help define a future path.

The first task was to visit each of the component Universities of the Polymer IRC and talk with leading researchers and with each of the Vice-Chancellors and senior members of their executive team.

Objectives identified for the Director were to:

- Promote greater inter-university research collaboration,
- Encourage greater coherence amongst IRC members,
- Raise the profile of the Polymer IRC with University executive groups,
- Promote the benefits of the IRC to Research Councils, Industry and Government bodies.

These objectives were agreed by the newly formed Executive Group consisting of the Associate Directors from each University, Dr Barry Maunders, responsible for network development , and Helen Clancy the Executive Manager for the Polymer IRC. The Executive Group has revised the membership and terms of reference for the Advisory Board and involved younger researchers in the management of the Polymer IRC through the formation of a Research Group.

The role of the Advisory Board was defined as:

"To advise, warn and encourage the Executive Group on the current and proposed activities of the Polymer IRC in the areas of research, training and knowledge transfer. Strategic advice will be of the greatest value to the members of the Polymer IRC in formulating their future activities, thus maximising its potential to enhance and develop polymer science and technology in the UK."

The newly formed Research Group's remit is to:

- Identify areas of research strength in polymer science and engineering within the Polymer IRC.
- Seek out and specify possible research programmes that utilise the ability of the Polymer IRC to address multidisciplinary topics.
- Nominate PIs and co-Is; identify possible sources of funding; e.g. Research Councils, Charities, Government Organisations, Industry.
- Explore the possibilities for individual research funding; e.g. fellowships; European Research Council awards; Royal Society Research Chairs.
- Review the current research portfolio and comment, where appropriate, on any proposals for follow – on activities made by PIs and co-Is.

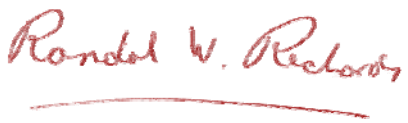
The activities of the Research Group are reported later in the Annual Review. Already two major research programmes have been identified that are particularly suitable for the multidisciplinary approach of the Polymer IRC.

Since the autumn of 2008 there has been a significant change in the prospects for research funding not only in the UK but worldwide. Loss of confidence in the business sector, together with the expenditure of public funds to maintain the banking system means that in the future money for research programmes will be more difficult to acquire. An immediate effect on the Polymer IRC was a contraction in the renewal of industrial subscriptions to the IRC Industrial Club.

A further change in the IRC's operating environment is the identification of major research themes by UK Research Councils along with their encouragement to submit longer, larger research proposals. In addition, following the forthcoming General Election, the expectation is that funding for Universities will not increase and may be cut to reduce Government borrowing levels. It was these considerations that led the Executive Group to evolve new strategies to respond to changing circumstances.

The Polymer IRC also wanted to refresh its knowledge of what members (current and future) need from the IRC Industrial Club. The amalgamation of businesses and consequent rationalisation of activities by these larger concerns has introduced fragmentation which requires Polymer IRC members to understand the new industrial environment, in particular the increasingly global nature of industrial polymer research and development. The Networks Director, Barry Maunders, will play a key role in helping bring this understanding into the Polymer IRC. To assist in this process Helen Clancy and I have visited a number of researchers in industry to learn of their concerns and determine what the Polymer IRC can do for them.

The work over the past year has gone a long way to restructuring and refocusing the Polymer IRC in what has been a very turbulent time for both industry and academe. The Polymer IRC is now positioned to exploit new areas of research which have the potential for growth e.g. in biologically related arenas; energy research etc. Moreover, the UK Government will in all likelihood want to see the outcomes from research move more rapidly from the laboratory bench to the market place. The Polymer IRC is well suited to such tasks with its reputation for high quality research allied to an efficient network of industrial contacts and supporters.



Advisory Board Members

Dr David Bott (Technology Strategy Board, Chair)

Dr Andrew Bourne (EPSRC)

Dr David Farrar (Smith & Nephew)

Professor Ray Hudson (University of Durham)

Professor Richard Jones (University of Sheffield)

Dr Rudy Koopmans (Dow)

Professor Kurt Kremer (Max Plank Institute)

Professor Jimmy Mays (Tennessee)

Dr Peter Mills (Cytec Engineered Materials)

Professor Mike Wilson (University of Leeds)

Professor Alastair Wood (Bradford University)

Dr David York (Procter & Gamble)

IRC Interactions

A Molecular Search For Happier Skin

Leeds scientists are collaborating with Unilever R&D to tackle the question of what makes skin feel good, and why.

The research is coordinated at the University of Leeds by Professor Peter Olmsted, who is bringing atomic force microscopy, computer simulation and theoretical physics to bear on the problem, within a larger collaborative project led by Dr Massimo Noro at Unilever R&D Port Sunlight. The aim is to design better skin products that appeal to consumers by working well - and making them feel good too.

Peter Olmsted will examine the properties of the lipid bilayers that are found in the stratum corneum membrane, the outermost layer of skin which is just 50-100 microns thick - about a tenth of the thickness of a sheet of paper. The Leeds team, which also includes Dr Simon Connell, will concentrate on understanding how the extremely complex composite structure of skin gives it its unique properties of strength and elasticity. Scientists will be able to construct a profile of the skin lipids that is accurate up to a millionth of a millimetre.
The team will use this information to carry out experiments and make theoretical calculations that model how skin behaves at a molecular level to the ingredients of personal care products, from simple water molecules to complex oils. In examining the science of these membranes the team hopes to come up with design rules for products that work better and are more appealing to the person who is using them. They will be testing the various ingredients used in these products to see what effects they have. Their wish is to link these effects to the science of the mechanics and permeability of complex membranes.

As skin grows from the inside of the body towards the outside, cells are pushed to the surface layers of the skin. They over-express certain proteins that form mechanical "bricks", held together by a "mortar" made of special lipid molecules called ceramides, in a form that only exists in skin. The research group is interested in how the special features of these molecules contribute to the elastic, strong, and supple object that is skin.

The project is funded by regional development agency Yorkshire Forward and Unilever R&D. A further award of £2 million has recently been made which also involves the Universities of Bradford and Hull.

Further information:

Peter Olmsted, Leeds,
email: p.d.olmsted@leeds.ac.uk

Massimo Noro, Unilever,
email: massimo.noro@unilever.com

Ternary Phase Separation During Spin Casting

Nigel Clarke, Richard Thompson, Durham University; Mark Geoghegan, Richard Jones, Sheffield University

EPSRC Funded Research

Spin coating is a widely used tool in the manufacture of very smooth and very thin polymer films. For example, it is routinely used on a massive scale for making integrated circuits and colour filters for liquid crystal displays. It is likely to be a centrally important processing step in the emerging field of polymer electronics.

The most common situation is the spin coating of a polymer solution (a polymer dissolved in a solvent). A flat disc, which has been flooded with the solution, is rotated at speeds of up to 10,000 revolutions per minute. This results in a uniform coating of solution. The solvent then rapidly evaporates to leave a very smooth and high quality film of pure polymer.

A more complicated situation, that has great technological potential, occurs when two polymers are spun from a common solvent. Most chemically different polymers do not like to mix, but if diluted enough in a solvent favourable to both polymers a mixed solution forms. However, the two polymers will separate from each other as the solvent evaporates.

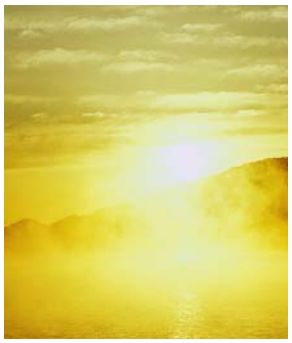
Significantly, this can result in a wide variety of microstructures in the final films. These can range from two well defined layers to situations in which lateral phase separation takes place on a variety of length-scales, from nanometres to many micrometres. In thin films of, for example, semiconducting polymers used in light emitting diodes and photovoltaic devices, the device efficiency depends critically on the microstructure. Hence, if one understands how to control the microstructure, one can achieve an optimised film in a single, inexpensive processing step.

Further information: Nigel Clarke
email: nigel.clarke@durham.ac.uk

High-efficiency Block Copolymer Solar Cells: A Scaleable Prototype for Low Cost Energy Generation

Mike Turner, Stephen Yeates & Brian Saunders, University of Manchester; Jenny Nelson and Saif Haque, Imperial College; David Lidzey, Anthony Ryan and Ahmed Iraqi, University of Sheffield; Nigel Clarke, Durham University.

EPSRC Funded Research



Widespread implementation of photovoltaic electricity to meet changing energy demands requires a step-change in the cost of photovoltaic power.
This programme assembles a consortium of chemists, physicists and materials scientists from Imperial College London and the universities of Manchester, Sheffield and Durham to produce new prototype polymer solar cells that have high power conversion efficiencies and could be mass produced cost effectively.

The work proposes new polymer solar cell designs that integrate flexibility with inexpensive materials and solution based processing. In one approach, block copolymers are used to direct formation of nanostructured thin films to provide high efficiency polymer solar cells. In a second approach, block copolymers will be used to direct crystallisation within nanostructured films.

Independent optimisation of the optical and electronic properties, together with theoretical modelling input, will provide design rules for maximising power conversion efficiency. The project will establish strategies for scaling up the device designs which have the highest efficiencies. Our objective is to construct affordable and scaleable polymer solar cells that have an energy conversion efficiency of at least 7%.

Further information: Nigel Clarke
email: nigel.clarke@durham.ac.uk

DYNACOP—Dynamics of Architecturally Complex Polymers

University of Leeds, Forschungszentrum Jülich, Foundation for Research and Technology Hellas, Universidad del Pais Vasco/Euskal Herriko Unibersitatea, Universiteit Twente, Universite Catholique de Louvain, Technical University of Denmark, Universita degli Studi di Napoli Federico II, National and Kapodistrian University of Athens, University of Durham, DOW Chemicals, BASF

EU Funded Research

This is a new Framework 7 Marie Curie Initial Training Network, involving ten universities and two industrial companies across Europe.

The scientific objective of DYNACOP is to obtain a fundamental understanding of the flow behaviour and the dynamics of blends of topologically complex macromolecular fluids and their role in processing and properties of nano-structured blends. These materials exhibit complex dynamics and rheology and, in many cases, show hierarchical relaxation over many different timescales. This in turn affects the processing and properties of the final materials. Such fluids include branched low density polyethylene, which is a fundamental material that appears in plastics of all forms. The processing of these materials, and the relation to properties, has frustrated and encouraged industry for many years: a simple recurring problem is instability in extrusion that leads to imperfect plastic parts, with costly results. The ability to predict and control this behaviour as a function of molecular chemistry has attracted a long history of collaboration between academia and industry.

In order to rationally design appropriate materials and processes for various technological applications, a rigorous, knowledge based approach is needed. This is especially urgent in face of the current opportunities offered by tailored molecular engineering of polymers at the industrial scale, and the proposed use of these materials in nano-structured composites for smart applications in devices, electronics, and high performance applications. The training objective of the ITN is to provide young post-doctoral researchers with the necessary interdisciplinary knowledge and experience in the field of soft-materials properties, which will allow them to address some of the many scientific and technological challenges in the field. This will first and foremost be achieved through a collaborative research programme and portfolio of training courses intimately linking industry and academia. To ensure fruitful collaborations, the participating research groups will work around a limited number of model systems; exchange the samples and apply to them the techniques and/or theoretical approaches developed in the different laboratories. The research groups are selected to obtain the needed synergy, as they have different backgrounds/expertise, in physics, chemistry and materials science. Very high profile international visiting scientists will bring their expertise to Europe to participate in the training and research.

Further information: https://eudoxus.leeds.ac.uk/dynacop

Innovation in Industrial Inkjet Technology

University of Cambridge, University of Durham, University of Leeds, Industrial Consortium

EPSRC Funded Research

A cross-disciplinary consortium of the Universities of Cambridge, Durham, Leeds and a group of nine companies, including the major players in the UK inkjet sector, have received a grant of £5 million from EPSRC to extend the benefits of inkjet technologies. The award will support a five-year programme of research to study the formulation, jetting and deposition of specialist printing fluids, and develop an overall process model. The work will improve the robustness of industrial ink-jet printing and help companies develop new applications for the technology.

Inkjet printing already dominates the desktop printing market. In commercial printing, it is rapidly becoming established for short-run applications and has, in only a few years, conquered a market previously occupied by conventional screen printing equipment , where its greater flexibility and inherent scalability give significant advantages. Further applications for ink-jet technology exist in the manufacture of high-value, high precision products such as flat-panel displays, printed electronics and photovoltaic cells for power generation.

The programme will consider three themes focused on key aspects of the industrial inkjet process: the formulation, rheology and jetting behaviour of colloidal printing fluids; understanding and controlling dynamic micro-scale drop impact, spreading and fixing; and development and validation of an advanced process model for industrial inkjet. Within these themes the team will develop: a theoretical and practical understanding of how to make stable high solid-content colloids suitable for inkjet deposition, and how they behave in an inkjet system and on the substrate; explore post-impact processes that determine the structure and functionality of the printed features, including surface morphology, chemistry and surface treatment , fluid dynamics of wetting and the interaction of successively printed materials; and develop a set of models, validated by precise measurements and underlying physical theory, to describe all aspects of the formation and ultimate fate of inkjet drops.

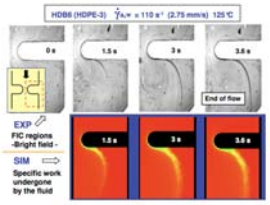
Further information: Oliver Harlen

email: o.g.harlen@leeds.ac.uk

Microscale Polymer Processing (μPP)

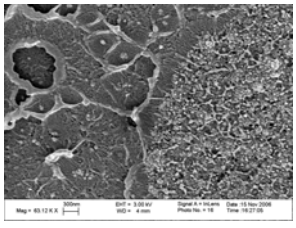
Universities of Leeds, Bradford, Durham, Sheffield, Cambridge, TU Eindhoven, Oxford, Reading, UCL, Nottingham, Virginia Tech., with BASF, DOW, DSM, ICI, Ineos, Lucite International, LyondellBasell and Mitsubishi

EPSRC Funded Research



One of the MuPP industrial collaborators summed up the enormity and ambition of the project when he called it "turning the polymer materials design arrow the other way around". Instead of developing commercial materials empirically, we have delivered to industry the molecular rules to design and engineer the molecular mix of macromolecules with process targeted. Using the tools such as REPTATE and FLOWSOLVE have helped the project partners create new products, and short-circuited the design process of blends. The Cambridge MPR is now on the way to becoming a standard "bridge-building" instrument between laboratory and process. Concurrently with this applied programme, the very act of doing it has unearthed fundamental new science in both theory and experiment. The system of bimodal blends has proved wonderfully rich, and a paper in preparation displays the astonishing result that for a material as complex as the highly-branched low density polyethylene, we can actually show the connection between the chemistry and the rheology quantitatively. Melt flow predictions now include anticipating where and how polymer crystals will first form, and capture the delicate tracery of stress between particles embedded in a polymer flow.

Tom McLeish.



A comparison of the birefringence of a polystyrene bead filled polystyrene melt flowing through a 4:1 constriction: flowSolve simulation (left hand side) and experimental measurements from the Cambridge Multi-Pass Rheometer (right hand side).

μPP was funded by EPSRC and Industry sponsors and brought together over 30 scientists from eleven major UK and international Universities: Leeds, Bradford, Durham, Cambridge, Sheffield, Reading, Oxford, UCL, Nottingham, Virginia Tech and TU Eindhoven, with industrial collaborators from BASF, Dow, DSM, LyondellBasell, ICI, Ineos, Lucite International and Mitsubishi.

Key Outcomes

- Development of advanced polymer theory software (REPTATE) and computational modelling software (FlowSolve)
- New chemistry for novel branched polymer molecules
- Prediction of chemical synthesis rules from bulk polymer properties defined by end users
- Processing of minute quantities of expensive materials
- Development of sophisticated instruments to measure structural changes in flowing polymer melts
- Knowledge Transfer activities

Computational Modelling - FlowSolve

FlowSolve is an advanced Computational Fluid Dynamics (CFD) software, developed at the University of Leeds, for the analysis of polymer processing and hosts a library of molecular polymer melt models. FlowSolve is capable of visually predicting process features of plastic melts that depend on their specific molecular structure.

Rheology Characterization – REPTATE

REPTATE software is uniquely suited to understand the molecular structure of polymers via easy-to-do rheology measurements and advanced molecular theories. It has potential applications in understanding batch to batch variability and designing new polymers for a given target application.

Bottom up prediction – REACT and BoB

- "React" software predicts molecular shapes from reaction chemistry
- "BoB" (for "Branch-on-Branch) predicts flow characteristics of arbitrarily branched polymers (http://sourceforge.net/projects/bob-rheology)

Knowledge Transfer

Our aim is to guide improvements in complex material handling and processing, and to help in the development and production of novel plastic products for specialized applications.

Working with SMEs

Development of new polymer materials is now increasingly sophisticated and designed with many molecular parameters in mind. However their processing is still more an art than a science. We are therefore keen to work with SMEs in delivering our advanced scientific tools. Some of the benefits are:

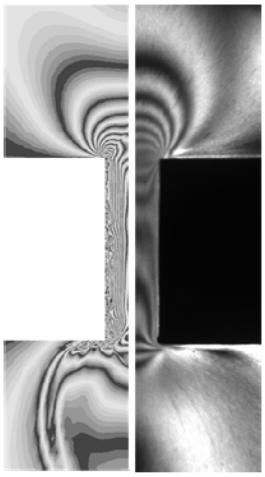
- Savings in cost and reduction of down-time
- Considerable reduction in time-to-market.
- Improved product quality.
- Increased knowledge assurance.
- To enable SMEs to secure niche markets.

µPP Showcase Event

We plan to hold a showcase event during 2010. This will be a highly interactive event, including discussions of a shared research agenda and a chance to formulate future project plans.

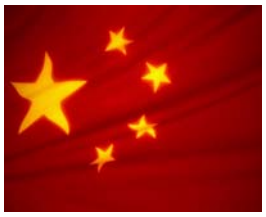
Further information: Suneel Kunamaneni

email: s.kunamaneni@leeds.ac.uk



Scanning electron microscope picture of the interface region of a commercial polystyrene reinforced with cross-linked polystyrene particles.

RESEARCH COUNCILS UK



Science Bridges Award

University of Bradford/China

RCUK Funded Programme

The programme focuses on the development of products aligned with the strategic priorities of both the Chinese and British governments in their respective health delivery policies and associated industries (e.g. diabetes, infection control, traditional Chinese medicine (TCM) and medical devices). Its overall purpose will be to provide effective solutions to these needs. Outcomes are expected to be new therapies, enhanced biomaterials and medical devices, and the application and validation of processes to accelerate the discovery and commercialization of new drugs/ medical devices.

We have two major themes: Pharmaceutical Sciences and Medical Technology. In the first theme, emphasis will be placed on Traditional Chinese Medicine, and in the second theme, materials for biomedical applications, and related devices. All the programme activities will involve Bradford-based teams (strengthened by other UK universities, Health Services and companies whenever appropriate) and identified leading Chinese universities and organisations. Building on existing strong links between the University of Bradford and Chinese academia, we aim to accelerate product invention, design, and development through stimulating open innovation between the UK and China, for Pharmaceutical Sciences - particularly drug discovery and delivery - and Medical Technology, meeting aligned needs of the UK and China. This will be addressed by three main activities: (i) an Open Innovation project scheme to develop prototypes and products, (ii) reciprocal training programmes based on the two themes, and (iii) developing state-of-the-art knowledge and commercial networks. We will also provide means for managing exploitation of the outcomes.

Each theme is associated with leading research and KT areas in Bradford: Pharmaceutical Sciences and drug discovery & development and Advanced Materials Engineering . Over the past 2 years these groups have developed an exciting third area of combined research, Healthcare Technologies - including a recent joint Chair in Pharmaceutical Engineering Science, and collaborative research and commercialisation projects. All three R&KT areas have extensive but developing (and sometimes connected) links with leading Chinese Universities and co-operative organisations such as Medilink Y&H Ltd, which is taking a major lead on behalf of UK Trade and Industry on health technology partnerships with China, to help regional high technology companies, including SMEs, develop opportunities and products.

Further information: Phil Coates

email: p.d.coates@bradford.ac.uk

EPSRC Virtual Institute of Polymer Process Structuring (VIPps) 2008-9

This EPSRC-funded (£227k) People Collaboration programme, focused on developing polymer engineering co-operations with academics in China, Japan, Taiwan and Korea. Led by Phil Coates, interactions started with strategy plus technical meetings with Chinese academics in Shanghai in July 2007, which surveyed leading polymer engineering-related groups in China. This was followed by meetings in Chengdu (State Key Laboratory for Polymer Materials Engineering), Beijing (Institute of Chemistry, Chinese Academy of Sciences) and Tokyo in May 2008.

At PPS-24, Salerno, June 2008, there was opportunity to meet with colleagues from the participating Far East countries, to discuss collaboration in micromoulding, nanocomposite structuring and processing of modified polymers. This complemented Phil Coates' visit to Taiwan, in conjunction with IUPAC Macro2008, which included a laboratory visit to the fluid-assisted moulding centre of Prof Liu. In July 2008, there were visits to four institutions in Beijing (Beijing University of Chemical Technology, ICCAS Beijing, Sinopec Beijing Research Institute and Tsinghua University). Leeds IRC colleagues have been involved in cooperative visits to Japan including Frederico Roschzttardtz on a 6 month placement with Prof H Watanabe at Kyoto University, and China.

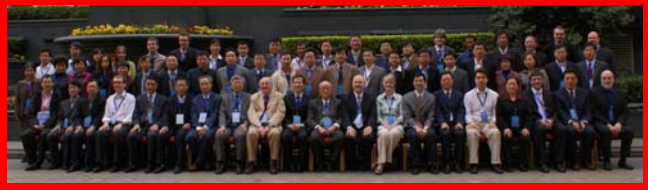
Picture 1

The VIPps UK meeting was held during September 2008, coinciding with the UK Polymer Showcase conference. 27 Chinese academics attended from Sichuan University, ICCAS, and Shanghai Jiao Tong University. Technical meetings between invited Chinese and IRC academics were held for two days in Bradford. Three academics from Sichuan came to Bradford for 2 weeks for cooperative research studies in our laboratory, with a view to building more substantial programmes (picture 1). Prof Koyama (Yamagata University) came to Bradford during February 2009. Further international contacts were developed at PPS-25 in India in March 2009 and the VIPps UK technical meeting was mirrored by one in China with 17 UK attendees and over 50 Chinese academics presenting their research (picture 2). The Polymer IRC was well represented by speakers including Nigel Clarke (Durham), Xiaosong Wang and Chinmay Das (Leeds) in addition to Bradford speakers. During the visit Phil Coates was made an Honorary Professor at Beijing University of Chemical Technology.

Academic and industrial activity in China is developing rapidly, so these co-operations have been both timely and strategic. In general the polymer industry has limited experience of R&D, although there is a trend by major polymer manufacturers to establish new laboratories in Beijing. Japanese polymer groups are strong, with an established industry base, so the nature of our interaction is more 'one to one'. The VIPps programme has received an extremely warm welcome, and has generated many new opportunities upon which we are now building. We are grateful for the very strong support for VIPps in each of the collaborating institutions.

Further information: www.polymervip.com

email: p.d.coates@bradford.ac.uk



Picture 2

Academic Directors

Professor Steve Armes

University of Sheffield

s.p.armes@sheffield.ac.uk

Dr Nigel Clarke

University of Durham

nigel.clarke@durham.ac.uk

Professor Phil Coates

University of Bradford

p.d.coates@bradford.ac.uk

Professor Peter Olmsted

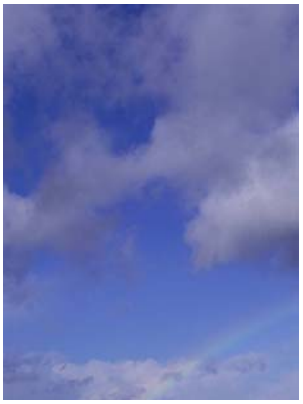
University of Leeds

Executive Group Chair 2010

p.d.olmsted@leeds.ac.uk

Future Research

Polymer IRC Research Group



To ensure that the Polymer IRC is alert to new opportunities and aware of new areas of research that we could break into, a research group has been formed from emerging talented academics from across the four member universities.

The tasks of the group include:

- The identification of areas of research strength within the Polymer IRC;
- Seeking out and specifying possible research programmes that utilise the ability of the Polymer IRC to address multidisciplinary topics. If there is a gap in the abilities available within the IRC, the group will identify collaborators who are willing and able to participate in the programme;
- The nomination of Principal investigators and Co-investigators;
- The identification of suitable sources of funding;
- Exploration of possible areas of individual research funding such as fellowships and Royal Society Research Chairs;

In the past year the Research group have met to collate the portfolio of skills across the IRC. From this they have identified a number of broad research themes that may be suitable for large collaborative research programmes. The research group organised workshops in the areas of Nanocomposites and Biopolymers and the results of these days are being developed into multidisciplinary proposals

Research Group Membership

Dr Mark Geoghegan (Sheffield)

Dr Tim Gough (Bradford)

Dr Lian Hutchings, Chair (Durham)

Dr Daniel Read (Leeds)

Further information: Lian Hutchings

email: l.r.hutchings@durham.ac.uk

Networking Activities

bringing UK polymer researchers together

External networking is one of the many interactions that are undertaken by the Polymer IRC to raise the profile of the expertise and skills that are available within the university groups. The Knowledge Transfer Networks (KTNs) funded by the Technology Strategy Board have been established to help businesses innovate by bringing together and supporting companies and innovators.

A significant activity for the IRC during the past year has been the delivery of seven further Foresight Workshops for the Polymer Sector (formally Polymer Innovation Network node) of the Materials KTN. The management, organisation and delivery of the workshops was handled by Steve Morris. The delivery of the workshops benefited greatly from the very generous support from individual members of the Polymer IRC who not only attended but also helped with the facilitation. In turn this exposed the Polymer IRC to several new, often small, companies for the first time and led to opportunities to be involved in potential projects arising from the workshops. In addition to working with the Materials KTN, Dr Ahmed Iraqi of the Polymer IRC was invited by the UK Displays and Lighting KTN to present at a Taiwanese mission held in the UK.

The EPSRC is a major partner for the Polymer IRC. Maintaining the profile of the Polymer IRC within EPSRC has taken place in a variety of ways including attending EPSRC events and one-to-one meetings. Reorganisation within EPSRC has seen the disappearance of a specific Programme for Materials. The new Physical Sciences Research Programme is most relevant for Polymer IRC interests and discussions have been held with the Head of Programme, Andrew Bourne, who is now a member of the Polymer IRC Board. The Polymer IRC Director, Randal Richards, met with the EPSRC Directors after the reorganisation to explore their views on how the Polymer IRC could look to the EPSRC for support in ensuring the IRC thrives and delivers for the UK. Discussions have also been held with EPSRC's John Baird, Head of Knowledge Transfer.

There are of course many other examples of external networking that we are all involved in, formally or informally, which raise the profile of the Polymer IRC; the ones described here are just a flavour. As people change and organisations revise and tune their strategies our challenge is to keep them aware of the Polymer IRC and our developments. For example, the KTNs have recently undergone significant changes as they enter into contracts with the Technology Strategy Board for the next 3 years, involving mergers, new management and revised business plans.

Barry Maunders

Network Development Director

email: b.maunders@leeds.ac.uk

Polymer IRC Club

Our Industrial Club

A major aim of the IRC is to build strong relationships with the industrial community. An Industrial Club Network Member can:

- access the research, technical development, knowledge transfer and enterprise activities of internationally recognized experts through a single gateway;
- network with other researchers to gain understanding across disciplines to develop new thinking and approaches;
- plug into technical and scientific developments at an early stage;
- convert networking opportunity into technical innovation;
- gain interdisciplinary understanding and develop new thinking and approaches;
- take advantage of opportunities to identify potential industry recruits from networking with academic researchers.

Partnership

The IRC can provide assistance to a diverse range of industries including (but not limited to) those involved in the production of plastics, elastomers, man-made fibres, adhesives, composite materials, surface coatings, food, packaging, personal care and medical sectors. Academics in the IRC network actively engage with industrial members, providing opportunities to develop first-class working relationships with internationally recognised experts. Regular meetings encourage the development of a common language and the sharing of skills, knowledge and technology necessary for successful innovation in polymer science and technology.

Exchanging ideas with other professional researchers in this way allows industrialists and academics to develop a better grasp of each other's needs, encouraging the conversion of networking opportunities into technical advances.

The wide range of core expertise includes :

- polymer synthesis;
- polymer self-assembly;
- molecular modelling;
- computer modelling of processing and products;
- materials characterisation;
- polymer processing.

The IRC can tackle almost any polymer related challenge, including nanotechnology, the control of polymer process and production, energy efficiency, polymers in electronic devices, biopolymers and medical/biomedical applications.

There are three levels of membership available to suit companies' needs.

Further information: Helen Clancy

email: h.e.clancy@leeds.ac.uk

Continuing Professional Development

Modular Training Course

43 delegates, evenly split between industrialists and academics, attended the IRC modular courses in Autumn 2009, at the Novotel in Sheffield. Feedback from the courses indicates that, once again, delegates were very impressed with the depth and content of the training provided.

This year the training portfolio was expanded to match market demand by introducing a module on Organic Electronics to the course programme. This gives an overview of the design, preparation and uses of organic conjugated polymers and oligomers in the electronics industry.

The new module complements the established course which already covers a wide range of topics including polymer engineering, physics, chemistry, biomaterials and nanotechnology.

Programme

- Basic Polymer Science Part I - Synthesis Properties and Processing
- Basic Polymer Science Part II – Characterisation and Analysis
- Polymer Chemistry
- Polymer Engineering
- Polymer Physics
- Multiphase Polymer Materials and Composites
- Organic Electronics – Synthesis, Properties and Application in Devices
- Polymeric Biomaterials
- Introduction to Polymer Nanotechnology
- Polymer Dynamics and Macromolecular Rheology

Delegates can choose to take part in as many or as few of the modules as required and each participant receives a personalised set of electronic and bound course notes. The 10-day programme is run annually during the last week of October and first week of November.

High demand for Basic Polymer Science I and II has led to them being repeated in the Spring for the past two years. The courses are aimed at those who interact with polymer scientists, either as a customer, supplier or within a research and development team, providing the basic skills that allow delegates to understand more about how products and/or processes work.

Further information: Shelagh Cowley

email: s.h.cowley@sheffield.ac.uk

Workshop Programme

The Polymer IRC has delivered a series of foresight workshops and technology alerts on behalf of the Polymer Sector (previously the Polymer Innovation Network node of the Materials KTN).

The Workshops

The themes for the workshops were developed in consultation with Polymer IRC staff, PIN Board members and IRC Industrial Club members to ensure the inclusion of topics with industrial relevance.

The topics were prioritised and merged with topics suggested by PIN Board members to create a final list of workshop themes.

The 8 workshops agreed and delivered were:

- New Frontiers in Polymer Waste Management
- Polymers to 'Lighten the Load' in Transport
- Polymers and 'Plastics in People'
- Polymers and 'Building Blocks' in Construction
- Polymers to 'Light up Life' (Polymer Electronics and Battery Technology)
- 'Polymers that Help Themselves' (Self-Healing/Self-Cleaning Polymers)
- 'Clever' Polymers (Smart Packaging and Labelling)
- Polymers and 'The Real Crystal Ball' (Building Polymers by Molecular Design).

Outcomes identified to date for specific workshops are:

Polymers and New Frontiers in Waste Management

An integrated UK-based plastics recycling plant.

Advanced construction composites from recycled plastic containing materials.

Regional plastics recycling infrastructure.

Polymers to "Lighten the Load" in Transport

A major car manufacturer and a global research company are collaborating to develop lightweight sound deadening materials for automotive applications.

The National Non-Food Crops Centre has developed a new thematic working group with Materials KTN focusing on polymers from natural/renewable sources.

Polymers that Help Themselves

A potential application was identified for Sheffield University's self-healing technology.

Polymers and "The Real Crystal Ball"

The Polymer IRC and Napier University have held discussions with Napier offering to help with dissemination of knowledge developed in the MuPP programme in a way that SMEs will be able to use to enable them to be more productive.

The reports from the workshops can be found on the Materials KTN website:

http://amf.globalwatchonline.com/epicentric_portal/site/AMF/menuitem.402f4e7a047b645a4391fa108380e1a0/

Please note you must register with the Materials KTN to view these pages.

Conferences

UK Polymer Showcase 2008

Polymers That Benefit Society

The 2008 UK Polymer Showcase was held in York at the National Science Learning Centre. Along with a round up of current IRC research projects, sessions addressed four topical research themes. Polymers in medicine looked into how microstructural design of materials creates biocompatibility. Advanced Polymer Waste Management examined naturally sourced polyurethanes alongside the bulk reprocessing of mixed plastic waste. Polymers for Sustainable Energy examined organic photovoltaics for large-scale solar energy harvesting and Polyolefins—The Next 50 Years, looked at the future for this particular polymer on the 75th anniversary of its invention.

Science, Education and the Media were brought together, with Radio presenter Quentin Cooper putting forward his views on how the public perceived science and scientists. John Holman, Director of the National Science Learning Centre, emphasised the need for excellence in science teaching in the UK and the importance of communicating what was happening in science to the wider community was emphasised by Tom Sheldon of the Science Media Centre.

The 2008 meeting was particularly pleased to host a delegation of 24 scientists from China. Their presence at the meeting was made possible by the IRC's EPSRC funded Virtual Institute-Polymer Process Structuring grant which aims to develop co-operations with fellow polymer scientists in China, Japan, Taiwan and Korea.

The meeting had a truly global feel, with delegates attending from Korea, Japan, China, USA and Europe.

The meeting also saw Professor Phil Coates, IRC Director at Bradford University, present the Institute of Materials, Minerals and Mining's 2008 Swinburne Lecture, before receiving the award from IRC founder member, Professor Ian Ward.

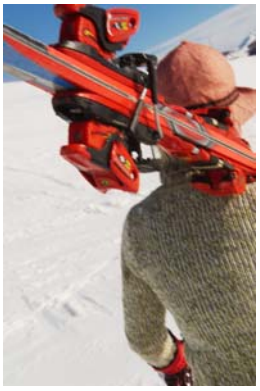
Further information: www.polymerirc.org/PolymerShowcase

email: polymer.showcase@leeds.ac.uk

UK Polymer Showcase 2009

Polymers in Sport: A Success Story

The development of polymeric materials, fibres and coatings has contributed directly to improvements in performance and is vital in safety applications in sports as diverse as formula one racing, track and field and swimming, with uses in clothing, footwear, surfaces and all types of vehicles. The 2009 UK Polymer Showcase demonstrated how advances in polymer science and technology are being applied in sports to add competitive edge, help protect participants from injury, aid damage repair and bring winter sports closer to home.



The programme opened with Dr Andrew Lynn of Orthomimetics taking a look at developments in the design and manufacture of regenerative medical implants and minimally invasive delivery systems for the treatment of sports injuries and other conditions that affect articular joints. This was followed by Dr Aileen Crawford from the University of Sheffield, describing the regenerative medicine approaches and tissue engineering techniques being utilized to provide cartilage and bone grafts to replace or regenerate defective cartilage, delaying the need for joint replacement.

The second session focussed on advanced clothing and footwear. Cath Rogan of the Smart Garment People demonstrated how nanomaterials could be incorporated into clothing for sports and personal protection. Neil Hopkinson (Loughborough University) described how rapid manufacturing techniques which require no tooling could be used to make sports footwear, reducing manufacturing costs.

The meeting moved on to consider developments in winter sports. Jonathan Philby described how Bradford University and Briton Engineering had worked together to improve the artificial ski slope surface "Snowflex", enabling ski fanatics to reduce their carbon footprints by practising their sport at home. Peter Styring (Sheffield University) explained how the advanced engineering in the Wildfire system for self -waxing skis could give competitive advantage and how this was entwined with sports regulation.

Mark Preston of Formtech Composites Ltd continued the speed theme in looking at the development of advanced polymer composites that could deal with the harsh environment of Formula 1 racing cars and how developments in this field affect industries such as aerospace and automotive manufacturing. Finally, Peter Hine (Leeds University) looked at the challenges of creating new generation single polymer self-reinforced composites and how these materials offered new opportunities for manufacturers.

In addition to insights into how advances in materials science were currently being applied in sports related industries, the speakers shared their visions and wish lists of how future advances might be harnessed by sportsmen and women, leaving the audience with food for thought on where they might contribute.

Further information: www.polymerirc.org/PolymerShowcase

Polymer Process Engineering 09

A polymer micro and nano technology focus

The biennial Polymer Process Engineering international meeting was held in the Norcroft Conference Centre, Bradford on 27th & 28th October 2009, organised in association with the Polymer Processing & Engineering Committee of the Polymer Society, Institute of Materials, Minerals and Mining and supported by the European Union FP7 programme (COTECH) and Nanofactory, a European Regional Development Fund initiative, both of which focus on polymer nanocomposites. PPE09 was hosted by the Polymer IRC laboratories, School of Engineering, Design & Technology at the University of Bradford.

The two day event was very well attended (ca. 100), with an international range of participants, and covered process, particularly injection and extrusion technology, monitoring and simulation developments, as well as a major focus on polymer nanocomposites and micro & nano technology developments. The well received key note presentation was given by Professor Ian Ward on the orientation processing of polymers. Medical applications of polymer process innovation were emphasised with the use of polyetheretherketone for long term implantable medical devices, which have a better mechanical properties match to bone, for structural use in areas such as spinal and orthopaedic applications, and the use of hot melt extrusion for enhancing the solubility of drugs.

A significant range of polymer micro and nano technology presentations formed the major part of the conference. These included precision moulding studies, including surface replication, proactive stimulation of stem cell development by surface structures, a dental root canal product, and microfluidics system moulding; novel techniques and products for two-component micromoulding and in-process thermal measurements and optical evaluations; validation of modelling, and strategies for accelerating innovation.

During the event, the launch of the new Polymer Micro and Nano Technology Centre at Bradford (a £1.4m investment) was celebrated.

During the coffee and lunch breaks opportunity was available for participants to network and visit the exhibitors, which included equipment suppliers Rondol, Battenfeld, Thermo Fisher and Desma, and the various Nanofactory partners. The last sessions on both days were used to provide laboratory demonstrations for the participants in the Polymer IRC / Polymer MNT Centre. Overall the 2 days were very successful with a great mix of presentation, networking and practical demonstrations. The conference papers are available in a hardbound book – Polymer Process Engineering 09, Enhanced Polymer Processing, Edited by P D Coates (ISBN 13 978 85143 262 2).

Phil Coates

www.polyeng.com

Centres for Knowledge Transfer

The Polymer Centre

The Polymer Centre represents approximately 40 academic staff and their research groups active in seven departments across the University of Sheffield. Managed by Dr Liam Sutton, the Polymer Centre staff co-ordinate a range of training and technology opportunities for industry and other external partners, with a particular focus on shorter term interactions key to building the strong relationships necessary for successful, longer term collaborations.

The Polymer Centre provides a single-point-of-contact access to all aspects of polymer science and technology at the University of Sheffield, managing relationships and projects with a focus on clients and commercial expectations.

Polymer Centre Review of 2009

Further information: www.polymercentre.org.uk
email polymers@sheffield.ac.uk

FaraPack Polymers Ltd

FaraPack Polymers provides industry with technical expertise and problem solving capabilities in all areas of polymer science. It undertakes short to medium term proof-of-concept and trouble-shooting work in the area of polymer materials supported by the expertise and facilities of the Polymer IRC.

Specialising in short to medium term projects of a few days through to several months, it can meet the polymer research needs of both industry and academia by:

- Utilising FaraPack Polymers' in-house scientists
- Hiring academic and post-doctoral research staff from within the Polymer IRC
- Utilising state of the art facilities available at the four universities

Further information: www.farapackpolymers.com
email: enquiries@farapackpolymers.com

The N8 Molecular Engineering Translational Research Centre

"The Science of Everyday Things"

METRC is a virtual lab pooling expertise from leading research centres across Universities in the North of England. Our focus is on soft nanotechnology and its applications in UK industry. Together, we deliver the strategic R&D services needed to drive the research agenda and stimulate economic growth.

What we do

We make it possible for academic and industry researchers to work alongside each other to deliver research into innovative new projects. Our combined strength means we can tackle challenges and capitalise on opportunities beyond the scope of any one partner.
We build networks and foster partnerships, enabling people to work together towards a common goal. We undertake fundamental and applied R&D with our industry partners and help them to secure funding for these purposes.

How we do it

Our research is focused on translation to industry. We target markets where our knowledge and technology can make an economic impact and benefit society.

The benefits for industry

- Shared risk and reward on translational projects
- Ability to build wider multi-partner projects and networks
- Opportunity to help direct and focus research agendas
- Insight into new commercial opportunities
- Early access to new technology developments

Further information: www.molecular engineering.co.uk
email: METRC@shef.ac.uk

Polymer CIC

Making Knowledge Work, by Research Excellence Applied to Industrial Needs

Polymer Centre of Industrial Collaboration

The Polymer CIC, in the world-class IRC polymer engineering laboratories at Bradford University, is a centre of research excellence for advanced materials processing, especially polymers, and computer modelling of processes and products, plus material and product characterisation. It offers R& D solutions, long and short-term projects for companies of all sizes, and a gateway to its extensive networks of companies and academic groups. It aims to help companies with their R & D, regardless of size or location.

The Polymer CIC is of particular interest to businesses operating in full, or in part, in the following areas:

- Raw materials—polymers, compounds, additives
- Process—trade processors and technology suppliers
- Applications—processing polymers in-house to manufacture products for sale
- Associated areas— supply chain i.e. those using polymers in their products

Further information: www.polycic.com
email: j.c.mcgrath@bradford.ac.uk

Centre for Micro and Nano-Moulding

Recent advances in micro and nano-technology are realising devices with a huge range of applications in the telecommunications, biomedical and automotive sectors. Micromoulding has emerged as a technique for micro-device and nano-scale surface feature manufacture, which offers all the benefits of conventional injection moulding such as high production capacity at low marginal cost.

The laboratory has been internationally recognised for pioneering research in the micromoulding field for over half a decade. Insights gained over this period have provided an impressive range of techniques and knowledge which can be applied to future challenges, including materials development and characterisation, process troubleshooting and product development for emerging markets.

Further information: www.microandnanomoulding.com
email: b.r.whiteside@bradford.ac.uk

Key Contact Points

Professor Steve Armes **Director, University of Sheffield**	**s.p.armes@sheffield.ac.uk**	**+44 (0) 114 2229342**
Dr Simon Butler **Manager METRC**	**simon.butler@sheffield.ac.uk**	**+44(0) 114 2229450**
Mrs Helen Clancy **Executive Manager Polymer IRC**	**h.e.clancy@leeds.ac.uk**	**+44 (0) 113 3433856**
Dr Nigel Clarke **Director, University of Durham**	**nigel.clarke@durham.ac.uk**	**+44 (0) 191 3342069**
Professor Phil Coates **Director, University of Bradford**	**p.d.coates@bradford.ac.uk**	**+44 (0) 1274 234540**
Miss Shelagh Cowley **Training and Events Manager** **Polymer Centre, University of Sheffield**	**s.h.cowley@sheffield.ac.uk**	**+44 (0) 114 2229520**
Dr Lian Hutchings **Chair, IRC Research Group**	**l.r.hutchings@durham.ac.uk**	**+44 (0) 191 3342133**
Dr Barry Maunders **Network Development Director**	**b.maunders@leeds.ac.uk**	**+44 (0) 1483 765584**
John McGrath **Manager, Polymer CIC**	**j.c.mcgrath@bradford.ac.uk**	**+44 (0) 1274 233624**
Professor Peter Olmsted **Director, University of Leeds**	**p.d.olmsted@leeds.ac.uk**	**+44 (0) 113 3433830**
Dr Liam Sutton **Polymer Centre Manager** **University of Sheffield**	**l.r.sutton@sheffield.ac.uk**	**+44 (0) 114 2229383**
Dr Ben Whiteside **Technical Manager Micro & Nano-Moulding** **University of Bradford**	**b.r.whiteside@bradford.ac.uk**	**+44 (0) 1274 236266**

IRC Directory 2009

Dr David Adolf, School of Physics & Astronomy, University of Leeds +44 (0) 113 3433812
d.b.adolf@leeds.ac.uk
Applications include rheology, gas diffusion in melts, chain folding/unfolding & controlled delivery.
Experimental: Time resolved optical spectroscopy to monitor local polymer dynamics (solution to blended and unblended melt) at pressures up to 3000 atmospheres.
Computational: Molecular dynamics simulations of gas permeability in polymer melts. Molecular and brownian dynamics simulations of linear and dendritic polymers from the solution to the melt state.

Dr Amalia Aggeli, Centre for Molecular Nanoscience, School of Chemistry, University of Leeds +44 (0) 113 3436407
a.aggeli@chem.leeds.ac.uk
Peptides. Biomaterials.
Fibrils. Molecular self-assembly. Biopolymers.

Professor Steven P Armes, Department of Chemistry, University of Sheffield +44 (0) 114 2229342
s.p.armes@sheffield.ac.uk
Surface polymerisation from ultrafine silica sols in aqueous solution.
Biocompatible block copolymers and their self-assembly to form micelles, vesicles and gels in aqueous solution.
Living radical polymerisation techniques to synthesise a wide range of controlled-structure, methacrylate-based water-soluble polymers
Synthetic polymer chemistry, with a strong emphasis on colloidal forms of polymers.
Nanocomposites.
Microscopic conducting polymer-based particles.
Stimulus responsive microgels.
Pickering emulsifiers for the production of oil-in-water emulsions.

Dr Stefan Auer, Centre for Molecular Nanoscience, University of Leeds +44 (0) 113 3438669
s.auer@leeds.ac.uk
Application of theoretical computational tools developed in soft condensed matter physics to investigate the phase behaviour and transitions of complex systems of biomolecules.
Colloidal crystallization and the aggregation of proteins into amyloid fibrils.
Nucleation and regulation of normal and aberrant self-assembly in biological systems and their functionalisation as nanomaterials.

Professor Colin Bain, Department of Chemistry, University of Durham +44 (0) 191 3342138
c.d.bain@durham.ac.uk
Lubrication, Food Processing, Printing, Coating, Process Engineering.
Thin films.
Surfaces and Interfaces.
Wet surface chemistry.

Professor David Barton, Mechanical Engineering, University of Leeds +44 (0) 113 3432137
d.c.barton@leeds.ac.uk
High strain properties and applications of polymers and composites.
Biomedical applications of polymers.
Finite element analysis of solid state deformation.
Processing and properties of solid phase polymers.

Dr Giuseppe Battaglia, Department of Biomedical Sciences, University of Sheffield +44 (0)114 2225962
g.battaglia@sheffield.ac.uk
Internalisation pathways of nanoparticles.
Bio nanotechnology; synthetic biology.
Biophysics; diagnostics/delivery.
Self assembling polymers in water for the design of functional materials (e.g. drug delivery systems and tissue engineering scaffolds)
Phase behaviour of amphiphilic polymers in self assembled membranes.

Professor Hadj Benkreira, School of Engineering, Design & Technology, University of Bradford +44 (0) 1274 233721
h.benkreira@bradford.ac.uk
Rheology of polymers, films and coating flows, polymer processing, especially extrusion processing; biaxially oriented films; novel processes.

Dr. Elaine Brown, School of Engineering, Design & Technology, University of Bradford +44 (0) 1274 234531
e.brown@bradford.ac.uk
Ultrasound melt flows.

Enhanced Polymer Processing.

Dr Alastair Buckley, Department of Physics and Astronomy, University of Sheffield +44 (0) 114 2223597
alastair.buckley@sheffield.ac.uk
Organic semiconductor devices.
Fabrication.
Spectroscopy of organic semiconductors.
Industrial applications OLED devices.

Dr Ashley Cadby, Department of Physics and Astronomy, University of Sheffield +44 (0) 114 2224295
a.cadby@sheffield.ac.uk
Advanced microscopy including scanning tunnelling, atomic force and scanning near field (STM, AFM and SNOM).
SNOM allows investigation for the optical properties of samples at sub-diffraction length scales (<50nm).
Energy transfer at the interface of two conjugated polymers (for development of polymer devices with higher efficiencies).
Nano-scale spectroscopy.
Light harvesting in biological systems.

Professor Neil Cameron, Department of Chemistry, University of Durham +44 (0) 191 3342008
n.r.cameron@durham.ac.uk
Polymers for tissue engineering and 3D cell culture.
Production of functional nanostructures by polymeric self-assembly.
Polypeptides.
Living radical polymerisations.
Glycopolymers.
Porous polymers.
Biologically active polymers.

Dr Matt Carre, Department of Mechanical Engineering, University of Sheffield +44 (0) 114 2227839
m.j.carre@sheffield.ac.uk
Sports engineering: improving the performance of sports equipment including hockey sticks, balls, football boots and artificial playing surfaces.
Human interaction with objects.
Hand-object interactions.
Foot/shoe surface interactions.

Dr Phil Caton-Rose, School of Engineering, Design & Technology, University of Bradford +44(0) 1274 234551
p.caton-rose@bradford.ac.uk
FEA of solid polymer deformation.

Dr Buddhapriya Chakrabarti, Department of Mathematical Sciences, University of Durham +44 (0) 191 3343073
buddhapriya.chakrabarti@durham.ac.uk
Theory of complex fluids: polymers (including poly-electrolytes, block-copolymers, and biopolymers), liquid crystals, colloidal suspensions, surfactants, synthetic and biological membranes.
Rheology and flow induced instabilities in complex fluids: polymer and colloidal gels, wormlike micelles, liquid crystals, active particles and bacterial hydrodynamics.
Theory of self-assembly of soft materials.
Biologically motivated physics: Membrane dynamics & phase behaviour, protein allostery, mechanics of viruses, DNA-protein recognition.

Dr. Rongjun Chen, Centre for Molecular Nanoscience, University of Leeds +44(0) 113 3439102
r.chen@leeds.ac.uk
Design, synthesis, characterization, in-vitro and in-vivo testing of smart biomaterials for drug delivery and gene therapy: stimuli-responsive polymers, micelles, nanoparticles and carbon nanotubes.
Medical imaging using quantum dots and fluorescent dyes.
Biomaterial-membrane interactions and toxicity studies.
Magnetic cell labelling through chemical/metabolic biotinylation and development of 3-D multicellular constructs.
Porous polymer scaffolds for bioproduction, bioseparation and tissue engineering.
Cryopreservation and lyophilization to improve the long term stability of pharmaceuticals and living cells.

Dr Chuh Chong, Department of Engineering Materials, University of Sheffield +44 (0) 114 2225984
c.k.chong@sheffield.ac.uk
Tissue engineering (experimental and modelling studies).
Effects of structural properties of scaffold, mass transport, biochemical cues and mechanical stresses on biological parameters.
Developing functional cell-seeding devices, bioreactors, porous scaffolds and biological matrices with desired architecture and material properties.
Pharmacokinetics and design of drug-eluting stents.
Understanding flow and transport in porous materials.

Dr Frederik Claeyssens, Department of Engineering Materials, University of Sheffield +44 (0) 114 2225513
f.claeyssens@sheffield.ac.uk
Laser processing of biomaterials and its applications.
Coatings for biology: biocompatible coatings of semiconductors to be integrated into cell-silicon interfaces for biosensors.
Bio printing: laser based techniques for printing biomolecules/cells for producing biomolecule arrays and biosensors.
Biomaterials manufacture via microstereolithography.

Dr Nigel Clarke, Department of Chemistry, University of Durham
+44 (0) 191 3342069
nigel.clarke@durham.ac.uk

Theory.
Modelling.
Scattering.
Rheology.
Thin films.
Blends.

Professor Phil Coates, School of Engineering, Design & Technology, University of Bradford
+44 (0)1274 234540
p.d.coates@bradford.ac.uk

Polymer Engineering: Combination of real time measurements on polymers in the melt and solid phase during processing operations and computer modelling of processing.
Research & application of process monitoring techniques: investigate molecular features, assist process design & material formulations, data for rheological CAD.
Techniques used: process rheometry, in-line & on-line measurements, visualisation, ultrasound, image analysis, UV spectroscopy.
Process modelling using finite element analysis in conjunction with process measurement techniques.

Dr Sharon Cooper, Department of Chemistry, University of Durham
+44 (0) 191 3342098
sharon.cooper@durham.ac.uk

Semi-crystalline polymers, crystallisation mechanisms.
Interfacial effects and crystallisation control and their implication for adhesion between semi-crystalline and amorphous polymers.
The research uses the combined techniques of x-ray diffraction, FTIR, optical microscopy and computational modelling.

Dr. Aileen Crawford, School of Clinical Dentistry, University of Sheffield
+44 (0) 114 2717939
a.crawford@sheffield.ac.uk

Cartilage tissue engineering: roles of cell source and scaffold on the quality of engineered tissue.
Scaffold materials.
Electrospun fibres.
Thermoresponsive gels.

Professor Steve Daley, Department of Automatic Control and Systems Engineering, University of Sheffield
+44 (0) 114 2225608
steve.daley@sheffield.ac.uk

Active control of sound and vibration.
Smart fluids, materials and devices.
Fault detection and isolation methods.
Control of dynamic test systems.
Auto-tuning and adaptive control.
Iterative learning control.
Repetitive and harmonic control.
Geometric design methodologies.
Marine systems.

Professor Andrew Day, School of Engineering Design & Technology, University of Bradford
+44 (0) 1274 234522
a.j.day@bradford.ac.uk

Engineering applications of elastomers and friction materials, especially in automotive applications.
Quality engineering and Automotive engineering - brakes and belts.

Professor Rob Dwyer-Joyce, Department of Mechanical Engineering, University of Sheffield
+44 (0) 114 2227736
r.dwyer-joyce@sheffield.ac.uk

Tribology: wear, friction & lubrication: monitoring and evaluating tribology between novel and traditional materials used in manufacturing today.
Industrial wear and lubrication problems: testing and modelling components. Examples include polymer and composite bearings and gears.
Ultrasonic measurement of interfaces and lubricant film thickness in machine components.

Professor Howell Edwards, Department of Chemical Technology, University of Bradford
+44 (0) 1274 233787
h.g.m.edwards@bradford.ac.uk

Infra red and raman spectroscopy of polymers and a wide variety of materials.
At-process spectroscopy of polymers.

Dr Rammile Ettelaie, Department of Food Science, University of Leeds
+44 (0) 113 3432981
r.ettelaie@food.leeds.ac.uk

Study of steric and electrostatic interactions in food colloids and emulsions.
Simulation and modelling of competitive adsorption process in food systems.
Mechanical properties and rheology of complex fluids in food.
Modelling of disproportion and stability of bubbles.
Transport properties in heterogeneous food systems.

Dr Mike Evans, School of Physics & Astronomy, University of Leeds
+44 (0) 113 3433807
r.m.l.evans@leeds.ac.uk

Kinetics of phase ordering: nucleation, spinodal decomposition, metastable phases mesoscopic morphology.
Effects of molecular polydispersity on phase equilibria, structure & dynamics.
Statistical mechanics of driven steady states including continuous shear flow.
Theory of Complex Fluids: polymer/liquid crystal mixtures, colloids, amphiphiles.

Dr Patrick Fairclough, Department of Chemistry, University of Sheffield
+44 (0) 114 2229411
p.fairclough@sheffield.ac.uk

Gas permeability in polymers.
Integration of experimental techniques.
The study of ordered systems, both well ordered (e.g. block copolymers) and weakly ordered (e.g. polymer networks and gels).
Response of polymers to external stimuli using small angle X-ray, neutron and light scattering, supplemented with optical, IR and electron microscopy.

Dr Christine M. Fernyhough, Department of Chemistry, University of Sheffield
+44 (0) 114 2229415
c.m.fernyhough@sheffield.ac.uk

Anionic polymerisation of polymers with controlled architectures including combs, stars, and diblock copolymers.
Synthesis of near-monodisperse polymers with specific molecular mass and composition for determining structure-property relationships in a range of applications from packaging to biomaterials.

Dr Suzanne Fielding, Department of Physics, University of Durham
+44 (0) 191 3341408
suzanne.fielding@durham.ac.uk

Mainly numerical simulation, complemented by analytical theory of the following: Glassy ageing dynamics of disordered soft "glassy" materials including foams, emulsions and dense colloids.
Hydrodynamic instabilities in biologically active materials such as cell extracts and bacterial suspensions.
Flow instabilities and flow-induced transitions in complex fluids including surfactants, polymers and liquid crystals.

Dr Joe Gaunt, The Polymer Centre, University of Sheffield
+44 (0) 114 2229440
j.gaunt@sheffield.ac.uk

Polymer technology transfer.
Matching industry needs to the most appropriate expert(s) in the faculties of Science, Engineering and Medicine.
Determination of the most appropriate format for collaborations.
Assistance in identifying and obtaining funding for collaboration.

Dr Mark Geoghegan, Department of Physics & Astronomy, University of Sheffield
+44 (0) 114 2223544
mark.geoghegan@sheffield.ac.uk

Neutron reflectometry, scanning probe microscopies, confocal microscopy, fluorescence correlation spectroscopy, ion beam analysis
Semiconducting polymers.
Stability of polymer films.
Polymer gels and networks.
Diffusion in polymer systems.
Polymer adhesion.
Structural properties of all-polymer electronic devices.
Polymers at surfaces and interfaces
Smart (responsive) materials (e.g. polyelectrolyte brushes).

Dr Elaheh Ghassemieh, Department of Mechanical Engineering, University of Sheffield
+44 (0) 114 2227868
e.ghassemieh@sheffield.ac.uk

Computational analysis of the mechanics and processing of advanced materials.
Composite materials: bio-composites (medical), functional metal based composites (aerospace and automotive applications) and technical textiles (e.g. non-wovens).
Nanocomposite elastomers.
Finite element modelling for fracture mechanics, stress and micromechanical analysis.
Image processing techniques for micro-structural evaluation.
Additive layer manufacture (wing structure).

Professor Ramin Golestanian, Departments of Physics and Chemistry, University of Sheffield
+44 (0) 114 2224273
r.golestanian@sheffield.ac.uk

Casimir effect and dispersion forces at the nano-scale.
Soft condensed matter .
Interdisciplinary data work-up.
Theoretical (and predictive) modelling.
Elasticity of biopolymers.
Polyelectrolytes.
Wetting.
Molecular machines and fluid dynamics.

Dr Tim Gough, School of Engineering, Design & Technology, University of Bradford
+44 (0) 1274 234536
t.gough@bradford.ac.uk

Flow visualisation, rheo-optics, spectroscopy, x-ray and neutron scattering for improved understanding of materials processing.

Dr Martin Grell, Department of Physics & Astronomy, University of Sheffield
+44 (0) 114 2223598
m.grell@sheffield.ac.uk

Field effect transistors (FETs) using organic semiconductors.
FETs as sensors for pollutants.
Development of simple, portable characterisation methods that can work in the field.
Light emitting organic materials.

Dr. Chris Groves, School of Engineering and Computing Sciences, University of Durham
+44 (0) 191 3342495
chris.groves@durham.ac.uk

Monte Carlo modelling of charge transport in organic materials.
Improving device performance of organic photovoltaics through understanding the effect of morphology.

Professor Jim Guthrie, Department of Colour & Polymer Chemistry, University of Leeds
+44 (0) 113 3432934
j.t.guthrie@leeds.ac.uk
Fibre reinforced polymer composites.
Influence of polymers on the "delivery" of pharmaceutical preparations.
Physical chemistry of formulation, application, wetting, film formation, adhesion and drying/curing in surface coatings systems.
Polymers in flame retardant coatings and fillers-glass lamination systems.
Optimisation of image creation processes in printing packaging and graphics (the role of the polymer).
Polymers in personal cosmetic systems.
Studies of interactions in composite polymer systems, copolymers and blends via solution properties.

Dr Oliver Harlen , School of Mathematics, University of Leeds
+44 (0) 113 3435189
o.g.harlen@leeds.ac.uk
Dynamics of multiphase materials, filled polymer melts and polymer foams.
Numerical simulation of processing of viscoelastic materials using finite element methods.
Dynamics of polymer melts and solutions. Development of constitutive equations for polymeric fluids.
Modelling of inkjet printing of complex fluids.

Dr Sarah Harris, School of Physics & Astronomy, University of Leeds
+44 (0) 113 3433816
s.a.harris@leeds.ac.uk
Biophysics.
DNA structure and dynamics.
Peptide self-assembly.
Pka prediction.
Molecular dynamics.

Professor Paul Hatton, School of Clinical Dentistry, University of Sheffield
+44 (0) 114 2717938
p.v.hatton@sheffield.ac.uk
Glass-ionomer bone cements.
Facilities for assessing of polymers and other materials used in the healthcare industry.
Bioactive glasses and ceramics for mineralised tissue repair.
Tissue engineering (cartilage and bone) and polymer biocompatibility.
Academic-industrial collaboration and technology transfer in the orthopaedic, craniofacial and dental material sectors.

Dr John Haycock, Department of Engineering Materials, University of Sheffield
+44 (0) 114 2225972
j.w.haycock@sheffield.ac.uk
Interactions between living cells and tissues with synthetic materials.
Bioactive surfaces.
Dip-dry anti-inflammatory, anti bacterial, advanced materials.
Controlling the behaviour of skin and nerve cells with adhesive, migratory and anti-inflammatory peptides.
Nerve tissue engineering using bioreactors and nerve guidance channels.
Skin tissue engineering using synthetic fibre scaffolds.
3D in vitro models to detect toxic and inflammatory compounds as an alternative to animal models.

Dr Simon Hayes, Department of Engineering Materials, University of Sheffield
+44 (0) 114 2225516
s.a.hayes@sheffield.ac.uk
Nanomechanical testing, including nanoindentation for testing bulk polymers, thin polymer coatings and biological materials.
Viscoelastic properties of very low modulus polymers at a range of temperatures and frequencies.
Self-sensing and self-healing smart materials for damage/degradation detection/mitigation and cure monitoring systems.

Dr Peter Hine, School of Physics & Astronomy, University of Leeds
+44 (0) 113 3433827
p.j.hine@leeds.ac.uk
The production and properties of novel self reinforced polymer/polymer composites (Hot Compaction).
The use of particulate fillers (including nano-fillers) to modify the mechanical properties of polymers in the solid and melt states.
Linking molecular structure to processing and properties in unfilled and filled polymers.
Structure/property relationships in novel polymers including functionalised novel norbornenes synthesised at Durham University.

Dr Jamie Hobbs, Departments of Chemistry and Physics and Astronomy, University of Sheffield
+44 (0) 114 2224532
jamie.hobbs@sheffield.ac.uk
Ultra-fast and temperature controlled atomic force microscopy.
Following surface dynamic process and polymer crystallisation.
Development and application of scanning probe microscopy (SPM) techniques for the study of polymers.
Non-destructive observations of processes in polymers in real time under a wide variety of environmental conditions.

Dr Alma Hodzic, Aerospace Engineering, University of Sheffield
+44 (0) 114 2227720
a.hodzic@sheffield.ac.uk
Dispersion of nanoparticles in advanced polymer matrices.
Design of better interfaces between all types of reinforcing fibres and corresponding matrices, with utilization of new research tools in nanotechnology.
Environmental degradation of composites.
Natural fibre composites designed to replace synthetic components in the automotive and building industries.
Development and design of recycled polymer products for structural applications.
Life cycle analysis of recycled technologies and composite materials in aerospace.

Professor Kirill Horoshenkov, School of Engineering, Design & Technology, University of Bradford
+44 (0) 1274 233867
k.horoshenkov@bradford.ac.uk
Acoustics of polymers in the form of foams and resilient layers and ultrasonic methods of polymer characterisation.

Dr Jonathan Howse, Department of Chemical & Process Engineering, University of Sheffield
+44 (0) 114 2227596
j.r.howse@sheffield.ac.uk
Polymers at surfaces - grafted lipid bilayers and biomimetic, engineered surfaces.
Amphiphilic polymer microphase separation and self-assembly.
Novel routes for polymer vesicle production.
Nano-machines and nano-swimmers - responsive polymers.
Use and behaviour of polymers at the nanoscale.
X-ray and neutron reflectometry, ellipsometry, atomic force microscopy, optical and confocal fluorescence microscopy.
Small angle x-ray scattering.

Dr Lian Hutchings, Department of Chemistry, University of Durham
+44 (0) 191 3342133
l.r.hutchings@durham.ac.uk
Living polymerisation techniques principally anionic polymerisation but also ring opening metathesis polymerisation (ROMP), atom transfer radical polymerisation (ATRP) and reversible addition fragmentation chain transfer polymerisation (RAFT).
Synthesis and application of novel well defined, long-chain, branched polymer architectures - DendriMacs and HyperMacs.
Multifunctional polymer additives for the control and modification of surface properties - where a surface constitutes an air-polymer, polymer-polymer, polymer-liquid or polymer-solid interface, including nanoparticles.

Dr Ahmed Iraqi, Department of Chemistry, University of Sheffield
+44 (0) 114 2229566
a.iraqi@sheffield.ac.uk
Design and development of conjugated polymers for application in displays and solar cells.
Electro-and photo-active polymers including polythiophenes, conjugated main-chain carbazole polymers and polyacenes.
Synthesis and characterisation of a wide range of tractable, functionalised, regioregular polythiophenes by post-modification of preformed precursor polymers.

Dr Lars Jeuken, School of Physics and Astronomy, University of Leeds
+44 (0) 113 3433829
l.j.c.jeuken@leeds.ac.uk
Redox-active membrane enzymes.
Novel electrode surfaces.
Protein-Film Voltammetry.

Professor Zhongmin Jin, School of Mechanical Engineering, University of Leeds
+44 (0)113 3437471
z.jin@leeds.ac.uk
Joint replacement and substitution.
Tissue re-engineering.
Functional spinal interventions.

Professor Frank Jones, Department of Engineering Materials, University of Sheffield
+44 (0) 114 2225477
f.r.jones@sheffield.ac.uk
Fibre-reinforced composites; mechanics, chemistry and performance.
Self-healing, self sensing composites.
Smart-polymer matrix composites.
Functional coatings for composite reinforcing fibres (e.g. plasma polymers).
Computational prediction of resin properties.

Professor Richard Jones, Department of Physics & Astronomy, University of Sheffield
+44 (0) 114 2229820
r.a.l.jones@sheffield.ac.uk
Biopolymer mixtures: phase separation.
Ultrathin polymer films: structure of interfaces, stability and glass transition.
Interface effects on polymer transitions.
Proteins at interfaces: folding.
Interface structure and thin films.
Polymers at surfaces and interfaces (experimental and theoretical).
Polymer brushes: structures and response to changing environments.
Morphology in semiconducting polymers.
Self motile objects at micro and nanoscale.
Broader issues in nanotechnology.

Dr Adrian Kelly, School of Engineering, Design and Technology, University of Bradford
+44(0) 1274 234532
a.l.kelly@bradford.ac.uk
Materials formulation, including composites, nanocomposites and additives.
Polymer melt processing research and thermal optimisation, including extrusion, compounding and injection moulding.
In-process monitoring techniques such as rheometry, ultrasound and spectroscopy.
Pharmaceutical polymer formulations, processing and characterisation.

Dr Robert Kelsall, Centre for Molecular Nanoscience and School of Electronic & Electrical Engineering, University of Leeds
+44 (0) 113 3432068
r.w.kelsall@leeds.ac.uk
Theory and simulation of semiconductor and molecular nanostructures and nanodevices.

Dr Ezat Khosravi, Department of Chemistry, University of Durham
+44 (0) 191 3342014
ezat.khosravi@durham.ac.uk
Polymerisation Chemistry, Polymerisation Reactions particularly ring opening metathesis polymerisation (ROMP); Polymeric Materials; Biopolymers; Self Healing Polymer Systems.

Professor Graham Leggett, Department of Chemistry, University of Sheffield
+44 (0) 114 2229556
graham.leggett@sheffield.ac.uk
Nano fabrication.
Surface analysis: XPS and SIMS.
Biological interactions at surfaces.
Friction force microscopy.
Chemical force microscopy.
Nano tribology.
Scanning probe microscopy and atomic force microscopy to gain direct access to surface morphology and properties with nanometre spatial resolution.

Dr Roger Lewis, Department of Mechanical Engineering, University of Sheffield
+44 (0) 114 2227838
roger.lewis@sheffield.ac.uk
Finger friction and grip of sports equipment and packaging.
Ultrasonic techniques for characterising contact pressures and areas in component interfaces.
Design codes for wear resistance in industrial applications.
Solving industrial wear problems e.g. wheel/rail tribology and automotive tribology issues.

Professor David Lidzey, Department of Physics & Astronomy, University of Sheffield
+44 (0) 114 2223501
d.g.lidzey@sheffield.ac.uk
Fabrication of high efficiency polymer LEDs in an inert atmosphere to prevent oxidation of their low work function metallic cathode.
Preparation of thin-films and devices in dust-free conditions to create high quality structures and devices.
Organic optoelectronic and photonic devices and structures.
Conjugated polymer LEDs (light-emitting diodes) and photovoltaic devices.
Spectroscopy of organic semiconductors; linear, time-resolved emission, pump-probe; allows measurements of optical and electronic properties.

Professor Long Lin, Department of Colour & Polymer Chemistry, University of Leeds
+44 (0) 113 3436735
l.lin@leeds.ac.uk
Synthesis of dyes, pigments and polymers, synthesis of thermochromic and photochromic colorants, printed electronics, micro/nano-encapsulation, security printing and anti-counterfeit solutions.
Digital printing and conventional printing technologies - particularly for high-value added applications, ink/coating formulations.

Professor Sheila MacNeil, Department of Engineering Materials and Division of Clinical Sciences, University of Sheffield
+44 (0) 114 2225995
s.macneil@sheffield.ac.uk
Electrospun polymeric scaffolds.
Tissue engineering of skin and other soft tissues (oral mucosa, cornea, nerve, oesophagus and bladder).
How polymers can serve as matrices for generating replacement human tissue.
3D tissue-engineered models to study dermatotoxicity and mucotoxicity, wound healing, skin contracture, pigmentation, melanoma invasion and angiogenesis.
Wound modifying dressings.
Bacterial sensing using stimuli responsive polymers.
Computer modelling of epithelial tissues.
Hydrogels for scaffolds (cornea), drug delivery and sensing.

Dr Mike Martyn, School of Engineering, Design & Technology, University of Bradford
+44 (0) 1274 235929
m.t.martyn@bradford.ac.uk
Coextrusion Processing.
Biomaterials Processing.
Ceramic and metal injection moulding.
Polymer Property Enhancement.

Dr Johan Mattsson, School of Physics and Astronomy, University of Leeds
+44 (0) 113 3433815
k.j.l.mattsson@leeds.ac.uk
Experiments: Scattering techniques, dielectric spectroscopy, rheology, calorimetry and microscopy.
Relaxation dynamics in molecular and polymeric materials. The effects of shear on non-equilibrium systems. The role of hydrogen bonding in the dynamics and structure of complex fluids. Dynamics in confined systems; physics of thin polymer films.
Physics of non-equilibrium systems; dynamic arrest in molecular and colloidal glass-formers; dynamic arrest in colloidal and polymeric gel-formers; dynamics and structure in soft matter; jamming.

Professor Tom McLeish, Departments of Physics and Chemistry, University of Durham
+44(0) 191 3346051
t.c.b.mcleish@durham.ac.uk
Dynamics of Phase Separation in Polymeric Fields.
Self-Assembled Complex Fluids and Biopolymers.
Molecular Polymer Rheology.
Polymer Melt Processing.
Protein Dynamics.

Dr Leigh Mulvaney-Johnson, School of Engineering, Design & Technology, University of Bradford
+44(0) 1274 236267
l.johnson@bradford.ac.uk
Gas assisted injection moulding.
Water assisted injection moulding.
Injection moulding.

Dr Brent Murray, Food Sciences, University of Leeds
+44 (0) 113 3432962
b.s.murray@food.leeds.ac.uk
Gelation of proteins and polysaccharides.
Interfacial and bulk rheology of adsorbed biopolymers.
Colloidal interaction forces.
Emulsions, foams, dispersions.

Dr Peter Olley, School of Engineering, Design & Technology, University of Bradford
+44 (0) 1274 234437
p.olley@bradford.ac.uk
Computer modelling of polymer processing; constitutive development and 3D modelling of viscoelastic polymer melt and plastic/viscoelastic solid phase polymer; development of methods for 3D finite element application.

Professor Peter Olmsted, School of Physics and Astronomy, University of Leeds
+44 (0) 113 3433830
p.d.olmsted@leeds.ac.uk
Biologically motivated physics: Membrane dynamics & phase behaviour; protein dynamics.
Flow induced structure and phase transitions in complex fluids; including lamellar phases, wormlike micelles, liquid crystals, polymer solutions.
Polymer crystallisation; phase behaviour in polymer solutions, melts & blends.
Theory (phase behaviour & dynamics) of complex fluids: polymers, colloidal suspensions, liquid crystals, surfactants & biomaterials.

Dr Emanuele Paci, School of Physics and Astronomy, University of Leeds
+44 (0) 113 3433806
e.paci@leeds.ac.uk
Computational studies of protein folding.
Simulation of the mechanisms of forced unfolding and unbinding.

Dr Raj Patel, School of Engineering, Design and Technology, University of Bradford
+44 (0) 1274 233690
r.patel@bradford.ac.uk
Polymer Processing: Mixing in extrusion, nanocomposites formulation using purpose built minimixer.
Coating Flows: Study of instabilities (air entrainment) in high speed coating flows.
Research & application of process monitoring techniques: Investigate nanocomposite structure with a view to enhancing properties. Scale-up work to assist process design.
Techniques used: in-process measurements, off line rheology

Dr Simon Pope, Department of Automatic Control and Systems Engineering, University of Sheffield
+44 (0) 114 2225186
s.a.pope@sheffield.ac.uk
Integration of next and future generation active materials into sound, vibration and fluid flow control.
Energy redistribution in actively controlled structures.
Active control and detection of vibration, sound and electromagnetic signals.
Energy harvesting.
Nonlinear structures in space and planetary plasmas.

Mr Andy Pryke, FaraPack Polymers Ltd, University of Sheffield
+44 (0) 114 22209499
andy.pryke@farapackpolymers.com
Polymer Synthesis.
New materials.
Packaging.
Feasibility studies.
Polymer testing and analysis.
Short-term research and development.

Professor Chris Rayner, School of Chemistry, University of Leeds
+44 (0) 113 3436579
c.m.rayner@leeds.ac.uk
Natural product synthesis.
Photochemistry.
Coloration and natural dyes.
Renewable biopolymers (e.g. PLA).
Preparation of coloured and functionalised polymers.
Continuous reactions.
Reactivity of CO2.
Supercritical CO2.
Stereocontrol (enantioselectivity and diastereoselectivity).

Dr Daniel Read, School of Applied Mathematics, University of Leeds
+44 (0) 113 3435124
d.j.read@leeds.ac.uk
Development of constitutive equations for linear and branched polymers.
Relating mechanical properties to microstructure of semicrystalline and phase-separated polymers.
Statistics of polymer architectures obtained in industrial reactions.
Theoretical polymer physics: calculation of scattering patterns from stretched polymer melts & blends.

Dr Gwen Reilly, Department of Engineering Materials, University of Sheffield
+44 (0) 114 2225986
g.reilly@sheffield.ac.uk
Tissue engineering of bone and cartilage.
Mechanical properties of biomaterial scaffolds.
Effects of controlled mechanical loading on the growth and orientation of tissue in a 3D scaffold.
Cell-material interactions, cell mechanics and cell signalling.
Alternatives to animals in musculoskeletal research.

Dr Tim Richardson, Department of Physics & Astronomy, University of Sheffield — **+44 (0) 114 2224280**
Modelling the interactions of porphyrins and molecular species. — **t.richardson@sheffield.ac.uk**
Electrical and optical properties of gold nanoparticle Langmuir-Blodgett (LB) and Langmuir-Schaefer (LS) films.
Building organised molecular multilayered architectures using a wide range of materials.
Sensing using thin films.
Applied molecular engineering.
Ultra-thin film deposition of polymers.
Nanolithography.
Polyether LB films for battery applications and luminescent polymers.

Dr Mike Ries, School of Physics & Astronomy, University of Leeds — **+44 (0) 113 3433859**
NMR micro imaging, diffusion tensor imaging, self-diffusion constants and rheo-nmr. — **m.e.ries@leeds.ac.uk**
Solid state NMR to measure dynamics in polymeric systems.
NMR experimental & theoretical studies of: Orientation & dynamics in polymer networks, network blends & interpenetrating polymer networks; crosslink densities, screening lengths & correlation times.
Structure & dynamics of miscible polymer melt blends; local friction coefficient & entanglement length as a function of composition.
Rouse & reptation parameters of linear monodisperse polymer melts; Kuhn length, Rouse times & ideal glass transition temperature.
Polymer electrolytes; the effect of salt on dynamics & structure of polymer matrix.

Dr Steve Rimmer, Department of Chemistry , University of Sheffield — **+44 (0) 114 2229565**
Synthesis of telechelic oligomers (living radical/cationic polymerizations and chain cleavage). — **s.rimmer@sheffield.ac.uk**
Molecular imprinted polymer colloids (synthetic antibodies).
New synthetic methods for the synthesis of polymers.
Polymers that undergo phase transitions in response to biological stimuli.
Polymer co-networks.
Polymers for tissue engineering.
Synthesis of designed functional polymers for medical applications.

Dr Jem Rongong, Department of Mechanical Engineering, University of Sheffield — **+44 (0) 114 2227845**
Friction-based damping systems; particle dampers (e.g. granular polymeric materials as fillers). — **j.a.rongong@sheffield.ac.uk**
Characterisation of materials in terms of their damping characteristics.
Design of damped components (e.g. hollow turbomachinery blades).
Active and adaptive structures for damping.
Vibration damping using polymers.
Predictive modelling of vibrating and damped systems.
Viscoelastic damping materials: development, analysis and testing of polymers; design and testing of syntactic foams and other multiphase systems.
Surface damping treatments: free and constrained layer systems using organic and ceramic materials.

Dr George Rosala, School of Engineering, Design & Technology, University of Bradford — **+44 (0) 1274 234521**
Finite element analysis of polymer solids and engineering materials. — **g.f.rosala@bradford.ac.uk**

Professor Tony Ryan, Department of Chemistry , University of Sheffield — **+44 (0) 114 2229760**
Polyurethane. — **tony.ryan@sheffield.ac.uk**
Nanotechnology, responsive polymers and control of microstructure.
Building analytical techniques into processes.
Building new techniques to follow development of structure.
Polymer structures, properties and processing.
Following structural changes in real time during processing synthesis and use.

Dr Ian Scowen, Department of Chemical Technology, University of Bradford — **+44 (0) 1274 233765**
Organo-metallic catalysis. — **i.scowen@bradford.ac.uk**

Professor Costas Soutis, Department of Mechanical Engineering , University of Sheffield — **+44 (0) 114 2227718**
Structural health monitoring of composites. — **c.soutis@sheffield.ac.uk**
Structural applications of composites.
Aerospace.
Advanced composites structures mechanical properties and characterisation.
Failure analysis and fracture mechanics from micro to macro scale.
Joining and repair of composites.
Intelligent materials and structures.
Non-destructive testing and evaluation.
Modelling and finite element analysis.

Professor Peter Styring, Department of Chemical & Process Engineering, University of Sheffield — **+44 (0) 114 2227571**
Immobilisation of catalysts onto swellable polymers to facilitate heterogeneous catalysis (androgynous catalysis). — **p.styring@sheffield.ac.uk**
Design and synthesis of electromechanical polymers for use as micro pumps and valves.
Chemical micro and meso reactors.
Polymers and soft actuators in chemical engineering.
Snow sports engineering: self waxing skis and new functional polymers for ski surfaces.
Carbon-cycle: carbon capture, activation and conversion.
Green, benign and sustainable technologies.

Dr Liam Sutton, The Polymer Centre, University of Sheffield — **+44 (0) 114 2229383**
General Manager of the Polymer Centre. — **l.r.sutton@sheffield.ac.uk**
Contract research, consultancy and testing services (pure and applied research).
Training and education courses.
Developing collaborative links between academia and industry.
Commercial exploitation and demonstrator projects.
Industrial seminars and outreach activities.
Marketing and communication.
Research and training partnerships.

Dr Linda Swanson, Department of Chemistry, University of Sheffield — **+44 (0) 114 2229564**
Motion of polymers in solid and solution phases. — **l.swanson@sheffield.ac.uk**
Interactions of polymers with other types of polymers, biopolymers and surfaces.
Use of luminescent labels attached to polymer backbones to monitor the dynamics of individual polymer chains in polymer solids and blends.
Use of labelled polymers to establish links between molecular properties and mechanical and electrical behaviour.

Dr John Sweeney, School of Engineering, Design & Technology, University of Bradford — **+44 (0) 1274 235456**
Solid phase deformation processing of polymers; constitutive relationships for solid polymers; finite element analysis of deformation processing. — **j.sweeney@bradford.ac.uk**

Dr Annette Taylor, School of Chemistry, University of Leeds — **+44 (0) 113 3436529**
Complex systems. — **a.f.taylor@leeds.ac.uk**
Excitable media.
Biomimetics.
Chemical and biological kinetics.
Nonlinear dynamics.
Oscillations, waves and patterns.

Dr Richard Thompson, Department of Chemistry , University of Durham — **+44 (0) 191 3342139**
Ion beam analysis and neutron scattering techniques applied to study polymer surfaces and interfaces. — **r.l.thompson@durham.ac.uk**
Ion beam and AFM services for visiting researchers.

Dr Harvey Thompson, School of Mechanical Engineering, University of Leeds — **+44 (0) 113 3432136**
Experimental flow visualisation. — **h.m.thompson@leeds.ac.uk**
Process flow simulation and optimisation.

Professor Geof Tomlinson, Department of Mechanical Engineering, University of Sheffield — **+44 (0) 114 2227705**
Novel damping technologies (e.g. non-contact damping devices, gradient materials and energy transfer concepts). — **g.tomlinson@sheffield.ac.uk**
Characterisation of materials in terms of their damping characteristics.
All aspects relating to the vibration of engineering structures.
Vibration damping using polymeric/viscoelastic materials and composites.
Finite element models to estimate the characteristics of materials in service.
Non-linear analysis.
The work is heavily applied; materials passing test criteria are subsequently incorporated into engine and other test beds in industry, prior to production.

Dr Lance Twyman, Department of Chemistry, University of Sheffield — **+44 (0) 114 2229560**
Synthesis, properties and commercial exploitation of highly branched polymers and dendrimers. — **l.j.twyman@sheffield.ac.uk**
Control of architecture and morphology of hyper-branched polymers.
Dendrimers and hyperbranched polymers for drug and gene delivery.
Dendritic polymers as enzyme mimics, size selective inhibitors to protein-protein binding and potential artificial blood.
Light harvesting dendritic polymers.
Immobilized dendrons for solid phase applications.

Professor Goran Ungar, Department of Engineering Materials, University of Sheffield
+44 (0) 114 2225457
g.ungar@sheffield.ac.uk
Structure and morphology of semi-crystalline polymers (including biodegradable and light-emitting polymers).
Self assembly of large molecules and polymers into supra-molecular structures.
Molecular architecture and functionality selection to provide a range of shapes (cylinders, spheres, wedges and ribbons).
Structure and phase behaviour of liquid crystalline and supra-molecular polymeric, oligomeric and low molecular systems.
Development of advanced instrumentation and analytical methods for x-ray and neutron scattering.
Fast real-time small-angle neutron scattering (RTSANS).

Professor Ric van Noort, School of Clinical Dentistry, University of Sheffield
+44 (0) 114 2717910
r.vannoort@sheffield.ac.uk
Finite element analysis to study behaviour of the system as a whole.
Interaction between the materials and the biological environment.
Biocompatibility testing using 3D oral mucosal model.
Customised prostheses based on detailed imaging data.
Enamel/dentine and other bond strength measurements and testing.
The relationship and interaction between the properties and design of dental materials and their clinical performance.
Structural integrity of the restored tooth.
CAD-CAM technologies.
Nano-particulate filled composites.

Dr Alison Voice, School of Physics & Astronomy, University of Leeds
+44 (0) 113 3436647
a.m.voice@leeds.ac.uk
IR and Raman spectroscopy/microscopy, DSC, Rheology.
Polymer Gel Electrolytes. Lithium Batteries.
PVDF, PEN, PEEK.

Dr Xiasong Wang, School of Chemistry, University of Leeds
+44 (0) 113 3432809
x.s.wang@leeds.ac.uk
Functional nanomaterials: to create nanomaterials through supramolecular chemistry and explore nano-size induced properties for application in modern technologies.
Synthesis of well designed polymers that have controlled designed attributes.
Supramolecular Chemistry: to understand macromolecular self-assembly behaviour.
Synthesis, macromolecules, Supramolecular chemistry, Functional Nanomaterials, Biomedical applications.

Professor Ian Ward, School of Physics & Astronomy, University of Leeds
+44 (0) 113 3433808
i.m.ward@leeds.ac.uk
Highly-oriented polymers & studies of their properties & structure.
Structural studies of polymer deformation processes; NMR; molecular modelling of orientation; modelling the mechanics of engineering processes; hot compaction.
Ionically conducting polymers for rechargeable lithium batteries.

Dr Ben Whiteside , School of Engineering, Design and technology, University of Bradford
+44 (0) 1274 236266
b.r.whiteside@bradford.ac.uk
Modelling.
Glass filled polymer injection.
Micro and Nano-moulding.

Dr Mark Wilson, School of Mechanical Engineering, University of Leeds
+44 (0) 113 3432177
m.wilson@leeds.ac.uk
Industrial coating flows.
Thin film flow over topographies.
Ink jet printing.
Droplet dynamics.
Mixing/chaotic advection.
Lattice Boltzmann methods.
Dynamic wetting.
Vehicle ventilation for animal welfare.

Professor Mark Wilson, Department of Chemistry, University of Durham
+44 (0) 191 3344634
mark.wilson@durham.ac.uk
Molecular dynamics and Monte Carlo simulation techniques - simulation of functional polymers including amphiphilic polymers at interfaces and liquid crystal polymers.
Simulation of polymers, dendrimers, liquid crystals and soft matter.
Development of coarse-grained simulation models for macromolecular systems.
Development of new parallel simulation methods for polymers.
Studies of diesel and diesel additives.
Simulations of biopolymers including proteins and studies of amino acid/lipid interactions.

Dr Andrew Wilson, School of Chemistry, University of Leeds
+44 (0) 113 3431409
a.j.wilson@leeds.ac.uk
Organic synthesis.
Supra-molecular chemistry.
Molecular recognition.
Self-assembly.

Professor Alastair Wood, School of Engineering, Design & Technology, University of Bradford
+44 (0) 1274 234281
a.s.wood@bradford.ac.uk
Phase change.
Numerical heat transfer.
Numerical techniques for polymer forming.
Plastics fusion modelling.
Energy modelling.
Optimisation.

Dr Junjie Wu, School of Engineering, University of Durham
+44 (0) 191 3342440
junjie.wu@durham.ac.uk
Tissue Engineering
Bioactive Chemistry.
Biomedical engineering and Energy Conversion.

Dr Xiangbing Zeng, Department of Engineering Materials, University of Sheffield
+44 (0) 114 2225948
x.zeng@sheffield.ac.uk
Nano-scale structural studies using small angle x-ray and neutron scattering (SAXS and SANS).
Study of 1-d, 2-d, 3-d ordered macromolecular and supra-molecular nano-structures (on the scale 1-100nm).
Transient structures and rapid transformations such as polymer crystallization.
Liquid quasi-crystalline polymers.
High band gap polymers.
Nanocomposites (porous aluminas with LC in channels).