



Organised by the Polymer IRC and sponsored in part by the Polymer Innovation Network and Yorkshire Forward, the UK Polymer Showcase highlights recent new technology and invites collaboration on all levels. This year, the Showcase took place at the prestigious London College of Fashion. As expected then, there were opportunities for questions to be asked by both art and science representatives from industrial, business and academic environments and indeed to consider the awareness, interchange of ideas and “physical” cooperation between these two disciplines.

In the introduction from the IRC Director, Professor Tom McLeish referred to this high-potential interaction; two foremost expressions of this being the anticipated “Wonderland” and “Smart Textile” exhibits.

The first session, under the title “Polymer IRC Research”, presented the work of the members of both the IRC and industrial club. In particular, Peter Hine from the University of Leeds described the doctrine of the Microscale Polymer Project (MuPP), now into its fourth year. This collaborative enterprise has brought together a multidisciplinary team of academics and industrialists with the aim of understanding how molecular variables affect processing, and, ultimately properties. Initially focussed on polymers with precisely tailored architectures, the project has expanded its scope to investigate blends of different molecular topologies, devise theories and experiments for polydispersed ‘industrial’ polymers and explore more exotic materials.

In “Smart Textiles”, Jane McCann of the University of Wales gave an overview of current trends and requirements in today’s market driven textile retail trade, with special reference to “Smart Clothes” and “Wearable Technology”. In the first, she outlined new multilayer textiles for sport, insulation and travel wear. This demands the selection of a complementary mix of technical textiles and the specification of appropriate construction methods. From this arose the pertinent question of how synthetic fibres/textiles from future polymers might be designed and introduced. A transfer of “embedded technology”, principally from the sportswear sector in to a suitable format for use by the active ageing community, was also proposed.

In “Polymer Biomaterials”, Stanislav Gorb of the Max Planck Institute gave an inspired lecture

on the adhesive properties of artificial fibrillar contact structures. The attachment systems of beetles were chosen to serve as a working model. Biomimetic mushroom-shaped fibrillar adhesive microstructures inspired by these systems were characterized in terms of adhesive strength and service life. The image of a robot walking unaided up a vertical surface using this dry adhesive technology certainly fired the imagination of the audience. In the same session, the field of degrading polymers in orthopaedics was explored by David Farrar of Smith & Nephew Research, York. In many medical implant applications material degradation is an undesirable feature; however, bioresorbable implants turn this otherwise unwanted phenomenon into a virtue. These polymers are increasingly in use to replace metals in orthopaedic devices such as suture anchors/tacks, interference screws for ligament repair and fracture fixation screws, pins and plates. Despite the success of these bioresorbable polymers, and the growth in their use, a number of key challenges remain including optimisation of degradation rates to better match healing rates of tissues; development of materials with improved mechanical properties for greater load-bearing applications; and improvement in biocompatibility of breakdown products and long-term in-vivo performance.

On the second day, the “UK Materials Strategy” session was initiated by Simon Edmonds of B.E.R.R (formerly D.T.I.). He emphasised why such an Innovation and Stimulation strategy is vitally important to the UK Government and how a new streamlined programme has been put in place to rationalise and co-ordinate these schemes. Previously, the portfolio of such incentive schemes was large and unwieldy, but the implementation of a new Technology Strategy Board signifies easier access to finance, support in integrating new regulations, enhanced links between business and the research community and improved support for programmes to deliver innovative solutions. A knowledge transfer network has been established that creates research communities in key markets and technologies connected to fund providers and science expertise. Robert Quarshie, director of this new Knowledge Transfer Network continued in this theme, with particular emphasis on the development of a Materials Network, covering such commodities as metals, polymers, textiles and nano-particles,

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incorporating raw materials producers, materials manufacturers and downstream processors. This approach has already generated several award-winning and commercially workable projects.

The anticipated "Science and the Arts" section was brought to life with "Wonderland", a collaboration between leading fashion designer Helen Storey and Sheffield University's ICI Professor Tony Ryan. Sponsored by EPSRC, this visual feast is intended to stimulate debate about the disposable nature of everyday items and the impact on the environment. A dissolving dress, loaded with "explosive" chemicals and printed with appropriate equations was sadly seen to be destroyed in a matter of minutes, the dissolution process itself being part of the aesthetic experience. This meeting of minds then followed up with a bottle that, when no longer needed, dissolves to form a bio-culture and an inspired water purification bottle for use in developing countries. Commercially viable patents have already been applied for and just as important; millions in Europe alone through the power of the media have been exposed to polymer science and environmental issues. The second feature making use of creative imagery was presented by Cristina De Matteis, who, in "Lighting-up the Invisi-

ble", developed a series of graphics and videos with the BBC, depicting commodities, such as sugar, water and silk as space-filling molecular forms in everyday settings: "... which highlight the beauty of the molecular world, both in scientific and aesthetic terms". The geometry of proteins and trimethylamine molecules gave further inspiration for her novel lighting designs.

Finally, material science issues were revisited; Helen Wilson expounded on recent work at UCL, where the problem of process instability for polymer melts is being solved by predictive computational simulations. At present, linear stability theory is used to assess the stability of quasi-two-dimensional flows and computational modelling has progressed now to the point where it is possible to distinguish between numerical and physical instabilities. Numerical instabilities are failures of the computational simulation to adequately capture reality: unsteady flows and large stresses may be predicted in what ought to be a smooth flow. Physical instabilities, on the other hand, are real, and a simulation which is modelling true flow well must show unsteady behaviour where the real flow behaves badly. This work is supported by "real world" experimentation on analogous polymer melts and flow geometries.

Alma Hodzic gave a comprehensive review of nano-particles and fibres in polymer matrices. This extensive discussion covered the composite history to date but then led on to the problem of establishing how the matrix properties are affected in the interphase region, where the adhesives and surface coatings physically and chemically interact with the matrix polymer. In order to understand better the interfacial mechanisms in composite materials and the role of coupling agents, several experimental techniques have now been designed and employed to test local regions in the composite materials. Single fibre tests have been developed to reduce the influence of complicated stress transfer mechanisms in composites.

The Polymer Showcase was rounded off with a splendid evening reception at the Royal Society. Abstracts and talks can be found at <http://www.polymerirc.org/> while "Wonderland" is located at <http://www.polymercentre.org.uk/community/wonderland.php>

Figure 1:
Helen Storey and Professor Tony Ryan with the "Wonderland" dissolving dress.



This is an extract of the complete reprint-pdf, available at the Applied Rheology website
<http://www.appliedrheology.org>