

Polymer Networks 2006, the 18th International Polymer Networks Group Meeting was held in Sheffield, UK from 3-7 September 2006. The conference was organised by the Sheffield Polymer Centre, University of Sheffield under the co-Chairmanship of John Stanford (University of Manchester), Tony Ryan (University of Sheffield) and Simon Ross-Murphy (Kings College, London). The conference was kindly sponsored by the Polymer Division of the International Union of Pure and Applied Chemistry (IUPAC).

The main theme of the conference “*Functional and Biological Gels and Networks: Theory and Experiment*” highlighted a stimulating exchange of the latest research by members of the macromolecular and biological science communities, on topics that cross the boundaries between synthetic, bio- and physical gels and networks. The scientific program was multidisciplinary in its content with individual themes on functional and biological gels that ranged from the chemistry, processing, structure and properties of synthetic elastomers, to the molecular and supramolecular characterisation of gels and networks, to theory and modelling of gelation and network formation, to nanostructured gels and network nanocomposites as high-performance engineering materials, to bio- and physical gels and networks with applications in the biomedical field, in drug release, cosmetics and in the food industry. There was one plenary lecture followed by 10 invited lectures and 39 contributed oral contributions and 57 posters, all covering diverse experimental and theoretical topics within the various themes defined for the conference.

This special volume of Macromolecular Symposia contains contributions selected from the papers presented at the conference and is divided into five parts that reflect the themes of the conference programme:

- Statistical Studies on Networks
- Processing-Structure-Properties of Networks

- Scattering from Gels and Networks
- Nanostructured Gels and Networks
- Physical and Biological Gels

The first paper is from the conference plenary lecture by Walther Burchard, a founder member and former Chairman of the *Polymer Networks Group*. Walther Burchard is a distinguished polymer scientist, and is most renowned for his pioneering work on light scattering of polymers and branching theory of polymer networks, and has also worked extensively on natural and biological polymers. Such a broad and impressive background in synthetic and natural polymers presented in the plenary lecture reflected exactly the main theme of *Polymer Networks 2006*, and makes an ideal introduction to this volume.

Part 1 of this volume comprises papers from all four of the invited speakers who made presentations in the special session *Statistical Studies on Networks* that was organised at the conference in honour of Bob Stepto and to celebrate his outstanding contributions to polymer science and to the *Polymer Networks Group*. Bob Stepto who retired recently from the University of Manchester, was a founder member, former Chairman and Secretary of the *PNG*, and has also been the President of the Polymer Division of IUPAC. Bob Stepto has established a world-renowned reputation in polymer gelation and chain statistics. His research has involved both experimental and theoretical aspects, with strong emphases on the formation, structure and properties of polymer networks, and on polymerisation statistics that include significant advances in the understanding of intramolecular reaction in linear and non-linear polymerisations and, in the latter case, its interpretation in terms of theories of gelation. He has made major contributions to the understanding of the sol-gel transition, or gel point, and its relation to macroscopic effects such as viscosity and modulus that are of immense importance in the processing of all polymer

network-forming systems, and in the determination of final physical properties. Bob Stepto has collaborated with many of the world's leading polymer scientists, four of whom, Karel Dusek, Bruce Eichinger, Jim Mark and Ian Ward agreed enthusiastically to make presentations at *Polymer Networks 2006*, and to submit full papers in this special volume.

In **Part 2**, *Processing-Structure-Properties of Networks* Networks, the important link between the development of polymer network materials with suitable properties and their widespread industrial application is clearly demonstrated, using as examples, toughened epoxy resins and polyurethane foams. The two papers presented here elegantly describe the fundamental molecular processes involved in the transformation from reactive liquid state to solid polymer material, and the relationships between structure and properties. The transformation processes, studied using real-time analytical techniques, define the correlations between the chemistry, molecular and morphological structure and properties, with particular reference to polymerisation kinetics, gelation and network formation, and to competitive phase separation and vitrification processes.

Parts 3 and 4 comprise papers on *Scattering from Gels and Networks* and on *Nanostructured Gels and Networks*. Whilst scattering methods have become the techniques of choice for the study of structure and dynamics in a broad range of materials, only recently have they found widespread application in gels and networks. The papers herein convey the broad range of excellent work now being undertaken in laboratories around the world and highlight new techniques, such as photon correlation spectroscopy with x-rays, and the interpretation of scattering experiments through their comparison with rheology, osmotic pressure measurements and theory. Scat-

tering is also implicit in the characterisation of nanostructured gels and networks, and is used most effectively as part of a wide range of characterisation tools to uncover the mode of action of a synthetic muscle as well as to characterise hyperbranched networks and nanocomposite gels.

The final part, **Part 5**, *Physical and Biological Gels*, as the title implies, discusses a range of macromolecular systems, how these networks are formed and, (perhaps pertinently, as in the paper on ephemeral gels broken down again) their structure and applications. The systems range from the archetypal gelatin gels through to more exotic systems such as those formed from collagen and hyaluronic acid. It also includes valuable work on scaffolds for cell growth applications. Overall the papers reflect the state of the art in this important and growing area of research on polymer networks.

In many ways, *Polymer Networks 2006* was a great success signalling, on the one hand, the end of an era in the history of the *PNG* whilst, at the same time, acknowledging the exciting contributions of current and developing younger research scientists. The contributions to the development of polymer science in general, and to polymer networks in particular, over the past 50 years, by Walther Burchard, Karel Dusek, Bruce Eichinger, Jim Mark, Bob Stepto and Ian Ward, and other contemporaries who have also retired, cannot be underestimated. Moreover, *Polymer Networks 2006* demonstrated unequivocally that the aims and objectives of the *Polymer Networks Group*, to foster research into all aspects of polymer networks, continue with confidence for the future.

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T. Ryan,
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POLYMER NETWORKS 2006 CONFERENCE

Sheffield University 3-7 September 2006

***Statistical Studies on Networks:* Special Session in honour of Professor Bob Stepto**

Walther Burchard

Bruce Eichinger

Joan Stepto

Bob Stepto

Ian Ward

Jim Mark

Karel Dusek

John Stanford