

Convergent trends in the development of Advanced Polymer Technologies

This issue of *Macromolecular Symposia* contains selected papers presented at the 8th International Symposium on Polymers for Advanced Technologies (PAT 2005) held in Budapest, September 2005.

Advancement in modern polymer technologies such as photo-electronics, pharmaceutical and biomedical fields, environmental biodegradable systems and specific composites are increasingly interrelated. There are several reasons for it including the challenge of

- the rapid development in syntheses,
- more and more deep understanding of the theoretical basis of multicomponent systems,
- increasing possibilities for simple and controllable nanocomposite technologies and
- advancement of surface/interface engineering.

The interdisciplinary feature of the mentioned achievements provides unusual solutions for various technologies of advanced polymer systems and initiate further research activities. Thus development of an area of advanced polymer systems is adapted to another much sooner than earlier. The common thinking of scientists specialized in certain segments of polymer science and technology is strongly encouraged by conferences of interdisciplinary interest such as PAT 2006 organized by PAT board and Budapest University of Technology and Economics under the auspices of IUPAC, European Polymer Federation, Society of Polymer Science Japan, Chemical Society of Japan, Polymer and PMSE Divisions of American Chemical Society, Budapest University of Technology and Economics, Hungarian Academy of Sciences.

The four sessions of the meeting in Budapest (1. Advanced macromolecular syntheses, structures, 2. Advanced multi-

component systems, nanocomposites, 3. Electro-optical and other advanced technologies and 4. Biomedical application, biodegradation) involved more than 350 active participants from 50 countries. There were eight plenary lectures (J. Economy, P. Hodge, Y. Okamoto, A.R. Khokhlov, K. Matyjaszewski, E. Tsuchida, B. Voit, J.B. Nagy), 44 invited lectures, about 120 contributed oral presentations, and more than 150 posters.

The general and keynote lectures provided an opportunity for the participants to hear the most important recent advancement in all the areas within the scope of the conference. The keynote lecture presented by W. Kaminsky (University of Hamburg) on "Nanocomposites by in situ polymerization of olefins with metallocene catalysts" described a new economic process for producing various types of poly(propylene) nanocomposites. Novel way for synthesizing of color-controllable materials was presented by Tabata (Hokkaido University). He formed poly(phenylacetylenes) having alkoxy groups at the *para* position. The change of the colour of the resulting polymer depends on the degree of the crystallinity and dimensions of the pseudo-hexagonal structure of the polymers. J. Economy (University of Illinois) cited an US intelligence report according to which by the year 2015 water, not energy or food, will become the major resource problem in the U.S. and world. A number of new systems for trace contaminant removal have been described e.g. new and improved high surface area adsorbent polymer fibers designed to remove trace contaminants to below 1 ppb (1). P. Hodge (University of Manchester) discussed the theoretical and technological aspects of Ring-Chain Equilibria including an introduction to Ring-Chain Equilibria, introduction to the Entropically-driven Ring-Opening Polymerization (ED-ROP), useful features of

ED-ROPs, preparation of macrocyclic oligomers, and possible practical applications (2). One of the most frequently cited scientist, K. Matyjaszewski (Carnegie Mellon University), presented recent polymer syntheses, using ATRP (atom transfer radical polymerization) of acrylates, methacrylates, styrenes, acrylamides, acrylonitrile and many other vinyl monomers provides polymers with molecular weights in a large range and with low polydispersities (3). Development of plastic optical fiber materials (POF) was presented by Y. Okamoto. (Polytechnic University Brooklyn) POF has been increasingly applied to local area network. Their elastic moduli are typically many times lower than those of silica combined with several other advantageous properties. An especially interesting topic was presented by B. Voit (Leibniz Institute of Polymerresearch Dresden) demonstrating the applicability of photo- and thermally labile polymers for template formation and surface patterning (4).

It is not possible to cite here all the interesting topics of the meeting but it has to be mentioned that the activity in the field of biodegradable polymer composites (5) was especially large as it appeared not only at the meeting but in this issue as well.

The last presentation and closing remarks, given by Gy Marosi (Budapest University of Technology and Economics), focused on the convergent trends of advanced technologies. Polymer science and technology was divided for a long time to several branches that developed almost independently. This tendency has been changed recently; the gap between the different areas is getting less and less wide. Convergent concepts can be seen in the developments of advanced polymer systems used as pharmaceuticals, biomaterials, polymer composites, fire retarded polymers, membranes, conductive polymer systems and fuel cells. Examples presented in the talk include the use of process



Figure 1. Prof. Lewin (left) receiving the Zemplen award of Budapest University of Technology and Economics

control for the synthesis of reactive surfactants and polymer dispersions intercalated with nanolayers. Such systems are advantageous both for controlled release of drugs from solid pharmaceuticals in fire retarded polymer systems (6,7). Raman microscopic investigation of complex composites and pharmaceuticals, determination of polymorph structures at the interphases and, last but not least, the fire retardancy of biodegradable polymers are excellent examples of the convergency of different fields.

Valuable poster presentations extended the success of the oral sessions, which were presented by university members Ph.D. students and pharmaceutical/clinical institutions.

The rich social programs of the meeting included a concert in the main hall of the building of Hungarian Academy of Sciences, which was dedicated to Professor Menachem Lewin (Hebrew University of Jerusalem and Polytechnic University Brooklyn), the honorary chairmen of the PAT symposium and journal, who received a ZEMPLÉN award from the Dean of

Chemical Faculty of Budapest University of Technology and Economics for his valuable contribution to the advanced polymer technology and propagation the results of international science.

The sessions of PAT 2005 were worthwhile not only for devotees of certain areas but audience of different interest attended all of them. This issue of *Macromolecular Symposia* is focusing mainly on the papers presented in the field of synthesis, characterization and technology of modified polymer systems. The results of this issue confirm that the new reactive methods for modification of polymers and interfaces mean a great advancement not only in nanocomposites but also in other multi-component systems. Thus the polymers for advanced technologies, that represent strongly diverse materials, got closer to each other in Budapest and this tendency will surely continue in Shanghai, where PAT 2007 conference will be organized.

References

1. Z. Yue, C. L. Mangun, J. Economy, *Carbon* **2002**, 40(8), 1181–1191.
2. A. Ben-Haida, P. Hodge, H. M. Colquhoun, *Macromolecules* **2005**, 38, 722.
3. K. Matyjaszewski, T. P. Davis, Eds. Handbook of Radical Polymerization; Wiley, Hoboken **2002**.
4. M. Messerschmidt, L. Häußler, B. Voit, T. Krause, W.-D. Habicher, *Macromol. Symp.* **2004**, 210, 111–120.
5. G. Romhány, J. Karger-Kocsis, T. Czigány, *Macromol. Mater. Eng.* **2003**, 288(9), 699–707.
6. I. Csontos, S. Keszei, B. Marosfői, A. Szép, P. Anna, Gy. Marosi, *Eur. J. Pharm. Sci.* **2005**, 25./Supp., 75–76.
7. S. Keszei, Sz. Matkó, Gy. Bertalan, P. Anna, Gy. Marosi, A. Tóth, *Eur. Polym. J.* **2005**, 41, 697–705.

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