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BIO AND POLYMERS NEW POLYMER TECHNOLOGIES WITH WATER

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The conference titled “Bio and Polymer. New Polymer Technologies with Water” was held on September 28–30, 2008 in Aachen (Germany). This biannual meeting was organized by Gesellschaft Deutscher Chemiker, GDCh (German Chemical Society) and Fachgruppe Makromolekulare Chemie (Division of “Macromolecular chemistry”).

The meeting was supported by Deutsche Forschungsgemeinschaft (DFG), the Chemical Company BASF, Bayer Material Science, Cognis, Evonik Industrial, LanXess, Henkel, Wacker. The scientific committee included world-known scientists: H.-W. Engels (Leverkusen), H. Heckroth (Leverkusen), B. Kupperts (Aachen), K. Landfester (Ulm), M. Moller (Aachen), G. Oenbrink (Marl), J. Sandler (Ludwigshafen), R. Schoenfeld (Dusseldorf), C. Birkner (GDCh, Frankfurt am Main), C. Dorr (GDCh, Frankfurt am Main).

The conference was focused on the exchange of new results on the interface of classical polymer science and biological systems studies as well as on the importance of new water-based technologies development. This includes topics ranging from “polymers from biomass” and “chemical and physico-chemical transformations in water” to “development of novel bio-inspired macromolecular systems and bio-hybrids”. Under the common sub-title “New Polymer Technologies with Water” the conference spanned topics starting from application oriented research in water based polymers to engineering polymers from biomass and highly specific and novel bio-functional polymers.

Limited resources of water, energy, and materials cause a growing need for new concepts in material development and its ecological integration. Water technology and resource-management is a central factor not only in environmental protection, health care, and agriculture, but also in energy production and biomass application as a material source. Within Polymer Science this requires an adoption of a ‘biological view’ on polymer synthesis, application, and the utilization of polymer materials after use. Here a key to future advancement is the ability to deal with water and to take advantage of its unique properties. Due to its dielectric properties,

amphoteric nature, and ability to undergo hydrogen bonding, water is certainly the most powerful solvent we know. It imposes enthalpic and entropic forces on other molecules that form an essential base for the richness in structure formation in nature and the molecular functions in living systems. Hence, highly topical scientific and technological challenges open up upon mastering water-based self-organization of polymers; responsiveness, switching water solubility for water insolubility, and hybridization of synthetic components with biological systems.

The program of the conference comprised almost 50 lectures with plenary papers given by:

- Dr. Stefan Marcinowski, Board member of BASF SE, Ludwigshafen
 - Prof. Buddy Ratner, Director University of Washington Engineered Biomaterials
 - Prof. Jean Frechet, Professor of Chemical Engineering, University of California
 - Prof. Rolf Muelhaupt, Director Institute of Macromolecular Chemistry, Freiburg University
 - Prof. Bernhard Rieger, WACKER-Chair of Macromolecular Chemistry, Technical University Munich
- Dr. H-W. Engels (Chairman of the GDCh-division), Dr. E.M. Schmachtenberg (Rector of the RWTH Aachen), and Mr. J.Linden, (Mayor of Aachen) took part in the opening ceremony of the conference.

The plenary lecture of Dr. S. Marcinowski had title “Renewable Raw Materials – a Novel Approach in Polymer”. Prof. J.M. Frechet spoke in his plenary lecture about water-compatible polymer carriers for therapeutics and Prof. B.D. Ratner communicated information about water and biomaterials (hydrogels, healing and non-fouling).

Prof. B. Rieger presented information about carbon dioxide as building block of novel polymer architectures and Prof. R. Muelhaupt spoke about biofunctional materials (preparation, properties, and application).

Several sessions were included in the scientific program. The session “Bio-inspired Polymers” consisted of 11 oral presentations. Self-assembly of an aquaporin

mimic, tailoring surface properties with polymer brushes, bioinspired block copolymers, hierarchically structured conjugated polymers via supramolecular self-assembly, natural polymeric composites with mechanical function, macromolecular oxidation catalysts based on miniemulsion polymerization, and some other problems were discussed during this session.

The second session entitled “Bio-medical Polymers” included 11 lectures. The participants discussed the following problems: functionalized nanoparticles and nanocapsules as markers and nanocarriers in biomedical applications, smart hydrogels for biomedical applications, injectable biodegradable hydrogels for protein and cell delivery, biohybrid hydrogels for regenerative therapies, biodegradable polymers for biomedical applications, design and function of DNA and protein nanoparticles.

The session “Polymer from Biomass” included 8 oral presentations. These presentations were devoted to the problems of polymers production (synthesis) from biomass, particularly: sustainability assessment of polymers based on renewable resources; novel cellulose based materials and processing routes; biomass-based polyesters and polycarbonates for coating and engineering plastic applications; plant oils as renewable resources in polymer science.

The problems of bio-functional polymers were discussed on the 4th session. This session included 6

lectures. The speakers delivered information about biofunctional dendritic architectures, biocompatible and bioactive polymers containing saccharide functionality, design and mechanisms of antimicrobial polymers, control of protein adsorption on functionalized electrospun fibers, microcapsules and nanoparticles for controlled delivery and repair, smart nanocarriers for bioseparation and responsive drug delivery systems.

The last session “Waterborne Polymers” included 8 presentations. The following issues were discussed: synthesis of smart nano-hydrogels, influence of adsorbed polymers on keratin surface properties in an aqueous environment, pH- and temperature-sensitive microgels for stimuli controlled emulsion stabilisation, industrial application of mini-emulsion polymerization in the coating field, PLURONIC® block copolymers in balanced microemulsions.

About 100 participants from 11 countries (Germany, The USA, The Netherlands, Switzerland, China, Poland, Sweden, Finland, Austria, Russia, and India) took part in this conference.

Two poster sessions included about 40 posters which discussed some particular tasks in the field of new polymer technologies with water.

The meeting demonstrated that biopolymers are very important part of contemporary polymer science, especially in view of constant oil price rise.

The next similar conference will be held in 2010.