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IUPAC Polymer Chemistry Meeting, Leuven, Belgium

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Conference Reports

IUPAC Polymer Chemistry Meeting Leuven, Belgium

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A Polymer Chemistry Meeting was held in Leuven, Belgium, from September 26 to 28, 1984, honoring Prof. George Smets on the occasion of his retirement. This meeting, under the cochairmanship of Prof. M. Van Beylen and Prof. F. DeSchryver, was under the sponsorship of the IUPAC and a number of other scientific organizations from Belgium. It was attended by over 200 participants from twenty countries. The meeting consisted of sixteen invited lectures; in addition, forty papers were presented in poster format.

On Wednesday, September 26th, the meeting was opened by Prof. Van Beylen who described the life and scientific accomplishments of Prof. Smets and the impact that he has made on the polymer community. Prof. Smets is officially retiring from the University of Leuven, after forty years of service to the University. In Prof. Van Beylen's talk as well as in the talks by many of Prof. Smets' colleagues and friends, it was stated that Prof. Smets will undoubtedly continue to be active and be a guiding light in the polymer science community. Prof. C. H. Bamford, the President of the Macromolecular Division of IUPAC, outlined the importance that Prof. Smets has played in the IUPAC organization, particularly as secretary of the Macromolecular Division and President of the entire IUPAC organization (1977-79). Prof. Smets has also held other offices in the IUPAC and was active on numerous committees.

In the first invited lecture Prof. Otto Vogl, Polytechnic Institute of New York, presented his work on "Optically Active Polymers Based on Macromolecular Asymmetry (Helicity)," an area that promises new dimensions in polymer science. He described special polymers with isotactic helical structure, polymers that do not have chiral centers in the polymer main chain; these polymers have high optical rotation based on macromolecular asymmetry (helicity); helicity had been recognized in the past as part of the tertiary structure of proteins, and contributes to the overall optical activity of proteins. Isotactic polyolefins, where the monomer units have chiral centers directly attached to the polymer chain, also show in part optical activity based on



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helicity. These contributions are relatively small as compared to the helicity which has not been achieved.

Prof. C. G. Overberger, University of Michigan, described "Synthesis, Characterization and Spectroscopic Analysis of Cytosyl Grafted Polyethyleneimine." Although polynucleotide analogues have been investigated in the past, with particular attention to the regular placement of the bases attached to the polymer backbone, Prof. Overberger's laboratory has studied the influence of chiral centers adjacent to the polymer backbone of various synthetic polyamines. These polymers have promise because of their biological activity in chemotherapeutic cancer treatment.

In the third invited lecture, Prof. A. Ledwith, University of Liverpool, U.K., discussed "Polymer Photochemistry and Microlithography." Styrene-based polymers have long been of interest as negative resists for E-beam lithography because they can readily undergo radiation-induced crosslinking. Recently, p-methylstyrene with mixtures of p- and m-chloromethylstyrene has been copolymerized which allowed the preparation of polymers for useful resists. Polymer resists are now indispensable for the manufacturing of integrated circuits, especially as smaller and smaller feature sizes are required. Dr. S. Y. Farid, Eastman Kodak Co., U.S.A., presented his work on "Photochemistry of Cross-Linkable Polymers: The Role of Energy Migration." This work is usually achieved through triplet sensitization. The quantum yields of those reactions depend on the dimerizable moieties. Side reactions, however, occur; the author described the photochemical quenching processes and tried to evaluate the sources of inefficiency in these reactions. Prof. T. Tsuruta, Science University of Tokyo, Japan, presented his work on "Molecular Design of Functional Polymers Having Amino Groups." He described the synthesis of functional isoprene oligomers with one amino end group, the study of soluble poly(1,4-divinylbenzene), and the use of isobutylamine for regulating the molecular weight of the soluble polymers. Prof. Tsuruta also described the preparation of polyamine macromers based on 1,4-divinylbenzene chemistry and the polymerization and copolymerization of these macromers, some of which are of biomedical interest. The lecture by Prof. P. Rempp, C. R. M., Strasbourg, France, on "Macromonomers, Synthesis and Applications" was presented by Dr. Emile Franta. Macromers, short-chain polymers with a

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Invited speakers of Polymer Chemistry Meeting, Leuven 1984.

polymerizable vinyl or epoxy end group, have now become available by a variety of means. The unsaturation is generally introduced on "living" sites, but in some cases unsaturated ionic initiators have been used. Macromonomers (macromers) provide simple monomers for the preparation of new graft or comb polymers by free radical and ionic polymerization. Macromonomers have also been used to synthesize block copolymers or polymer networks.

While the first day of the Polymer Chemistry Meeting was devoted to polymer synthesis, the second day concentrated on polymer physical chemistry. Prof. H. Morawetz, Polytechnic Institute of New York, USA, described his recent "Studies on Synthetic Polymers Carrying Fluorescent Labels." Excimer emission, nonradiated energy transfer, and the dependence of the quantum efficiency of emission can be used to study various polymer properties in solution. Fluorescent labels on polymers are used for the studies of conformational transitions, compatibility of blends, chain interpenetration, and complex formation in polymer mixtures. Prof. H. Masuhara, University of Osaka, Japan, discussed "Laser Photochemistry of Polymers." The use of lasers has changed drastically many aspects of spectroscopy. Because of its short pulse duration, high intensity, and good beam divergence, more precise data are obtained; the use of pulse lasers in flash photolysis measurements of poly(N-vinylcarbazole) was discussed. Prof. L. Monnerie, Ecole Supérieure de Physique et Chimie Industrielle de Paris, France, described his work on "Analysis of the Molecular Mobility of Polymers in the Bulk State by Fluorescence Techniques," using various

spectroscopic techniques such as dielectric relaxation, NMR, ESR, quasi-elastic lightscattering, and neutron scattering to understand the most important glass transition phenomena of polymers. Fluorescence anisotropy decay measurements were used on 9,10-dialkylanthracenes and butadiene polymers containing anthracene units.

The next series of lectures were again devoted to polymer chemistry. Prof. P. Pino, Eidgenössische Technische Hochschule, Zurich, presented his new work on "The Role of Lewis Bases on the Investigation of the Mechanism of Ziegler/Natta Polymerization of Olefins." Lewis bases dramatically improved the stereospecificity of a number of transition metal initiator systems for the polymerization of α -olefins. In addition to specificity, the productivity of these systems was also highly influenced by Lewis base addition. Prof. R. C. Schulz, University of Mainz, F. R. G., discussed "Some New Examples of Polymer Modifications." Several types of synthetic polymers were described: the ring-opening polymerization of cyclic 7-membered formals with an additional double bond; the use of nylons as polymeric reagents, for example, N-chloro- and N-trifluoroacetoxy-nylons; anionic grafting reactions on the amide nitrogen of several polyamides; the reduction of the amide groups of various commercially available polyamides to polyalkylamines.

Prof. V. Kabanov, Moscow State University, USSR, presented his investigation of "Cooperative Interpolyelectrolyte Reactions." His research group studied the formation and behavior of interpolyelectrolyte complexes. When oppositely charged polyelectrolytes were mixed, complexes of soluble

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materials were obtained. When polyacrylic acid of high molecular weight was used, the oppositely charged polycation, for example, poly-N-ethylvinylpyridinium salts, or ionenes, had to be of relatively low molecular weight. Some measurements investigating these phenomena were done by luminescent quenching with luminescing labels introduced into the sodium polymethacrylate chain. Prof. G. Riess, Ecole Nationale Supérieure de Chimie, Paris, France, presented "Surfactive Properties of Block and Graft Copolymers." He described the micellar and surface chemical behaviors of various types of block and graft copolymers. Unique properties in solution and especially in solid two-phase systems could be attributed to incompatibility of dissimilar blocks. The miscellization as a function of structure, molecular weight, and composition were studied. Prof. W. Bailey, University of Maryland, USA, described his work on "Free Radical Ring-Opening Polymerization." He pointed out that bicyclic monomers with a vinyl group can be polymerized by radical initiators, and, during this polymerization, ring opening of the spiral ortho ester or ortho carbonate ring was found to proceed by expansion of volume rather than the normal shrinkage commonly known in polymerizations.

Dr. E. A. Chandross, Bell Telephone, USA, discussed "The Development of New Photoresists for Use in the Deep Ultraviolet." Optical lithography is now widely accepted as the most practical method for pattern definition and semiconductor technology. As higher density of elements in integrated circuits becomes necessary, the individual elements must become smaller and smaller. It is desirable to develop resists for deep ultraviolet ($\lambda_{\text{max}} = 300 \text{ nm}$) lithography. Incorporation of comonomers into PMMA, for example, acyloximino and indanone groups, has been found especially desirable, but *o*-nitrobenzyl esters of methacrylic acid were also found useful. The concluding talk was given by Prof. K. Hayashi, Osaka University, Japan, who presented his recent work on "Recent Progress of Photo and Radiation Induced Ionic Polymerization." He mentioned particularly the polymerization of various organic cations as photochemical initiator for cationic polymerization which were used for the radiation-induced polymerization of *o*-methylstyrene and cyclohexane oxide in the presence of diphenyliodonium salts.

In the final remarks by Prof. F. C. DeSchryver, the chairman of the Symposium, concluded that this meeting had provided an opportunity for many scientists involved in polymer synthesis and polymer photochemistry to meet and exchange scientific knowledge and at the same time honor one of the giants of Polymer Chemistry.

In addition to invited lectures, forty papers were presented in poster form. We are presenting here a list of the poster papers: A Novel Synthesis of Poly(Arylene Vinylene)s; The Synthesis of Reactive Polysaccharide Derivatives as Intermediates in the Preparation of Polymeric Drugs; Stereoselective Nucleophilic Substitution on PVC; Non-Classical Free Radical Polymerization; Investigation of Methylmethacrylate *n*-Laurylmercaptan Polymerization at 60°C; Poly-(Styrene-*b*-Ethylene-co-Propylene) Copolymers; Synthesis by Ziegler-Natta Catalysis and Characterization; Study of a Hydrophobic-Hydrophilic Block Copolymer; Poly[Styrene-*p*-(2-Hydroxyethyl Methacrylate)]; Neighboring Group Effects

in the Quaternization of Poly(4-Vinylpyridine) in Solution; Synthesis of Substituted Polyamines, Their Use in Activated Ester Hydrolysis; Template Polymerization; Preparation of Di- and Tri-Block Copolymers by a Free Radical Oligomerization Technique; Graft Copolymerization of Vinyl Acetate onto Cellulose; Polymerization of Methyl Methacrylate by Special Redox Systems; Plasma-Induced Living Radical Copolymerization; Polysaccharides as Chiral Stationary Phases for High Performance Liquid Chromatographic Resolution of Enantiomers; Cationic Polymerization of Several 1,1'-Bilindenes; Synthesis of (Styrene-*b*-Isoprene) by Anionic Methods; Synthesis of Graft and Block Copolymers by Changing the Active Centers; Synthesis of High Molecular Weight Poly- α -L-Glutamic Acid; Polyelectrolyte Hydrogel for the Specific Low Density Lipoproteins (LDL) from Plasma; Synthesis of Polydepsipeptides by Ring-Opening Polymerization; Mechanism of the Free Radical Polymerization of Orthomethacryloyloxybenzoic Acid; Ceiling Temperature of Methyl-(*p*-Substituted Benzyl) Acrylates; Steric Arrangements of Ester Groups in Copolymers Prepared from Derivatives of Maleic and Hydride and Styrene; Influence of Tacticity on the Quantum Yields of Photodehydrochlorination of PVC; Modified Polysaccharides as Supports for Enzymes and Drugs; High Resolution Plasma Developable Resist; Study of the Molecular Dynamics of the Peptide Chain by Excited Complex Formation; Spectroscopic and Photophysical Properties of Model Compounds for Polyvinylpolymers with Aromatic Substituents; Microenvironment Polarity of Macromolecules in Solution and in Bulk; Miscible Multicomponent Polymer Systems Evaluation of the Binary Flory-Huggins Interaction Parameter from Melting Point Depression Data; Chemical Nucleation, A New Concept Applied to the Mechanism of Action of Organic Acid Salts on the Crystallization of Poly(ethylene terephthalate) and Bisphenol A Polycarbonate; Chemical Modifications Occurring in Polymer Blends During Processing; Chemical Modification of Poly(vinyl chloroformate) Using Phase Transfer Catalysis; Mobility of Macromolecular Chains as Studied by Means of Excimer Fluorescence; Time Resolved Laser Spectroscopy in Polymer Photochemistry; Laser Curing of Acrylic Photoresists; Molecular Mobility Studies in Polyepoxides Obtained by Photoinitiated Cationic Polymerization; Investigation of PMMA and PVC Blends by Nonradiative Energy Transfer; On the Behavior of Photochromes in Organized Structures; Control of Decoloration Kinetics of Merocyanine Spiropyranes in Polymer Matrix; Polymer Photochemistry at the City University of New York.

This Polymer Chemistry Meeting not only was of high scientific quality, with a substantial number of important and interesting contributions both in the invited lectures as well as in the poster presentations, but also throughout the meeting there was a great deal of collegiality and friendship. This was particularly noticeable at parties at the home of Prof. Smets, which were attended by a number of his colleagues and friends, particularly from abroad, and at the Symposium banquet on Thursday evening which was attended by nearly 180 people. Prof. Overberger, in his after-dinner speech, described Prof. Smets as a great scientist, organizer, and a warm human being.