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# The 33rd IUPAC Congress, Budapest, August 17-22, 1991

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# The 33rd IUPAC Congress

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The 33rd IUPAC Congress, organized by the Hungarian Academy of Sciences, was held in Budapest, Hungary from August 17 to 22, 1991. IUPAC Congresses are held biennially and have provided the chemical community with an efficient and most pleasant way of interaction among the different disciplines of the chemical sciences. The IUPAC Congress in Budapest consisted of 7 sections: a) Prospectives of Analytical Chemistry; b) Inorganic and Physical Chemistry; c) Electrochemistry and Electro-Analysis; d) Chemistry and Biochemistry of Biologically Active Organic Compounds; e) Biotechnology; f) Chemistry of Fats; g) Polymer Chemistry.

The conference was attended by almost 1,000 people, a third of whom were from the host country, Hungary. The conference consisted of plenary lectures, keynote addresses and presentations of papers in oral and in poster form. The conference had 8 plenary lectures, one of which was by Professor A. Keller of the University of Bristol, U.K., who represented the polymer community.

The polymer section consisted of 12 keynote speakers; 34 papers were presented in oral form, about 51 papers were given as posters. The papers included communications from polymer synthesis to the physics of polymers; some presentations involved biopolymers.

In his plenary lecture on the "Morphology of Polymers," Professor Keller emphasized that long chain molecules can display a virtually unlimited spectrum of organizations on a number of dimensions ranging from the atomic to the macroscopic levels, which can create a rich variety of morphologies built on a hierarchical principle. On the lower dimensional level, the subject is linked to what is traditionally termed crystal structure. Flexible chains are superimposed by chain folding on the crystallization process, creating a unique area of science. Classical crystal growth is coupled with the statistics and dynamics of long chains leading to a family of lamellar morphologies. While apparently a different subject area, certain connections with folding in proteins can be recognized. Other morphologies arrive from liquid-liquid phase separation providing structures of gels, porous structures, and colloids. The possibility of meta stability to what are normally equilibrium phases can invert the relative stability of these phases.

The section on polymers of the 33rd IUPAC Congress was formally opened by the keynote address of Otto Vogl of New York, entitled "New Directions in the Chemistry of Polymers." Numerous techniques have been developed for the preparation of new polymer compositions for condensation polymers, especially when they are used in composites and blends. Relatively low molecular weight high performance polymers with reactive end groups are being synthesized for polymer build-ups (without the release of low molecular weight compounds) by addition reactions. Several new directions in polymer formations are being pursued in ring opening polymerizations using macrocycles. Living polymers can now be prepared by all three classical chain reaction polymerization techniques (anionic, cationic and radical polymerization), as well as by coordinated anionic and coordinated cationic polymerizations. Such techniques allow a high degree of control over polymer chain architecture and permit not only the synthesis of linear homo and copolymers but also block copolymers, comb shaped or multiarmed polymers, which result in polymers with a multitude of physical properties. Especially emphasized were


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Ernö Pungor, Chairman, IUPAC Congress.

Technical University, Budapest.

polymers with structures that have adenine or cubane linkages in the polymer structure. Functional polymers, especially polymer-bound stabilizers, polymers with electrical, liquid crystalline and nonlinear optical properties are increasing in importance. The newly developed area of interest is in the chemistry of very low molecular weight oligomers, especially those which are part of the embryonic state of stereospecific and conformational specific polymeric structures.

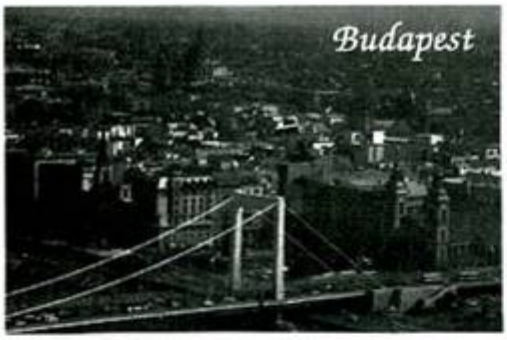
Walter Heitz of Marburg, Germany presented his lecture on "The Synthesis of Rod Like Polyhydrocarbons." Aromatic AB-polyesters can be obtained in soluble form if both monomer units are statistically monosubstituted. o-Biphenyl is the only substitutent where one substitution per repeating unit gives rise to solubility. Stiff macromolecules could be obtained by combining two aromatic units either directly or by vinylene or acetylene units. Poly(1,4-pyridininum salts) is a new class of compounds which are rod-like polycations; they are soluble inorganic solvents. "Isodisperse Telechelic Polymerization" was discussed by F. Tudos of Budapest, Hungary. In order to produce polymers with optical, physical and mechanical properties from a reactive polymer it must fulfill several requirements: a) oligomers should contain end groups for further reactions; b) the number of average degree of polymerization should be kept constant; c) the polydispersity of the oligomers should be kept at a minimum and at a constant value; d) the functionality of the oligomers should also be constant. Since radical polymerization is economically most advantageous for the production of reactive oligomers, it is often the polymerization of choice. The polymerization fulfilling the above requirements of an isodisperse polymer that could be realized by radical polymerization was investigated.

"New Bipolar Membranes and Their Application in the Chemical Process Industry" was presented by A. Strathmann, Germany. Electrodialysis with bipolar membranes has recently gained increasing attention as an efficient method for the production of acids and bases from the corresponding salt solution by electrically enforced water dissociation. The process which has been known for many years is economically very attractive and has a multitude of very interesting applications. Today, caustic soda is produced mainly by the chlorine-alkaline process. With decreasing demand of chlorine this process becomes more and more problematic. The exclusive production of sodium hydroxide from the corresponding salts by electrodialysis with bipolar membranes is considered technically feasible and an alternative solution to this problem. It is also a cost-effective route for the recovery and for the recycling of salt streams. The main parameters which determine the efficiency of the process require properties of bipolar membranes with specific properties.

Jan F. Rabek of Stockholm, Sweden discussed "The Coordination Complexes Between Polyethers and Inorganic Salts." Poly(alkylene oxides) can form coordination complexes with a number of metal salts. Coordination complexes were found to give solid or single phase thermoplastic materials depending on the type

Ferenc Tüdös, Chairman, (left) and Làszlò Jókay, Secretary, Polymer Section (right).

Budapest—Hotel Gellert.




**Budapest—Panorama.**

**Budapest—Parliament.**

of metal salts and the weight ratio of polymer to metal salt. An excellent example is a complex between poly(ethylene oxide) and tetrachloroferrate ions at a ratio of 7 to 4 which gave a substantial increase of the glass transition temperature. The morphology and the crystal structure of these salts were discussed.

Clement Bamford of Liverpool, U.K., discussed "Non-Classical Polymerization: Size Dependent Termination and Some Implications." Diffusion control of the interactions between radicals in solution manifests itself in the bimolecular termination reactions in radical polymerizations and resulted in a dependence of the termination coefficient on the size of the reacting radicals. A "Group Termination Procedure" was developed according to which kinetically important quantities are expressed in terms of the arithmetic mean of the sizes of all radicals present and the total radical concentration. Nonstationary reactions presented problems arising from changes in the free-radical size distribution with time.

W. Wilke of Regensburg, Germany, presented his work on "The Change of the Super Structure of Semicrystalline Polymers During Deformation: Results from Small Angle Scattering with Synchrotron Radiation." Small angle x-ray scattering with synchrotron radiation has been known to be a tool for the investigation of changes of the superstructure (arrangements of crystalline and amorphous domains) at the formation of micro cracks during uniaxial deformations. Experiments were carried out with different types of polyethylenes. Different superstructures were formed, depending on the molecular weight of the polyethylene. Even a reverse change of the superstructure was obtained. Micro-cracks were also found during the deformation of some ethylene-alpha-olefin copolymers.

P. Hedvig of Budapest, Hungary, discussed "Mechanical and Electrical Relaxation in Irradiated Polyethylene." Various polyethylene types including linear, low density ethylene (co) polymers were irradiated by accelerated electrons in the presence and in the absence of oxygen. The degradation products were studied by combining differential thermal, dynamic mechanical, differential thermal mechanical analyses, and other techniques. In the absence of oxygen, crosslinking dominates, resulting in changes in the phase transition of the semi-crystalline polymer. In the presence of oxygen, degradation is the dominating process resulting in a dielectrically heterogeneous structure exhibiting strong interfacial polarization. The result is a dramatic increase in the low frequency permittivity in the transition temperature range.

"Block Copolymers from Macro Initiators" was presented by Bogdan C. Simionescu of Jassy, Romania. The possibilities of obtaining block copolymers of different structures and compositions using macro-initiators was discussed. The conditions for obtaining stable macro-radicals included the use of poor solvents or highly viscous media in emulsion polymerization. Structures and properties of the polymers obtained under these reaction conditions were also discussed.

Bengt Rånby of Stockholm, Sweden, presented his work on "Surface Modification of Polymer Fibers by Photo-Initiated Grafting." A new continuous method has been developed for the surface modification of synthetic polymer fibers (mono filament or yarn) by photo initiated grafting. In the process, the fibers are pulled through a presoaking solution of the photoinitiator and of the monomer in an organic solvent directly into a reaction chamber where the fibers are irradiated with UV light. Various synthetic fibers have been grafted with acrylic acid, acrylamide and glycidyl acrylate, which allows the introduction of new functional groups on very thin surface layers.

"Structure and Surface Modification of Polymers—New Approaches" was discussed by Menachim Lewin of Jerusalem, Israel. The structure of fibers and the surface of thermoplastic polymers, in the form of films or fibers can be modified by systems involving intrapolymer interaction between chemical moieties. Several polymers such as Nylon 6, polyacrylonitrile and poly-

**Szabadsàg Bridge, with the University of Economy in the background.**

propylene were treated with bromine and subsequently with ammonia. Significant changes in the properties and in the behavior of the polymers were obtained which is exemplified by enhanced absorption of dyes to improve polymer dyeability and by a decreased contact wetting angle.

"Atomic Scale and Morphological Analysis of Polymer Surfaces by Scanning Tunneling and Atomic Force Microscopy" was discussed by Hans-Joachim Cantow of Freiburg, Germany. It was found that crystalline low molecular weight compounds gave the base of atomic scale understanding of STM and AFM. On well-ordered inorganic and organic compounds correspondence was found between the AFM, STM method and crystallographic parameters. For polymers which are conductive, AFM offers unique insight into the atomic scale regime.

Jan Pospisil of Prague, Czechslovakia, described "Current Understanding and Exploitation of Stabilization Mechanisms in Polymers." The chemistry of the transformation of phenols and aromatic amines is used for the explanation of the activity and optimum utilization of both classes of stabilizers; they are used as antioxidants, as antifatigue agents and/or antiozonants in polymers. Specific mechanistic features characteristic of thermally and photochemically induced processes and their relationship to polymer degradation mechanisms were discussed. In some cases the creation of transformation products was found to be a necessary condition for the stabilizing effectiveness of the stabilizers as explained in the cooperation between phenols and/or sulfur containing antioxidants and hindered amines.

Z. Jedlinski of Zabre, Poland, discussed "The Role of Single and Two Electron Transfer in Organic Reactions and in Ring Opening Polymerizations." Electron transfer processes are very common in organic syntheses and anionic polymerizations. A new and novel reagent involving unusual electron transfer complexes are potassium and sodium metal complexed with crown ethers. These metal anions have recently been utilized in ring opening polymerizations and organic syntheses. Advantages of the described uncommon "living" type polymerization resulted in the synthesis of several "tailormade" block copolymers.

P. Kratochvil of Prague, Czechoslovakia, presented his work on the "Formation and Structure of Block and Graft Copolymer Micelles in Solution." Block and graft copolymers in selective solvents form characteristic mono-molecular or poly-molecular structures, so-called copolymer micelles. These micelles have densely packed cores formed by the poorly soluble blocks and an outer shell formed by the well-soluble blocks. The shell protects the micelle from macroscopic precipitation. Micelles were found to be able to solubilize in their cores low molecular weight compounds or homopolymers chemically identical or related with the core forming blocks. These solubilization capabilities of micelles may be used to stabilize polymer emulsions and could be effective in dispersion polymerization. The micelles could be stabilized by crosslinking the core by irradiation.

J. Petermann of Hamburg, Germany, discussed "Epitaxial Interfaces in Non-Compatible Polymer Blends and their Influences on Mechanical Properties." The adhesion of interfaces is the weak link in many non-compatible polymer blends concerning their mechanical properties. Block or graft copolymers are frequently used as compatibilizers for those systems. In some systems the one component can crystallize at the interface as an ultra thin (few nanometers) oriented layer with respect to the matrix polymer. The crystalline orientation of the matrix at the interface and the crystallization conditions for the second component were found to be critical parameters for obtaining an orientationally ordered (epitaxial) interface. Polymer blends containing those interfaces exhibited extraordinary properties regarding their stiffness and their peel strength.

The participants of the Conference were not only involved in scientific discussions, presentations, and personal interactions but some of the plenary lectures also were of a philosophical character. More importantly, a great deal of attention was paid to the interaction of the individual representatives of different disciplines on a personal and social basis.

On Friday, August 16, a reception with a buffet dinner was held at the Technical University of Budapest. This provided people who had just arrived in Budapest an opportunity to get to know each other. On Sunday, August 18, a very elegant reception with buffet dinner was held at the Ethnological Museum of Budapest. The President of the Academy of Sciences of Hungary, which was the host organization of the 33rd IUPAC Congress, was the host for this gala event. On Monday, August 19, the participants were invited to the Congress Hall, for a program of folk dancing and traditional Hungarian music and dances.

August 20th was the national holiday honoring the king and patron saint of Hungary, St. Stephen. The day was reserved as a rest day and for excursions. Some groups went to the Puszta, the famous countryside in Hungary between the Danube and Tisza Rivers, with its rural character still intact in many places. Another group went to Kecskemet; still another group toured the eastern country of Hungary around the city of Eger, which is famous for its medieval importance, its castle and its wine. Probably the most popular sightseeing tour was a boat trip up the Danube to the Danube-Bend, with a visit to the artists' settlement of Szentendre and a visit to Visegrad, one of the earlier capitals in Hungarian history as well as to Esztergom, the place of birth and coronation of the first king, St. Stephen. Another group visited Lake Balaton, the largest fresh water lake in central Europe and a popular vacation resort for many Hungarians and tourists.

During the 33rd IUPAC meeting many new friendships were established, while old friendships were renewed not only among polymer scientists but among participants of the entire chemical community. Many scientific interactions gave witness to the new developments and new progress that is being made in the chemical world. The participants of the congress had the opportunity to view the progress that is being made in eastern Europe, and particularly Hungary, in science, in business and in human relationships. The organizers have to be congratulated for this successful conference.