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Personalities in Polymer Science



Eli M. Pearce

Honoring Professor Eli M. Pearce on his 70th Birthday

Polymers at the Polytechnic University ("Brooklyn Poly") have continued to be a **visible force** in the polymer **world-wide community**. A significant part of the **continued preeminence** of the Polymer Research Institute is related to the **arrival of Eli Pearce** at the Polytechnic in 1974, his **research and professional activities**, and his ability to interact and work with the faculty.

Eli Pearce was born in Brooklyn on May 1, 1929, received his B.S. in 1949 from Brooklyn College, an M.S. in 1951 from N.Y.U., and his Ph.D. at the Polytechnic Institute of Brooklyn in 1958. His thesis advisor was Professor Charles G. Overberger, concerned with cationic and anionic polymerization. During this early period he was a biochemist at NYU Medical School and served two years in the Army ('53-'55).

In 1958, Eli Pearce joined DuPont's Carothers Laboratory, he became section manager at J.T. Baker in 1962, and manager at Allied Chemical Corp. in 1968. In 1974, he was appointed Director of the Dreyfus Laboratory at the Research Triangle Institute and, in 1974, was invited to join the Polytechnic University of New York as Professor of Chemistry and Chemical Engineering.

During his career at the Polytechnic University, he was Department Head

('76-'82), Dean of Arts and Science ('82-'90), Director of the Polymer Research Institute '81-'96), and is presently University Professor.

Eli Pearce's initial research dealt with biochemical research involving the study of the metabolism of steroids and colchicine. With Overberger, he investigated termination mechanisms during cationic styrene polymerization, as well as with anionic polymerization of methacrylonitrile.

At DuPont, after initially working on polyoxamides, he became involved in the demonstration of Tg reinforcement and the modification of Nylon 66 by melt blending with other miscible high Tg polyamides.

At J. T. Baker, his efforts in specialty polymers led to publications on synthesis and aging of high temperature methacrylates, as well as with new epoxy resins and sulfide block copolymers.

At Allied, Eli Pearce was involved in the study of a series of high Tg polyamides. Novel relationships were developed with regard to their Tg and Tm ratios and also of elastomeric block copolyamides. It was demonstrated that Tg(K)/Tm(K) was not 2/3, could be as high as 0.9, and depended on the crystallizability and crystallinity of the particular polyamide or copolyamide.

Eli Pearce also became involved in corporate flammability studies which led to the study of Nylon 6 oxygen index as a function of degree of polymerization and of end groups. Under his guidance, a number of new polyamide-imide polymers were prepared.

His interests in flammability continued at the Dreyfus Lab and at the Polytechnic Institute. Prior to Pearce's scientific studies much of polymer flammability approaches were art instead of a science, but he showed ways to understand the mechanisms involved in decreasing flammability.

In some polymers, like PET, he showed that flame retarding structures containing bromine or phosphorus when used as additives compared to PET copolymerizations showed little additional advantage in decreased flammability behavior, but proper polymer end groups affect the polymer degradation significantly. Increased condensed phase reactions lead to char formation and reduced volatiles which decreases the flame propagation. Target polymers included styrenic copolymers, substituted aromatic polyamides, polymers with cardo-structures including

epoxies, polyesters and polycarbonates, phosphazines, styryl-pyridine based epoxies and polyesters and others.

Later, Pearce began his studies on fluorine containing polymers which eventually led to his interests in miscible polymer blends involving hydrogen bonding and their properties. Polymers containing fluorinated ketone groups form hemiketal equilibria with alcohols. This fact could be used to separate alcohols from each other and other organic chemicals. Fluoroalcohol containing polystyrene, when blended with H-bond accepting polymers gave single Tg phenomena blends, requiring only a small amount of hydrogen bonding material, with a large number of H-bond acceptors over wide blend composition ranges.

Hexafluoroisopropanol modified polystyrene was found to be even more efficient. A few mole percent modification of polystyrene gave miscibility over the entire polymer blend composition range. Miscibility studies have now included a variety of H-bond donating groups - hexafluoroisopropanol, phenolic, carboxylic acid, phosphoric acid, sulfonic acid silanol and their interactions was stronger to weaker H-bond accepting groups.

Over the years, mythology had developed that miscible blends had an average of the properties of the two components. This was certainly not true when H-bonding was involved and this approach could be used to design structure and properties comparable to that previously requiring the making of new polymers or copolymers. Some of the properties systematically modified included thermal and UV stability, glass transition temperature, water absorption, and modulus. In addition, utilizing the lower critical solution temperature phenomena of these systems, a number of new semi-interpenetrating networks have been made showing single or double Tg phenomena depending on cure temperature. More recently diblock copolymers containing one H-bonding component such as PS-poly(vinyl phenol) have been shown to be "universal" compatibilizers for polystyrene blends with incompatible H-bond accepting polar polymers [e.g. p(MMA)].

Other significant research for Eli Pearce have included copolymers with stabilization of sulfur containing polymers, polymer stabilization and degradation of copper

complexes with poly(vinyl pyridine), photoresist materials, polyimides and phenolics.

The scientific work of Eli Pearce is recorded in over 250 papers and four patents.

For 25 years, Eli Pearce was the editor of the preeminent *Journal of Polymer Science*, Chemistry Edition, and he was and is on the Editorial Board of a number of polymer related journals. He has also been coeditor of six books dealing with flammability, fibers, the future of polymers, and lab manuals.

Eli Pearce has served in prominent positions in a number of professional societies. He is a fellow of the AAAS, AIC, NYAS, SPE, and NATAS. He has been very active in the American Chemical Society (ACS) and has been a candidate for ACS President and the Board of Directors. In 1998 he was elected as Director-at-Large to the Board of Directors of the American Chemical Society. He has chaired its Committee on Science and the Committee on Nominations and Election, and has been a member of the committees dealing with professional training, committee appointments and policy and on the Petroleum Research Fund Board. He also has been Chairman of the Division of Polymer Chemistry in 1981 and of Polyed, - the joint committee on polymer education.

Eli Pearce was also active in National and International Committees: e.g., National Materials Advisory Board, 1975-77; National Materials Advisory Board Committees; Materials Advisory Committee, Los Alamos National Laboratory; Advisory Committee on Polymers for Advanced Technology of IUPAC, National Institute of Standards and Technology Advisory Panel on Fire Research 1981-90; the Naval Research Board Panel on Polymers as chairman from 1993-95; several NSF committees; NATO Scientific Consultant from 1992-98.

In the Gordon Research Conferences, he was a member of the council in 1984, the co-chairman of the Conference on Polymer Combustion and Flammability in 1975 and the chairman of the Conference on Polymers in 1983. He served as the chairman of the U.S.-Japan Symposium on Polymer Synthesis in 1987. He has

been the co-chairman of several international meeting advisory committees and has been a frequent invited plenary lecturer.

Eli Pearce received a number of honors: The Distinguished Service Award, Division of Polymer Chemistry, ACS, in 1991 and the P.J. Flory Polymer Education Award in 1992. He was recognized by Polytechnic University as Distinguished Alumnus in 1997, he received the Gold Medal of the New York Institute of Chemists in 1992 and Polymer Education Awards from the Society of Plastics Engineers, the International Award on Education in 1988 and from the Plastics Institute of America in 1980. He also gave the Kaufman Lecture at Ramapo College in 1992 and was the Reed-Lignin Lecturer in 1987.

In 1980, Eli Pearce married Judith and he has two married children by a previous marriage, Russell and Debra Eli and has also two married step-children, Michael and Liz. Between them, they have ten grandchildren. Judith has been his companion, friend and culture counselor and has helped establish hobbies related to theater, art, music and politics.

This article was prepared by **Otto Vogl***, Herman F. Mark Professor of Polymer Science Emeritus, Polytechnic University, in cooperation with **Judith Pearce**, Two Fifth Ave, New York, NY 10011.