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PROFESSOR ELI M. PEARCE SIXTY YEARS DEDICATED TO SCEINCE

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Polymers at the Polytechnic University ("Brooklyn Poly") continue 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 attract 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. The advisor of his thesis, concerned with cationic and anionic polymerization, was Professor Charles G. Overberger,. During this early period he was a biochemist at NYU Medical School, and served two years in the Army (1953–1955), doing biochemical research on steroid metabolism (co-author of several papers).

In 1958 he joined DuPont's Carothers Laboratory and began his research on polyamide melt blends and was involved with demonstrating the concept of amorphous *Tg* reinforcement. As a section manager at JT Baker in 1962 he became interested in high use-temperature methacrylates as well as new epoxy and other systems. In 1968 as a manager at Allied Chemical Corp. he dealt with new polymers, polyamides, degradation, flame retardants, and membranes. In 1974 he was Director of the Dreyfus Laboratory at the Research Triangle Institute and then in 1974 was invited to join the Polytechnic as Professor of Chemistry and Chemical Engineering. During his career at the Polytechnic University, he was Department Head (1976–1982), Dean of Arts and Science (1982–1990), Director of the Polymer Research Institute (1981–1996), and University Research Professor. His scientific work is recorded in over 250 refereed papers and five patents.

His published biochemical research dealt with steroid and colchicine metabolism. With Overberger, he was involved in termination mechanisms during styrene cationic polymerization, as well as anionic polymerization of methacrylonitrile.

At DuPont, after initially working on polyoxamides, he became involved in the *Tg* reinforcement modification of nylon 66 by melt blends with other miscible high *Tg* polyamides. J.T. Baker's efforts in specialty polymer led to publications on synthesis and aging of high temperature methacrylates, as well as new epoxy resins and sulfide block copolymers. At Allied a series of high *Tg* and copolymer polyamides were prepared and relationships were developed in regard to their *Tg* and *Tm* ratios. lt 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. Synthetic routes such as the Ritter reaction to prepare polyamides were reinvestigated. Eli Pearce coauthored papers on elastomeric block copolyamides. At Allied he became involved in corporate flammability studies, which eventually led to several review articles as well as joint papers on the variation of the nylon 6 oxygen index as a function of DP and end groups. New polyamide-imide polymers were prepared from nitrilotriacetic acid and spiro-imides from methane tetracetic acid. His interests in flammability continued at the Dreyfus Lab and at the Polytechnic. He published papers trying to understand the mechanisms involved in decreasing flammability. Prior to his scientific studies much of polymer flammability approaches were rather art than science. Significantly, it was shown that certain flame retarding structures containing bromine or phosphorus when used as additives in PET showed little additional advantage in decreased flammability behavior compared to PET copolymerizates. Also PET polymer end groups, as previously demonstrated with nylon 6, affect polymer degradation and oxygen index values. A series of studies then began on modifying polymers so as to increase condensed phase reactions leading to char formation and reduced volatiles. Such studies involved styrenic copolymers, substituted aromatic polyamides, polymers with cardo-structures including epoxies, polyesters and polycarbonates, phosphazines, styryl-pyridine based

epoxies and polyesters and others. It was demonstrated that condensed phase reactions could lead to increased char formation by promoting crosslinking, ring formation and/or aromatization reactions (fire smart polymers). For example, in the cardo-based phenolphthalein polymers, the lactide ring opens to give interchain crosslinking by polyester formation; ortho-amine substituted aramides form thermally stable benzoxazole structures; styryl-pyridines cyclize to form ring structures; styrene/acrylonitrile copolymers as well as cyano substituted phosphazines and cyano-containing aramides using a zinc Chloride catalyst form thermally stable triazine structures. He is coprincipal investigator on NSF grant exploring nanochemical phenomena in regard to polymer flammability.

He began a series of studies on fluorine containing polymers which eventually led to his interests in miscible polymer blends and their properties. Polymers containing fluorinated ketone groups were prepared to study their hemiketal formation equilibria with alcohols and to eventually use these to separate alcohols from each other and other organic chemicals. Having made the p-trifluoromethyl ketone containing polystyrene, this was reduced to the alcohol, and then blended with H-bond accepting polymers. Only a small amount of trifluoromethylcarbinol modification was required to give single *Tg* phenomena blends with a large number of H-bond acceptors over a wide blend composition range. This led to synthesizing the hexafluoroisopropanol modified polystyrene and copolymers. This was even better and several mole percent modification of polystyrene was sufficient to give miscibility over the complete polymer blend composition range as shown by single *Tg* criteria. Studies on miscibility have now included modifications with a variety of H-bond donating groups – hexafluoroisopropanol, phenolic, carboxylic acid, phosphoric acid, sulfonic acid silanol and their interactions with stronger to weaker H-bond accepting groups, the composition between inter- and self H-bonding, and the systematic effect on a variety of properties. A mythology had developed that miscible blends had average properties of the two components. This was certainly not true, when H-bonding was involved, like it was not true that this approach could be used to design structure and properties comparable to that previously requiring the making of a new polymer or copolymer. Some of the properties systematically modified include 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-IPN's have been made showing single or double *Tg* phenomena depending on cure temperature. Block copolymers containing one H-bonding component such as PS-polyvinylphenol have been shown to be 'universal' compatibilizers for polystyrene blends with incompatible H-bond accepting polar polymers (*e.g. p*-MMA). More recently, we have studied surface enrichment phenomena in miscible blends leading to new concepts and uses of this surface enhancement.

Other significant research areas have included copolymers with stabilization of S polymers, polymer stabilization and degradation copper complexes with polyvinyl pyridine, photoresist materials, polyimides and phenolics.

Eli Pearce was the editor of the preeminent Journal of Polymer Science, Chemistry Edition (25 years), and is on the editorial board of several other journals. He has also been a coeditor of six books dealing with flammability, fibers, the future of polymers, and lab manuals.

Eli Pearce has been an active member of 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) in the capacity of its President and Board of Directors member. He also chaired its Committee on Science and the Committee on Nominations and Election and was a member of the committees dealing with professional training, committee appointments and policy and on the Petroleum Research Fund Board. In addition to that he chaired the Division of Polymer Chemistry and Polyed, – the joint committee on polymer education.

Eli Pearce was also active in National and International Committees: *e.g.* National Materials Advisory Board, 1975–1977; 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 1981–1990; the Naval Research Board Panel on Polymers as chairman from 1993–1995; several N F, committees; NATO Scientific Consultant from 1992–1998. He was also a member of the Chemical Science Round Table of the National Research Council and the Board of the Council of Scientific Society Presidents.

He was the council member at the Gordon Research Conferences in 1984, co-chairman of the Conference on Polymer Combustion and Flammability in 1975, and co-chaired the Conference on Polymers in 1983. He served as the chairman of the U.S.–Japan Symposium on Polymer Synthesis in 1987. He co-chaired several international advisory committees and many times was an 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, received the Gold Medal of the New York Institute of Chemists in 1992 and Polymer Education Awards from the Society of Plastics Engineers International Award in Education in 1988 and from the Plastics Institute of America in 1980. He also gave the Kaufman Lecture at Ramapo College, 1992 and was the Reed-Lignin Lecturer in 1987.

He was the recipient of the Chemistry Teachers Club of New York Oscar Riker Foster Award in 2000. In 2002 he received the Henry A. Hill Award for distinguished service and achievement towards the advancement of professional relations from the Division of Professional relations of the American Chemical Society. In 2003 he received a Citation from the American Chemical Society, Committee of Minority Affairs for his contribution to diversity and the Giullio Natta Centennial Medal from the Italian Chemistry Society. In 2006 he received the H.F. Mark-Medal from the Austrian Institute of Chemistry and Technology for his contributions to polymer science. In 2007 he was elected an honorary member of the Accademia Gioienia, Catania, Italy.

He married Judith in 1980 and has two married children from a previous marriage – Russell and Debra, two married step-children, – Michael and Liz, and ten grandchildren. Judith has been his companion, friend and culture counselor and has helped establish hobbies related to theater, art, music and politics.

Professor Eli M. Pearce is full of energy and ideas in the field of polymer chemistry and technology. We wish him a long life and further achievements in pure and applied chemistry.