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12. Pierre Sigwalt

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Personalities in Polymer Science



Pierre Sigwalt

Pierre Sigwalt is one of the most highly regarded and most influential personalities in polymer chemistry in France. He has created a school of polymer chemistry in Paris that has had a fundamental impact on the development of this field throughout the world. His scientific activities have made him the foremost representative of his country. He is known not only for his scientific accomplishments, but also as organizer and International representative of France.

Pierre Sigwalt was born in Paris on July 15, 1925, as the son of Marcel Sigwalt and of Germaine Galienne who were also born in Paris. He is the grandson of Martin Sigwalt, born in Alsace who came to Paris in 1890.

Pierre went to Elementary School, the Ecole Communale St. Louis en L'isle (Paris), then to the Lycée Turgot in Paris, from where he received his baccalaureate in 1943. Pierre Sigwalt then enrolled at the Ecole Nationale Supérieure de Chimie de Paris, received his Licence ès Sciences in 1947, and his Ingénieur degree, (ENSCP) in 1947. He was appointed in 1948 as Assistant at the Ecole Supérieure de Physique et Chimie de Paris, rue Vauquelin, and started his research under Professor George Champetier. He remained there for 10 years and received his doctoral degree of Docteur ès Sciences in 1958.

In 1958, Pierre Sigwalt was promoted to Assistant Professor at the University of Paris (Chef de Travaux at the Faculté des Sciences de Paris) in the Sorbonne building. There, he started a new laboratory which was still under the overall direction of Professor George Champetier. It was at that time that Sigwalt began his independent research on anionic and cationic polymerization, beginning with 6 students. In 1962 he was appointed Associate Professor at the University of Paris.

In 1964 Pierre Sigwalt became "Professeur sans chaire", and in 1969 he became Professeur Titulaire at the Faculté des Sciences de Paris. From 1974 to 1986, Pierre Sigwalt was Director of the Associate Laboratory (No. 24) of the CNRS; since 1988, he has been Professor Emeritus of the Université Pierre and Marie Curie.

In his scientific work, Pierre Sigwalt concentrated on Macromolecular Chemistry, more specifically, on the evaluation of the reaction mechanisms of polymer synthesis, but also on the preparation of new polymers by various methods of ionic and radical polymerizations. His work developed in the following directions:

1. Anionic Polymerizations: Reaction mechanisms were studied and the reactivity of the various anionic species was determined: Free ions, contact ion pairs, solvated ion pairs, ion pairs with cryptated ions and aggregated ion pairs. Studies of the polymerization of styrene derivatives, conjugated dienes, epoxides and episulfides were undertaken with these types of monomers, the synthesis of various types of copolymers, block copolymers and polymers of controlled molecular weight was accomplished. The synthesis of cyclic macromolecules, even of high molecular weight was accomplished. Stereospecific anionic polymerizations of racemic cyclic monomers have given polymer racemates with properties and crystal structures different from those of the pure polyenantiomers. The latter could also be prepared by kinetic resolution with chiral initiators, and pure monomeric enantiomers were also obtained in the same way.

2. Cationic polymerization: The first syntheses of high molecular weight polymers of indene and of cyclopentadiene were carried out. The direct initiation of carbocationic polymerizations

with Friedel-Crafts catalysts was evaluated and distinguished from polymerizations with coinitiators. The synthesis of graft copolymers with cationic grafting initiation was also studied as was the effect of cationic chain transfer.

The distinction between living and apparently living carbocationic polymerization was made and criteria for their occurrence were proposed. The effect of reversible termination and the possibility of the suppression of the transfer reaction were also explored. In the cationic ring opening polymerization of cyclic monomers, the study of the polymerization mechanism and measurements of the reactivity of cyclosiloxanes as a function of chain length and the competition between the formation of linear and cyclic polysiloxanes were also investigated.

3. Polymerization using Ziegler type catalysts. The polymerization mechanism of the polymerization of ethylene and styrene initiated with monometallic complexes of zirconium was studied and compared. The oligomerization and the copolymerization of styrene and *n*-hexene was advanced and the direction of insertion of styrene into the zirconium or titanium complexes was determined which was later confirmed.

4. Radical polymerization: The radical mechanism of the regular and alternating copolymerization was investigated especially when the polymerization was carried out in the presence of organoaluminum complexing agents. Polymerizations, initiated with dithiocarbamates, were also studied with special emphasis on the partially reversible termination of these polymerizations.

Pierre Sigwalt has published 250 scientific papers and directed numerous theses: 24 Doctorats d'Etat (Ph.D.), 54 doctoral theses de troisième cycle and doctorats d'ingénieurs.

Sigwalt was very active in publication; he has been or is on the Editorial Board of *Die Makromolekulare Chemie*, *Compte Rendus*, *Polymer International*, and Co-Editor of *Comprehensive Polymer Science* (Pergamon 1989).

Pierre Sigwalt was very much involved in professional societies, especially in IUPAC, the International Union of Pure and Applied Chemistry. He was a Member of Macromolecular Division and representative of France (1975-1987). He

also organized several significant Symposia: In Rouen in 1973, the 1st International Symposium on Cationic Polymerization; in Blois 1987, the 5th International Symposium on Ring Opening Polymerization. He was the Honorary Chairman of the 1st Symposium on Ionic Polymerization in Paris in 1997.

Pierre Sigwalt was also active as a consultant: for the Dow Chemical Co., USA 1965–1979, for Charbonnage de France (CDF), 1961–1986, and for Lafarge Coppée (1987–1994).

Pierre Sigwalt's extensive contributions to Science have been widely recognized. He received the Schützenberger Award from the Academie de Science in 1961, the Silver Medal, Centre National de la Recherche Scientifique [CNRS] (1964), the Prix Raymond Berr [Société Chimique de France] (1973). He was the President of a Committee on New Polymers of the French Delegation for Scientific Research (DGRST) from 1972 to 1997. He has been elected several times as a Member of the National Committee of CNRS and of the Comité Consultatif des Universités.

From 1985 to 1989 Sigwalt was a Permanent Consultant of the National Evaluation Committee of the Universities. In 1980 he was elected an Associate Member of the French Academy of Sciences, and, in 1993, he became an Officier de la Légion d'Honneur. He received the International Award of the Society of Polymer Science of Japan in 1996.

Pierre Sigwalt is an intellectual with interests in the arts, especially in paintings and in sculptures, and is a frequent visitor to museums and art exhibitions. His interests in art extends to all periods from the antique to the modern, which may explain his great liking to travel. He is also interested in the cinema, especially in foreign films of all periods.

In 1965, Pierre Sigwalt married Chen Chen Huang who was born in Taipei, Taiwan. She had studied in Taipei and also at Keio University in Yokohama, Japan. The Sigwalts have 2 boys, the elder son has two children.

This article was prepared by **Otto Vogl**, Herman F. Mark Professor of Polymer Science Emeritus, Department of Polymer Science and Engineering, University of Massachusetts, Amherst, MA, 01003-4580, USA.