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## 18. Dieter Freitag

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## Personalities in Polymer Science



Dieter Freitag

### Honoring Dr. Dieter Freitag on his 60th Birthday

Dieter Freitag is not only an industrial scientist, businessman and industrial politician par excellence, he is also one of the dominant personalities in the field of materials research and application in the Federal Republic of Germany. His impact is based primarily on his activities in the field of polycarbonates, especially his work on end-group technology, high glass transition temperature materials and branched resins. These materials have become the basis for the compact disc, polycarbonate twin wall sheets used in construction as well as plastic automotive components.

Dieter Freitag was born in Offenbach, Hessen, Germany on May 8, 1939 as the son of Elisabeth, née Maier, and Paul Freitag. Young Dieter attended the elementary school in Offenbach from 1946 to 1950. After passing the difficult entrance exam he enrolled in the Rudolf Koch Realgymnasium – an advanced middle and high school. His chemistry teacher sparked his interest in chemistry and he began buying chemistry books and a chemistry set to carry out exciting experiments at home. By the end of his high school education he was committed to studying chemistry at the university.

After graduating from the Rudolf Koch Realgymnasium in 1959, Freitag studied Chemistry at two universities famous for their work in experimental organic and

polymer chemistry. First he enrolled at the University of Freiburg, close to his relatives on his mother's side. In 1960, he transferred to the University of Frankfurt. Now closer to home, he finished his studies in Frankfurt in 1965 and continued the work on his doctorate, which he earned in 1967. His Master's thesis, entitled *Investigation of the Preparation of Substituted Cyclopentadienones as well as the Reaction of 2,5-Diphenyl-3,4-Indanonyl-cyclopentadienones to Higher Arylated Fluorenonones*. The title of his dissertation was *Reactions with Cyclopentadienones; in Particular the Preparation of 1,2,3,4-Tetraphenyl-5,6-benzo-pentalene*; it was carried out under the direction of Professor Walter Ried. As part of this research, Freitag prepared new cyclopentadienones, an oligophenylene molecule with 16 phenylene units and, finally, a soluble polyphenylene with a melting point of 480°C!

As a Research Associate in Professor Ried's group, Dieter Freitag had already been supported by the Bayer A.G. and had become known to Hermann Schnell, the German inventor of polycarbonates who, at that time, was Head of Research at the Bayer A.G. facilities located in Uerdingen, Germany. Schnell was so impressed with Freitag's work that he offered him a position at Bayer subject to the condition that he start his work two months later.

Freitag joined the Central Research facilities of Bayer A.G. in August of 1967 and was not assigned to polycarbonates, but rather, to organic intermediates. His first successes included the synthesis of a new diamine which was needed to prepare transparent polyamides, a key intermediate for the photographic process at AGFA, a new trinuclear bis-phenol for colorless resole resins, and finally, special bis-phenols from dienes.

In 1973, Freitag was promoted to manager of a polymers group in Central Research which would turn out to be an excellent decision by the company. The time between 1974 and 1978 was a highly successful time for the team led by Freitag. 18 experimental and commercial products were developed and over 50 patent applications were submitted! One key development was the discovery of isatin-bis-cresol as the optimal branching agent for polycarbonates. These branched polycarbonates had superior extrusion properties and allowed the preparation of

thin wall sheets used en masse as construction materials. In addition, a flame retardant polycarbonate was developed and commercialized.

Perhaps the most important advance was the development of polycarbonates with alkylphenyl end-groups. This new end-group technology resulted in the right properties for the development of compact discs with good accuracy and sound quality combined with fast production of high quality discs. At the same time, trimethylene-cyclohexane-bis-phenol polycarbonate, a high glass transition temperature material which is very important for a number of key materials applications, was discovered.

In 1978, Freitag and his entire research group were transferred from the Central Research Department to the Plastics Business Unit with responsibilities for the development of new polymers. Under Freitag's management, polyphosphonates and polyphenylene sulfide were investigated and polycarbonate blends were developed. During this period, Freitag and his team also took the discoveries made during their time in Central Research and turned them into market-ready products which have resulted in sales of more than 2 billion US \$ for Bayer so far!

In 1986, Freitag was appointed Senior Manager of Plastics Application Technology, which covered 18 different areas. Within 2 years, the profits of this group grew from 10 million US \$ to about 17 million US \$. This almost 50% increase in profits showed that Freitag's talents were not limited only to research.

As a result of these successes, Freitag was named Director of the Company in 1988 and was appointed world-wide Head of Bayer Plastics Research. At the same time, Bayer Plastics decided to refocus their activities, resulting in the termination of a number of projects and an increased emphasis on process technology. From this new focus came the development of a new melt process involving a new type of catalyst for the production of higher quality polycarbonates. A new process for the preparation of emulsion butadiene rubber for ABS was also developed. New products developed during this time include flame retardant polyamide and polycarbonate polymers and blends. A new concept for materials recycling was also introduced. Most importantly, the Plastics Research Division was reorganized into Plastics Research and

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## Columns

Development, including an increased focus on interactions with universities.

In 1994, Freitag became responsible for the entire Central Materials Research of Bayer with more than 250 employees and a budget of about 50 million dollars. Since then, Freitag and his team have been involved in the development, optimization and commercialization of several new materials and processes, including biodegradable polymers, electrically conducting polymers and gas phase butadiene rubber. In addition, new catalytic metallocene structures, which are expected to play an important role in polymerization processes of the future, were discovered.

In addition to his responsibilities as Head of Central Materials Research at Bayer, Freitag was the Head of the Bayer General R&D Committee on Materials from 1994 to 1997. This committee is responsible for directing and supporting the utilization of internal and external synergies, globalization of the materials field as well as the streamlining of processes involved in materials production.

As is typical for an industrial scientist, most of Freitag's work is published in patents. His name is on nearly 280 patents and 25 scientific publications on the chemistry of polymers and other materials as well as their applications. He is also on the editorial boards of a number of scientific journals including *Applied Macromolecular Chemistry and Physics*, *Progress in Polymer Science and Advanced Materials*. He has given numerous talks, several plenary and opening lectures, and over 30 press conferences.

Throughout his work at Bayer A.G., Dieter Freitag has had a considerable amount of influence on the research, development and production of materials in Germany. Consequently, he has been chosen to represent Bayer A.G., one of the top German chemical companies, in a number of German research committees and boards. He is the Chairman of the Board of the Fraunhofer Institute in Wuerzburg, the Chairman of the Nordrhein-Westfalen Section of the German Chemical Society, and a Member of the Board of the Division of Macromolecular Chemistry of the German Chemical Society. He is also a member of the steering committees of the scientific cooperation between Germany and Israel and between the Russian Academy of Sciences and Bayer A.G.

His accomplishments have been recognized by several medals. For his contributions to the development of thermoplastic materials, he received the Otto Bayer Medal in 1985 and the Herman F. Mark Medal of the Austrian Institute of Chemistry and Technology in 1997.

His limited free time is devoted to his family and his hobbies. In addition to his interests in swimming, jogging and cycling, Dieter Freitag is an avid coin collector and investigator of Roman history. His coin collection from the Roman period includes specimens starting from the periods of Julius Caesar, Augustus and his wife Livia, up to Marcianus, one of the last Roman Caesars. His oldest coin is from the Greek period, minted after the famous battle of Marathon in 480 BC.

In 1966 Dieter Freitag married Katherina Schüssler whom he knew from his time in Frankfurt. They have two sons. Alexander is a neurologist at the Ambrock Clinic in Hagen, Germany and Achim is studying medicine at the University of Essen. In addition to loving medicine, both sons are excellent swimmers and tennis players, having spent much time on the courts with their father, often playing in ranked teams with him.

Dieter Freitag currently lives with his wife in Krefeld, Germany. She is devoted to volunteer social work with their church and is an avid gardener.

This article was prepared by **Otto Vogl**, Herman F. Mark Professor Emeritus, Department of Polymer Science and Engineering, University of Massachusetts, Amherst, MA, 01003-4350, USA and **Karina Rigby**, Bayer A.G., D-51368 Leverkusen, Germany.

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