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## 39. Shu Kambara

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## Personalities in Polymer Science



Shu Kambara

Shu Kambara is one of the most important personalities in Polymer Science in Japan. He held leading positions in the Kanto (Tokyo) area and was substantially responsible for the development of Polymer Science and Rubber Technology in Japan after the second world war.

Shu Kambara, Emeritus Professor, Tokyo Institute of Technology was born on September 22, 1906 in Tokyo as the second son of Isaburo and Fumiko Kambara. He grew up in Tokyo and went to Hongo Elementary School, Seijoh Middle School, and Waseda High School. His father, who was a Civil Engineer, had studied three years of railway construction in England and served on the construction of the National Railroad throughout Japan at the beginning of the twentieth century, the Meiji era.

After High School, Shu Kambara enrolled in the very prestigious Waseda University and graduated with a Bachelor degree of Engineering in 1930. As was customary in those days, Shu Kambara decided on an academic career, and in 1930, was offered a position at the Tokyo Institute of Technology as Research Associate (Jo-Shu). He also enrolled in the doctoral program at the University of Tokyo and obtained his degree in 1944. Still employed at the Tokyo Institute of

Technology, he was promoted in 1939 to Associate Professor (Jo-Kyoju).

In 1946, Shu Kambara was appointed Professor (Kyoju), as the successor of Professor Yoshio Tanaka, at that time one of the leading professors in applied chemistry in Japan. In Tanaka's laboratory, at the Tokyo Institute of Technology, the chemistry and technology of rubber materials was primarily studied. In fact, this laboratory was one of the most important laboratories in Japan, where, what we know today as Polymer Science, was studied.

In 1953, Kambara switched to the Research Laboratory of Resources Utilization at the Tokyo Institute of Technology. In 1967, Shu Kambara reached the age of mandatory retirement and was then awarded by his University the position of Professor Emeritus.

After his retirement from the Tokyo Institute of Technology, Shu Kambara was offered and accepted the position of Professor at the Tokyo University of Agriculture and Technology. During the period 1968-69, Shu Kambara became Dean of the Faculty of Engineering and, in 1970, he again retired.

At the beginning of his academic career, Shu Kambara received a special assignment, in 1952, from the Ministry of Education of Japan. He was the first research professor after World War II to spend some time abroad. He was a Visiting Professor at the Polytechnic Institute in Brooklyn working with Professor Herman F. Mark, and the next year, at the University of Akron with Professor Maurice Morton. During this time Kambara consulted for the Japanese Government delegation which investigated synthetic rubber industries in the U.S. Based on the report of the commission, the Japan Synthetic Rubber Company was founded in 1957 with financial support of the Japanese Government.

Shu Kambara was one of the most influential personalities in polymer science in Japan in the 50's and 60's and even earlier. He played a major role in the creation of the Society of Synthetic Fibers in 1941, and the Society of Polymer Science, Japan in 1951. From 1969 to 1974, he was the President of the Japan Society of Plastics Technology; from 1969 to 1971 he was the Vice President of the Chemical Society of Japan, and, from

1971 to 1974, he was the President of the Society of Polymer Science, Japan, the third President following Professor Sobae and Sakurada. During his presidency an agreement of cooperation was reached with the Division of Polymer Chemistry of the American Chemical Society.

For many years, from 1972 to 1986, Kambara was the Chairman of the Chemical Inspection and Testing Institute of Japan and served as the Chairman of Organizing Committee of the International Rubber Conference in 1975.

A great number of honors reflect the recognition of Shu Kambara for his contributions in the development of science in Japan. In 1966, he received the Medal with Purple Ribbon, and in 1977 The Order of the Sacred Treasure, Gold and Silver Star. Professional Societies honored the service of Shu Kambara. In 1974 he was elected an Honorary Member of Society of Polymer Science, Japan, and in 1960, he received the George Oenslager Award of The Chemical Society of Japan and The Society of Rubber Industry, Japan.

Over the years Shu Kambara was engaged in a number of areas of scientific research:

1) Basic Research and Development of Synthetic Fibers: In 1941, he discovered a new method for the production of polyacrylonitrile fiber and named this fiber **Shinsen**. Polyacrylonitrile was dissolved in concentrated sulfuric acid and was spun to a fiber. This method of fiber spinning was extended in 1959 to the production of Kashmirlon, the trade name for polyacrylonitrile fibers produced by the Asahi Chemical Ind.

2) Basic Studies on Vulcanization: Kambara found and isolated a crystalline compound obtained by oxidation of sulfur vulcanizates of natural rubber with peracids and characterized its structure. These results gave the first real evidence for the presence of sulfur bridges in sulfur cured rubber elastomers. For this important investigation, Shu Kambara was awarded the "Oenslager Medal" from The Chemical Society of Japan.

3) Polymerization of Olefins and 1,3-Dienes with Ziegler Type Catalysts: Kambara's group carried out the syntheses of isotactic polystyrene, *cis*-1,4-polyisoprene, copolymers of propylene with isoprene, propylene with butadiene,

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and butadiene with isoprene using Ziegler-Natta type catalysts.

4) Studies on the Polymerization of Acetylenes and Electrical Conductivity of Polyacetylenes: The polymerization of acetylene and phenyl acetylene was investigated. After Professor Kambara moved from Tokyo Institute of Technology to the Tokyo University of Agriculture and Technology, Dr. H. Shirakawa, who had been a graduate student, working for his doctoral degree in Professor Kambara's research group, (in collaboration with Professor Ikeda) succeeded in the preparation of polyacetylene films.

5) Polymer Materials for Medical Applications: In collaboration with Professors Kimoto and Atsumi of The University of Tokyo, the preparation of artificial blood and artificial organs were investigated.

Shu Kambara's work was published in about 200 scientific papers, 20 patents, and 15 books where he was the author or co-author and in several book chapters.

Shu Kambara is a charming person with a wide range of interests and a man of many ideas. Therefore many people visit him in his office or his home, listen to his humor and ask his advice. Shu Kambara has a number of hobbies. He likes to read, primarily fiction and sometimes composes a "Haiku", the 17 syllable Japanese short poem. He also plays Japanese chess and mah-jongg. He has invented a mah-jongg table with a device that automatically arranges pieces, which is quite convenient and time saving for the players of the game.

Shu Kambara is a true gourmet and knowledgeable about many delicious foods. At home, Shu is proud of preparing and serving for his friends his *SK Special*, a cocktail which he prepares with great joy from equal amounts of Canadian Dry and Shochu, a Japanese liquor made from either potatoes or grains.

Shu Kambara married the former Kiyoko Isomura of Tokyo. They have one son and two daughters.

This article was prepared by **Otto Vogl\***, Mombusho Professor, Kyoto Institute of Technology, Matsugasaki, Sakyo-ku, Kyoto 606, Japan, and **Seiichi Nakahama**, Department of Polymer Chemistry, Tokyo Institute of Technology, Ookayama, Meguro-ku, Tokyo 152, Japan with the help of **Noboru Yamazaki**.