

## Akio Yamamoto: an appreciation

Professor Akio Yamamoto retired from the Tokyo Institute of Technology on 31st March 1990. It comes as a surprise that he retired at all, since he looks as young and is as full of energy and enthusiasm as ever.

Akio Yamamoto was born on the 18th of March 1930. He received a BSc. degree from Waseda University in 1954, and then a doctorate from Tokyo Institute of Technology in 1959 for his first researches on organotitanium chemistry, with Professor Shu Kambara. He was then appointed as a Research Associate at the Research Laboratory of Resources Utilization of the Tokyo Institute of Technology, followed by Associate Professor in 1967 and Professor in 1971. During his academic career in the Tokyo Institute of Technology, he worked as a post-doctoral research fellow in 1960–1962 with Professor Melvin Calvin at the University of California, Berkeley, on manganese phthalocyanin, and then in 1963 with professor Gunther Wilke at the Max-Planck Institute für Kohlenforschung at Mulheim where he was greatly influenced by Wilke's elegant chemistry involving the use of Schlenk techniques. He became a member of the Faculty Council of the Tokyo Institute of Technology, and was promoted to Director of the Research Laboratory of Resources Utilization during 1988–1990. He also played an important role as a Vice-President of the Chemical Society of Japan. He discharged admirably during 1985–1990 his important mission as a Science Advisor to the Science and International Affairs Bureau of the Ministry of Education Japan, where he identified, and argued successfully appealed to avert, the crisis facing basic research in chemistry in Japan.

Akio Yamamoto's primary research interests in organometallic chemistry involved isolation of active intermediate compounds in transition metal catalyses and development of their uses in new chemical transformations. His first research in organometallic chemistry was concerned with the isolation from Ziegler-type catalyst systems of alkylnickel(II), -cobalt(I) and -iron(II) complexes stabilized by 2,2'-bipyridine ligands, and the investigation of Cossee's model for Ziegler polymerization by the reactions of isolated organotransition metal complexes with various unsaturated molecules. His proposals arising from a mechanistic study of activation of transition metal–carbon bond in relation to catalysis and coordination chemistry, for which he received the Award of the Society of Polymer Science, Japan (1969), are especially highly regarded. He expanded his preparative chemistry of alkyl- and hydrido-transition metal complexes to Ti, V, Cr, Mn, Cu, Ru, Rh, Pd, and Pt species. He always told his students: "After only three day's involvement in organometallic chemistry you won't be able to give up continuing your research". He experienced serendipity in this fruitful field. The most striking event in his research was the unexpected isolation of the first dinitrogen complex of cobalt,  $\text{CoH}(\text{N}_2)(\text{PPh}_3)_3$ . One reason why his first love was the cobalt–dinitrogen complex was that he could not, at that time, afford to buy a pure argon line, but only an inexpensive nitrogen line to provide the inert gas in his laboratory.

Consistent throughout his research was his belief that one should investigate one's new complexes thoroughly to find unusual new reactions. He believed that "Good luck always repeats itself". Thus he also found a ruthenium analogue of the dinitrogen complex, and demonstrated the catalytic activities of both complexes in polymerization, dimerization, hydrogenation, and isomerization of olefins. His favorite phrase was "Ask your complex where you are going", which reflects his serendipitous success in organometallic chemistry. He was also concerned about fundamental research in organometallic chemistry, especially oxidative addition and reductive elimination of not only the C-X bond but also C-O, C-S and even C-H bonds, and insertion of various unsaturated small molecules such as CO, CO<sub>2</sub> and olefins into M-C and M-H bonds. This led to remarkable academic achievements. Many of his proposed fundamental concepts were widely accepted and highly regarded. Notable applications of these fundamental investigations were the double carbonylation of aryl halides and the polycondensation of aromatic dihalides to give electron-conducting and heat-resistant polymers. He found that the dialkylnickel(II) complex cleanly reacts with an aryl halide by reductive elimination, with formation of an arylhalonickel(II) complex, and regretted not exploiting the nickel-catalyzed selective cross-coupling reaction of Grignard reagents with aryl halides, that was later developed by Kumada and Corriu independently. For this remarkable work in basic organometallic chemistry he received the Chemical Society of Japan Award for 1986.

Akio Yamamoto said, "There are hunters and there are farmers in the scientific researcher. The former are apt to engage in several research areas, whereas the latter systematically plow in one". He believed that he was amongst the latter and did not wish to enter other fields, however brilliant their prospects seemed. He also said that his might have been because organometallic chemistry was in a "gold rush" period. The statement reminds us of his reserved and gentle personality that we all know.

Akio Yamamoto's other remarkable work was the systematization of organometallic chemistry, which appeared in his textbook, "Organotransition Metal Chemistry—Fundamental Concepts and Applications". The book is highly valued worldwide, even today, as a textbook for graduate students, and especially the "Intermezzo" section in the book takes readers into the spectacular world of organometallic chemistry.

Akio Yamamoto had more than 150 students, 20 of them earned their doctorates. His students came from many countries, which was unusual for Japanese professors at that time.

This appreciation would not be complete without some reference to other aspects of his life. His wife Yuko's devoted support to Akio should be noted. She acted as a typical Japanese wife for more than 30 years with him and his parents. Here kind and talented hospitality to all of Akio's students, friends, and foreign guests, and her perfect management of his emotional and physical health, described in the essay she contributed to his retirement volume, are greatly appreciated.

Although Akio Yamamoto formally retired from the Tokyo Institute of Technology in 1990, he intends to continue his chemistry research and teaching at Waseda University, where his father was a leading Professor of Chemistry. Not all of his coworkers and collaborators have been able to contribute to this special

issue of the journal, but all of us wish to express to him our feelings of friendship, gratitude, and respect, and our good wishes for many more years of fruitful scientific activity.

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