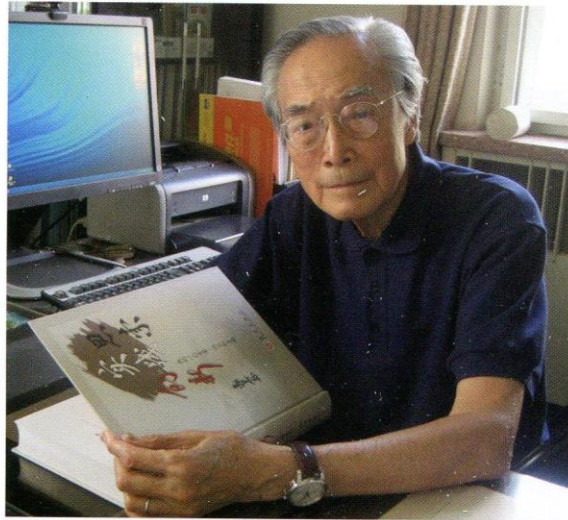


郭慕孙 Mooson Kwauk

(1920-6-24 – 2012-11-20)



您永远活在我们心中 **Forever In Our Hearts**

感谢您诚挚的悼念和亲切的关怀

Our deepest gratitude for your
sympathy, love and kindness

慧君

儿伟明，媳勤文，携 郭婷，郭嘉
女瑞明，婿曾泓，携 繁熙，繁睿
儿向明，媳万虹，携 欣旸，欣玥

Huichun

Weimin, Chinwen, Christina and Karena
Reimin, Hung, Francis and Ferris
Xianmin, Hong, Leon and Elena

A Tribute to Mooson Kwauk



Prof. Mooson Kwauk, our dear friend and colleague, passed away due to illness on November 20, 2012 in Beijing at the age of 92. His image remains indelibly impressed upon our memory and we often feel he were still busy working at home as usual. As Mooson's friends for several decades, we witnessed his unwaveringly high standards of excellence and his great passion for research. We consider him a fearless climber who would never stop the endless journey to the summit of Mount Science. We all feel a strong sense of loss of his passing away and a deep grief as thousands of words well up in our hearts. We can hardly begin to delineate his lifelong achievements, contributions and influence to society as a great scientist and educator.

His cutting-edge research insight, endless pursuit of knowledge, persistent upkeep with the latest intellectual trends and, most impressively, his forever friendly disposition established a distinguished model for youth to follow.

Mooson was born in Hanyang, Hubei Province, China, on June 24, 1920, and grew up in Shanghai. He graduated from the University of Shanghai with a degree in chemistry in 1943 and studied for his Master's degree at Princeton University from 1945 to 1946 under the late Prof. Richard H. Wilhelm. At Princeton, Mooson showed exemplary research capability, authoring the classical paper, "Fluidization of Solids Particles" (Chem. Eng. Prog., vol. 44, 1948, p.201.), in which aggregative fluidization and particulate fluidization were distinguished for the first time. After leaving Princeton, he joined Hydrocarbon Research in New York to work on process development for coal gasification, air separation, gas purification and gaseous reduction of iron ores. During a 4-year interlude of the employment by the Coca-Cola Export Corp., he built the first bottling plant in India, received the Chesterman Award in 1950 and led the Export Corp. Lab in New York City. Mooson later continued his career at Hydrocarbon Research and returned to China with his family in 1956.

Upon his return to China, Mooson helped to found the Institute of Chemical Metallurgy (ICM) (later renamed the Institute of Process Engineering in 2001 on the basis of his concept of "process engineering") in the Chinese Academy of Sciences (CAS), where he remained until his retirement. He set up China's first fluidization research laboratory in ICM and pioneered his country's fluidization research. In his early career, Mooson endeavored to unify all types of gas-solid operations and established the theory of *Generalized Fluidization*. Mooson also cooperated with industry in scaling up fluidized sulfate roasting of cupriferous iron ores, two-phase fluidized roasting of laterite, and other processes, which stimulated the application of fluidization in China. For these activities, the government awarded him the title *Excellent Scientific Researcher*, a high honor

In 1966 Mooson's research was interrupted due to the onset of the Cultural Revolution from which he and his family suffered greatly. Yet in spite of losing the right to conduct laboratory studies during this chaotic period, he continued to analyze experimental data, write notes and plan for future research from home, developing the concept of bubbleless gas-solid contacting and various other ideas. When research at ICM was partially restored in 1972, Mooson began testing his bubbleless contacting concept by

studying heat transfer in dilute phase, multi-stages shallow fluidized beds and fast fluidization. At this pivotal time, Mooson was appointed as the director of ICM with a mission to reestablish and reinvigorate research within the Institute. He was later elected a Member of the Chinese Academy of Sciences.

Under Mooson's leadership, ICM began a new era focusing on fundamental and innovative research and development in response to the needs of industry. New research areas were initiated, including biochemical engineering, particle technology, metallurgical physical chemistry, and multi-phase reaction engineering. Such changes won the support of the United Nations Development Program in 1984, leading to the establishment of the Multi-Phase Reaction (MPR) Lab in 1986, which was upgraded to the State Key Lab of Multi-Phase Complex Systems in 2006. Mooson guided the Lab through research of meso-scale problems like particle clustering in gas-solid flow and engineering problems like coal topping. Even after retirement as the Institute Director in 1986, Mooson never ceased his leadership and guidance to the Lab. He continued as the Emeritus Director of both ICM and the MPR Lab and made great efforts to promote scientific exchanges and to spearhead new disciplines. Beyond organizing many national and international conferences, he founded the Chinese Society of Particuology and served in leadership roles for the Chemical Industry and Engineering Society of China (CIESC). Mooson's lifetime of scientific achievements are recognized by many honors, such as the International Fluidization Award of Achievement at FLUIDIZATION VI, Banff in 1989; three National Natural Science Awards; he was honored as one of the fifty eminent chemical engineers of the "Foundation Age" by the American Institute of Chemical Engineering in 2008, and elected as foreign member of the Swiss Academy of Engineering Science. His contributions to the field are described in books like *FLUIDIZATION: Idealized and Bubbleless* (Science Press, Beijing; Ellis Horwood, U.K.), *Particle-Fluid Two-Phase Flow-Energy-Minimization Multi-Scale Method* (Metallurgical Industry Press, Beijing, 1994), *From Multiscale modeling to Mesoscience* (Springer, 2013), and four other books in Chinese. His research approaches are remembered as the guidance of R&D that he laid down for the MPR laboratory: "emphasizing accumulation (of knowledge), seeking excellence, exploring frontiers, and targeting needs." Mooson's achievements were largely due to his being open-minded, great enthusiasm, and consistent support of new ideas.

Perhaps the most long-lasting of Mooson's academic legacy is his impact on future generations of scholars to whom he dedicated long hours—as he always wanted—developing their writing skills. One is filled with great admiration upon browsing the articles that Mooson revised. His graduate students sent him poorly organized papers, and received after his careful and repeated revisions a well-thought out edited version with logic clearly supported by figures and tables. When he thought there were too many revisions for students to recognize, he would type and print the revised article for them; his high expectations towards his students can be felt between the lines. In addition to supporting young scholars by initiating the Young Scientist Award in Particuology with his own savings, he designed a science writing course in English to help graduate students write their papers using good English. His teachings in this course have been edited and published in the book *How to Write Science Papers in English* (Science Press, 2009).

Mooson's commitment to the exploration of new ideas and to the advancement of his discipline is evident by his diligence as the Editor (Beijing) of *Chemical Engineering Science* (Pergamon) and Editor-in-Chief of *Particuology*, a journal he launched in 2003 at the age of 83, each for more than a

decade. He put forth tremendous effort preparing worthy papers for his readers. As a rule, he always pre-edited manuscripts several times in consultation with the authors before sending them out for review, some of which were revised more than 10 times! He guided his colleagues in the Editorial Office of *Particuology* to check every equation and citation for accuracy and accessibility on Internet. In an interview in 2011, he said, “In all my life I never presented second-class products. The journal I run would never present inferior papers to my readers.” Through his tremendous efforts, *Particuology* has become a well-known international journal with high scientific quality.

There are many stories of his everyday life, which have a quiet but very powerful way to move and influence those around him. He also had an endearing habit of entering a room shaking hands and having small chats with everyone. He had the gift to make everyone feel that he regarded them important. Mooson always remembered what was said in the small chats even many years later. He never ceased learning something new and always maintained his curiosity in learning new things from his friends. Apart from writing skills, a most important lesson Mooson’s students and colleagues learned from him was his meticulous attention to details and his matter-of-fact attitude as a scientist. Colleagues who attended scientific activities with him witnessed this in his note-making. He would clearly and carefully record and archive the key points made by a speaker and summarize the content without exception. This kind of diligence is rarely seen! When we lost certain materials, we would invariably find an original copy at Mooson’s place.

Many of us in the chemical engineering community learned the true meaning of being a scientist from Mooson, whether inspired by his adept ability to draw complicated diagrams with computers in the 1980s—when computers had not yet become a familiar everyday research tool in China—or by his logical way of doing everything, including his hobbies. Mooson’s mind never slowed down from meaningful research and outreach activities that made science available to the public. For instance, his bilingual book, *Geometric Mobiles* (Science Press, 2008), promotes public understanding of the connection between artistic inspiration and scientific analysis. And even a few hours before he passed away, he was engaged in the work of promoting public understanding of science. Mooson’s commitment to science will be esteemed by the younger generations. His image will never fade from our memories and we will miss him forever!

We would like also to pay tribute to Huichun Gui, Mooson’s beloved wife, now 93. Huichun contributed significantly to Mooson’s accomplishments, in particular, always encouraging him to carry out world-class research under very difficult conditions and circumstances. Together, Mooson and Huichun were a model couple, supporting each other in a colorful and interesting life, contributing to society jointly and winning the respect of everyone who came to know them.

The world has lost a great man of science. We have lost a revered friend and mentor. Mooson’s family has lost a devoted father and loving husband. Mooson is survived by Huichun, three children, and six grandchildren. Our hearts go out to them. We send them our best wishes.

Jinghai Li, James Wei, Norman Li and Liang-Shih Fan