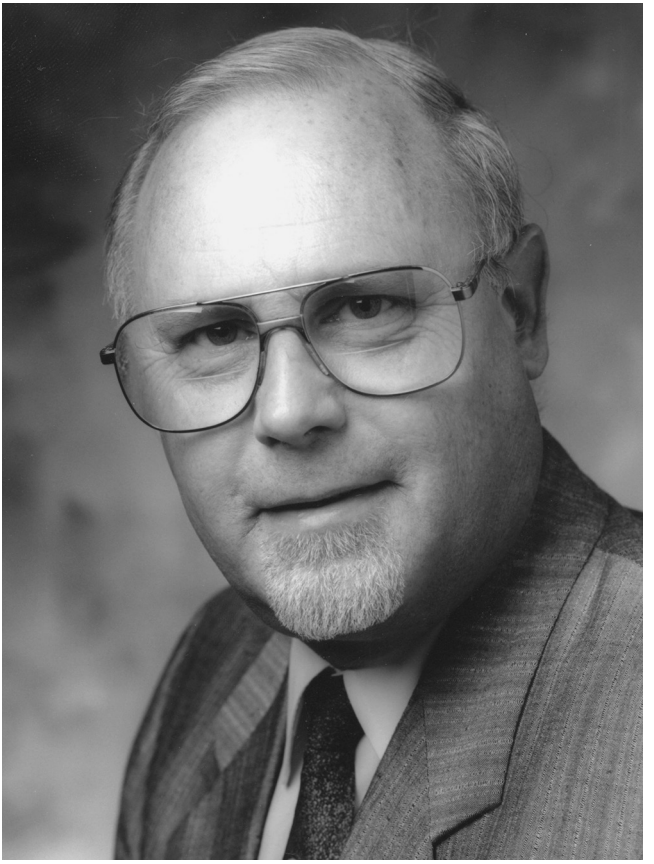

F. F. Lange

FREDERICK F. LANGE

1939–2010

Elected in 1992

"For innovative contributions to the understanding of ceramic processing."

BY SHELDON M. WIEDERHORN AND SUBHASH C. SINGHAL

FREDERICK F. LANGE, an outstanding personality in the world of ceramic science and engineering, died on April 2, 2010, at the age of 70. He was recognized as one of the great contributors to the field of ceramics by all who knew him and greatly earned their admiration.

Fred, as he was known to his friends and colleagues, was born in Montclair, New Jersey, on June 8, 1939. He spent his formative years in New Jersey, graduating from Verona High School in 1957 and from Rutgers University with a bachelor of science degree in ceramic engineering in 1961. He earned his PhD from Pennsylvania State University in the field of solid state technology in 1965.

In 1961, Fred married MaryAnn Kleissler and they remained devoted friends for the next 49 years. They had four children, David, Heather, Laura, and Helena, and two grandchildren, Jessica and Joshua. Fred and MaryAnn were attending their daughter Helena's PhD (nursing) thesis defense at the University of Arizona in Tucson when he suddenly died. In addition to his scientific work, Fred enjoyed woodworking, wine making, and telling stories to his grandchildren. He also enjoyed traveling worldwide with MaryAnn.

His first job after graduation was in the United Kingdom at the Atomic Energy Research Establishment in Harwell. There he worked with Roger Davidge studying the mechanical behavior of ceramic materials. This position was memorable in two regards: it shaped the first half of his career as an expert in the mechanical behavior of ceramics, and it established the first international connection of his career.

Fred had good ideas and an attractive way of explaining them, which made him desirable in the international ceramics community as an expert collaborator and lecturer in ceramic science. This expertise eventually bloomed into positions throughout the world where he spent time teaching, learning, and collaborating with his foreign colleagues.

At the end of his stay in the United Kingdom, he went to work at the Westinghouse Research Laboratory in Pittsburgh, Pennsylvania, where he studied structural ceramics for high-temperature operation. During this phase of his career, he improved the creep resistance of silicon nitride; he showed that minimizing the amount of impurity was essential to good high-temperature behavior, and that the toughness of these materials depended on the size of the grains in their structure. These contributions were seminal to our understanding of the mechanical properties of ceramics at high temperatures, as many of the lessons learned could be applied to other ceramic materials. During his work on silicon nitride, he came to appreciate the role of processing and gradually focused on it in his research.

Beginning in the late 1960s and into the 1980s, Fred recognized the importance of the new and emerging field of fracture mechanics to ceramic materials and was one of the original editors of the conference proceedings *Fracture Mechanics of Ceramic Materials*. This series of conferences occupied a central position in the field of structural ceramics for as long as fracture mechanics was a new and expanding field. Of the 14 volumes in the series, Fred was a coeditor of the first eight.

In 1976, Fred moved to California to join the Rockwell International Science Center, where he became a group leader

and a principal scientist. He was named Engineer of the Year in 1980 for his work on the space shuttle tile problem: tiles were becoming "unstuck" during space flights, and he developed a strategy to make sure they remained in place.

In 1986, he joined the faculty of the University of California at Santa Barbara with a joint appointment in the Departments of Materials and Chemical Engineering. He became chairman of the Materials Department in 1998 and was appointed Alcoa Chair and professor of materials in 1999. It was here that his research changed to processing research with an element of mechanical behavior, and later involved the interrelations between processing, phase relations, microstructure, and properties. His principal contributions included the development of ways of processing ceramic materials with higher crack growth resistance and improved reliability. He became world renowned for his work on powder processing, transformation toughening of zirconium oxide, mechanical behavior of silicon nitride, and colloidal processing of ceramic materials.

Fred Lange published more than 350 technical articles and is one of the most frequently cited authors in the field of ceramic materials. He also coauthored 32 patents dealing with ceramic materials and their processing. His outstanding work earned him 29 distinctions, honors, and awards, including membership in the National Academy of Engineering. He was a Humboldt Senior Fellow in 1993, won the Max Planck Research Award in 1997, and in 2009 was selected for the Richard Brook Prize by the European Ceramic Society and the W. David Kingery Award by the American Ceramic Society.

Paraphrasing from an editorial by Richard Brook, editor of the *Journal of the European Ceramic Society*, Fred Lange's research was distinguished by three characteristics. First, he tackled problems of practical significance. He recognized the importance of structural faults in powder bodies and concentrated on ways of eliminating them. He presented his conclusions in ways that were helpful to the practical engineer. His was not "ivory tower" research but a sound response to practical problems.

Second, Fred's research results were rapidly transferred

into teaching. All who heard his research absorbed the results and wanted to hear more. Fred made a particular effort to be sure that he was understood. He concentrated on research outcome rather than initial uncertainties of the results. He was also generous with colleagues at the beginning of their careers, taking time to see that they understood him and giving help where it was sought.

The third aspect of his work was its international scale. He participated fully in international meetings and held a number of important positions in countries outside the United States, including at the following institutions: Max Plank Institute in Stuttgart, Germany; Chalmers University, Sweden, as Jubilee Professor in 1983; University of Tianjin, China, in 1985; University of Melbourne, Australia, as a Miegunyah Distinguished Fellow; Institute of Materials Research and Engineering (Singapore) as a member of its Scientific Advisory Board; and National University of Singapore as a visiting professor.

At Fred's 65th birthday celebration, Prof. Anthony Evans, friend and colleague for more than 40 years, complimented Fred by saying that if you wanted to know where the important work was being done in processing or in the mechanical behavior of ceramic materials, look to see what Fred Lange was working on. Fred was unique; he will be sorely missed in the ceramics community.