IN MEMORIAM

Nathan W. T. Cheung
Professor of Electrical Engineering and Computer Sciences, Emeritus
UC Berkeley
1950 – 2016

Nathan Woontong Cheung, professor emeritus in the Department of Electrical Engineering and Computer Sciences at the University of California, Berkeley, and an international leader in integrated circuit fabrication technology, died Thursday, March 2, 2016. He was 65.

Born on August 1, 1950, Nathan Cheung graduated in 1971 from the Massachusetts Institute of Technology (MIT) with a bachelor's degree in physics. He continued graduate studies at MIT for four years, then acquired industrial experience at the Exxon Research Laboratory, Linden, New Jersey, in 1976, and at the Bell Telephone Laboratories, Murray Hill, New Jersey, from 1978 to 1979. He then went west to the California Institute of Technology, where he received his Ph.D. in applied physics in 1980, under the direction of Professors James W. Mayer and Marc-Aurele Nicolet. His dissertation, "I. Channeling Studies of Silicon Interfaces and II. Diffusion Barrier Properties of Titanium Nitride," was an important development in both characterizing interfaces and establishing barriers between metals and single crystal silicon.

Nathan joined the Department of Electrical Engineering and Computer Sciences at Berkeley as an assistant professor on July 1, 1980, was promoted to associate professor in 1983, and to full professor in 1989. During his career at Berkeley, he became a world leader in the field of semiconductor device fabrication. Over his tenure at UC Berkeley, he supervised about 20 Ph.D. graduate students and about a dozen postdoctoral students. His work led to over 250 publications and the granting of 26 patents. Nathan loved life, people, and being active. His Chinese banquets for graduating Ph.D. students were legendary.

Professor Cheung was an associate faculty member of the Lawrence Berkeley National Laboratory and was a visiting professor at the National Research and Resource Facility for Submicron Structures at Cornell University in 1987. He chaired the Applied Science and Technology Graduate Group from 2002 to 2004, and was an active participant in the Berkeley Scholars Program from 2004 to 2006. Professor Cheung was on sabbatical leave at the City University of Hong Kong in 2006–07, with an appointment as a Royal Society KTP Visiting Professor, striking out in a new research direction, investigating the use of nanofabrication techniques to manipulate biological cell surface affinities. After his retirement from Berkeley in June 2012, he continued his research at City University.

Professor Cheung was the lead professor for undergraduate and graduate courses in the field of microfabrication, and educated hundreds of students in the field of electronics device manufacturing. This included the upgrading and computerization of the testing instrumentation of the classroom laboratory for microfabrication where undergraduates received 'hands on' instruction in fabricating their own wafers. His breadth of knowledge of the rapidly evolving field was invaluable in keeping the course readings from the literature manageable as well as up-to-date. His depth of knowledge and enthusiasm were infectious and were vividly seen by students in courses he taught. Nathan particularly enjoyed bringing gadgets that he and his students had made to the classroom, such as the brightest white light LED anyone had ever seen.

Professor Cheung was an enthusiastic supporter of the Microfabrication Laboratory and the Cory Hall Machine Shop. As director of the Berkeley Microfabrication Laboratory in 2004 to 2006, he guided its transition from the fourth floor of Cory Hall into the new, enlarged Marvell Nanofabrication Laboratory in the Center for Information Technology Research in the Interest of Society in Sutardja Dai Hall. This transition was made with minimal disruption to the ongoing research by students in many fields on the Berkeley campus. Nathan also worked closely with the Machine Shop to build a large experimental apparatus, the Plasma Immersion Ion Implanter (PIII), as a novel apparatus for both research and processing in the laboratory. Nathan was always forthcoming with advice and contributions to common projects. This positive attitude was imparted to his students who became good lab citizens.

Professor Cheung authored numerous book chapters on advanced electronics manufacturing, including III-V nitride semiconductor fabrication, 3-D wafer-bonding technology, and plasma immersion ion implantation for semiconductor doping. Both in teaching and research, he always insisted on the widest dissemination of all developments by himself and his students. Technology transfer to industry was also a deep concern to him. He cofounded the Plasma Doping Users Group (PDUG) and Silicon China (Hong Kong) Limited, and he served as a member of the Advisory Board of SemiLEDs Corporation and as an advisor to InVisage Technologies.

Nathan loved to solve problems and was always thinking about applying new semiconductor processes and equipment to improve the art. He was a pioneer in an alternative method of implantation called plasma immersion ion implantation (PIII).

The potential throughput gains as well as its compatibility with future deep trench and submicron technologies were motivations for him to become a world-renowned expert and often cited researcher in PIII technology. Modern semiconductor processes now utilize PIII methods routinely, not in small part due to Nathan's pioneering work in this field.

Engineered substrate technology in the form of SOI and other material combinations were another area where Nathan contributed greatly. Nathan cofounded Silicon Genesis Corporation (SiGen) in 1997, and combined PIII implant technology with a novel layer-transfer approach to making SOI wafers with better specifications and lower cost. He received many U.S. patents related to this venture. Nathan's layer-transfer inventions are used in semiconductor substrates that are commonly found in products such as computers, cellphones, tablets, and automotive electronics.

Professor Cheung recently developed a miniature spectrometer suitable for in situ monitoring of semiconductor processing. In a novel approach he utilized a paper-thin LED photon source and a commercial image sensor as a three-channel spectrometer to collect real time data for hostile environment processing such as chemical etching. As a demonstration of this technique, he analyzed the in situ reflectance/emission spectra from the etchings of copper and aluminum thin films.

Andy Neureuther
Bill Oldham
Michael Lieberman
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