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THE 2014
NUKIYAMA MEMORIAL AWARD

Presented to

GANG CHEN

at the 15th International Heat Transfer Conference

August 14, 2014

by the Heat Transfer Society of Japan

Gang Chen

Dr. Gang Chen was born on June 20, 1964. He is the Carl Richard Soderberg Professor of Power Engineering and Head of the Department of Mechanical Engineering at Massachusetts Institute of Technology (MIT). He received his B.S. and M.S. degrees from Huazhong University of Science and Technology (HUST), China, in 1984 and 1987, respectively. He obtained his Ph.D. degree from Mechanical Engineering Department, UC Berkeley, in 1993 under the supervision of the Chancellor Chang-Lin Tien. He was an assistant professor at Duke University (1993-1997) and then a tenured associate professor at UC Los Angeles (1997-2001) before moving to MIT in 2001. He was the first holder of the Warren and Towneley Rohsenow Professorship at MIT (2006-2009).

Dr. Chen's research interests center on nanoscale transport and energy conversion phenomena, and their applications in energy storage and conversion, and thermal management. He has made seminal contributions to the understanding of reduced thermal conductivity in nanostructures structures such as quantum wells and superlattices via both modeling and experimental studies. He and his collaborators exploited the unique nanoscale heat conduction physics to advance the field of thermoelectric materials and their applications in solar thermal and waste heat recovery. His group also developed strategies to engineer nanostructures to achieve high thermal conductivities, including the development and demonstration that polymer nanofibers can be more thermally conductive than most metals, and additives to liquids which significantly improve their thermal conductivity. In addition to nanoscale heat conduction and nanostructured thermoelectrics, Dr. Chen's group also advanced the field of thermal radiation, including developing a method to measure radiation heat transfer between two surfaces down to nanometer separations and experimental demonstration that radiative

heat transfer at such small spacings can exceed the prediction of the Planck blackbody radiation law by three orders of magnitude, and photon trapping in solar photovoltaic cells. By exploring micro/nanoscale transport phenomena, Dr. Chen's group is advancing a wide range of technologies such as thermoelectric cooling and power generation, solar thermal and solar photovoltaics, desalination, and thermal interface materials.

Dr. Chen authored a book entitled "Nanoscale Energy Transfer and Conversion: a parallel treatment of electrons, molecules, phonons, and photons" ---the first textbook in the field. He has published more than 282 technical articles, 22 book chapters, and 380 invited talks. Dr. Chen has supervised over 50 M.S. and Ph.D. students, and worked with over 60 post-docs and visiting scholars. He has over 40 granted and pending patents, and cofounded two companies.

Dr. Chen chaired the advisory board of the ASME Nanotechnology Institute from 2005-2008. He has served on the editorial/advisory board of nine journals. He is currently the director of "Solid-State Solar-Thermal Energy Conversion Center (S3TEC)" funded by the US Department of Energy. He received the NSF Young Investigator Award, the R&D 100 award, the ASME Heat Transfer Memorial Award, and the ASME Heat Transfer Division 75th Anniversary Medal. In 2010, he was elected a member of the US National Academy of Engineering.

The Nukiyama Memorial Award

The Nukiyama Memorial Award has been established in 2011 by the Heat Transfer Society of Japan to commemorate outstanding contributions by Shiro Nukiyama as an excellent heat transfer scientist. Nukiyama addressed the challenges of the boiling phenomena and published a pioneering paper which clarified these phenomena in the form of the Nukiyama curve (boiling curve). This epoch-making work was done in 1930s, when heat transfer research was in an early stage and Nukiyama himself was young, under forty years old. The Nukiyama Memorial Award shall be bestowed to a scientist under/about fifty years of age, once every two years in the field of Thermal Science and Engineering.

Previous Recipient

2012 Peter Stephan

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Shiro Nukiyama 抜山 四郎 (1896−1983)

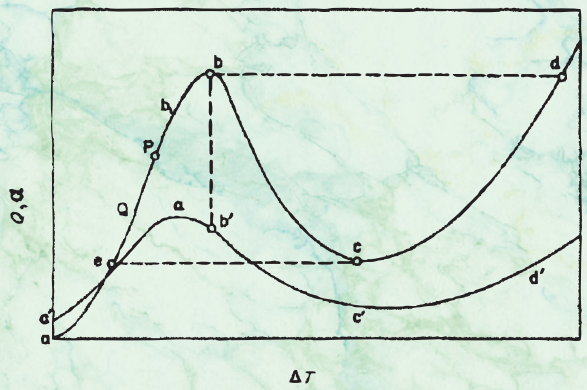
Shiro Nukiyama was born in 1896 in Tokyo, Japan. He graduated from Tokyo Imperial University, and immediately started his professional career as a Lecturer of Tohoku Imperial University (currently Tohoku University). He was appointed Associate Professor in 1921. He visited England, Germany, Switzerland and the United States in 1922~24. He was appointed Professor in 1926. In subsequent years he actively conducted boiling heat transfer research.

In 1934, Nukiyama published a pioneering paper*) which was entitled “The Maximum and Minimum Values of the Heat Q Transmitted from Metal to Boiling Water under Atmospheric Pressure.” This paper clarified and provided an overview of the boiling phenomena in the form of the Nukiyama Curve (boiling curve).

In this work, Nukiyama made an excellent experiment using a metallic wire or a metal wire), in which temperature and heat flux are evaluated accurately, and found that the relation between degree of superheating and heat flux is not monotonous, and that a maximum heat flux points appears in the nucleate boiling region and a minimum heat flux point appears in the film boiling region. He also found the hysteresis behavior that occurs in the transition region between the nucleate boiling and film boiling. Furthermore, he suggested that the boiling curve can be drawn even in the transition region if the state of the boiling water can be changed quasi-statically.

This was an epoch-making work which clarified the physics of boiling phenomena first. It has been highly appreciated in the international academic world of heat transfer. Also, it has become a guideline to heat transfer engineering for the design and control of combustion boilers and/or steam generators, and as such it has laid the foundation of modern energy technology. The Nukiyama Curve appears in every textbook of heat transfer today. Nukiyama is a great person in the international academic world of heat transfer.

In 1956 Nukiyama retired from Tohoku University, and was granted the title of Professor Emeritus. He served as the President of the Heat Transfer Society of Japan in 1963~64. He received the Max Jacob Memorial Award in 1968. In 1983, he passed away in Sendai, Japan.



*) : *Journal of the Japan Society of Mechanical Engineers*, vol. 37, no. 206, pp. 367-374, June 1934. The English translation was published twice in *International Journal of Heat and Mass Transfer*, in vol. 9, pp. 1419-1433, 1966 and in vol. 27, pp. 959-970, 1984.