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THE 2016
NUKIYAMA MEMORIAL AWARD

Presented to

MAMORU TANAHASHI

at the Fourth International Forum on Heat Transfer

November 3, 2016

by the Heat Transfer Society of Japan



Mamoru Tanahashi

Dr. Mamoru Tanahashi was born on November 1, 1966. He is professor of Department of Mechanical Engineering at Tokyo Institute of Technology (Tokyo Tech). He obtained his B.E. degree in 1990, M.E. degree in 1992 and Dr. Eng. degree in 1996 all from Tokyo Tech. He was research associate (1992-2000) and associate professor (2000-2012) at Tokyo Tech. He was appointed as full professor of Department of Mechanical and Aerospace Engineering at Tokyo Tech in 2012. Currently, he is serving as a deputy director of Academy for Co-creative Education of Environment and Energy Science from 2011 and a chair of Department of Mechanical and Aerospace Engineering from 2014 at Tokyo Tech.

Dr. Tanahashi's research interests include heat and mass transfer, fluid dynamics and combustion science. He has discovered universal fine scale structure of turbulence from the detailed analysis of direct numerical simulation (DNS) of various turbulent flows. Dr. Tanahashi extended his research to many turbulence-related phenomena such as turbulent heat & mass transfer, drag reduction, acoustics and so on. Based on the universal fine scale structure, he has investigated drag reduction mechanism and showed that all of drag reduction mechanism can be explained by considering the time scale of the universal fine scale structure near the wall. This idea has been applied for drag reduction by surfactant or micro-fiber addition and heat transfer enhancement of the drag-reducing flow, which are filed as several patents and licensed to a big gas company. To validate the existence of the universal fine scale structure of turbulence, he has developed high-resolution and high-speed particle image velocimetry which filed as Japanese patents and also licensed to a big trading company contributing to R&D in many industries and universities. In turbulent combustion research, Dr. Tanahashi conducted the world's first three-dimensional DNS of turbulent combustion with a detailed kinetic mechanism. From the detailed analysis of DNS results, he have shown

local and global flame structures in turbulence and proposed a new sub-grid scale combustion model. His research group has developed combined and high speed laser diagnostics such as simultaneous measurement of several radical concentrations and all velocity & velocity gradient components, to investigate fine scale structure of turbulent combustion and validate DNS results.

Dr. Tanahashi has published more than 110 refereed journal papers, more than 200 international conference papers, more than 24 review papers and 7 books. His invited or keynote lectures are more than 30 and he has won 15 awards from different institutions including Paper Award of Japan Society of Mechanical Engineers (JSME), Paper Award of Combustion Society of Japan (CSJ) and the Young Scientists' Prize, the commendation for science and technology by the Minister of Education, Culture, Sports, Science and Technology, Japan.

Dr. Tanahashi is fellow of Japan Society of Fluid Mechanics (JSFM) and JSME, board member of CSJ and JSFM (2014-2015), member of scientific council of Asian Union of Thermal Science and Engineering, member of steering committee of Japan Association of Computational Mechanics, member of editorial board of Flow, Turbulence and Combustion, chief editor of Journal of JSFM and member of organizing, advisory and executive committee of many international conferences.

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.

Past Recipients

2012 Peter Stephan

2014 Gang Chen

Board of the 2016 Nukiyama Memorial Award

H. Yoshida (Chairperson)

P. Stephan

K. Okazaki (Vice Chairperson)

T. W. Simon

J. S. Lee

X. Zhang

S. Maruyama

Shiro Nukiyama 抜山 四郎 (1896–1983)

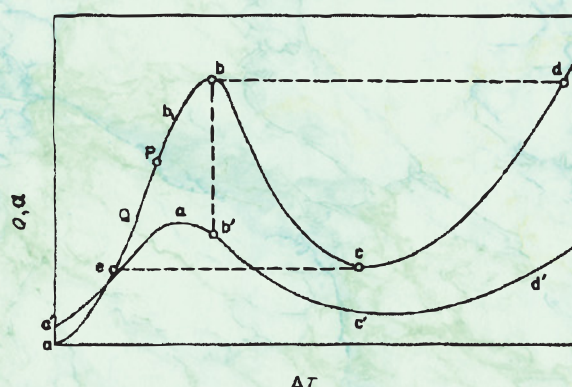
Shiro Nukiyama was born in 1896 in Tokyo, Japan. He graduated from Tokyo Imperial University, and immediately started his professional career as a Lecturer of Tohoku Imperial University (currently Tohoku University). He was appointed Associate Professor in 1921. He visited England, Germany, Switzerland 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.