



THE 2024
NUKIYAMA MEMORIAL AWARD

Presented to

ZUANKAI WANG

at the Third Asian Conference on Thermal Sciences

June 24, 2024

by the Heat Transfer Society of Japan



Zuankai Wang

Dr. Zuankai Wang was born in 1976 in China. He received his B.S. degree from Jilin University in 2000, M.S. degree from the Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, in 2003, and Ph.D. degree from Rensselaer Polytechnic Institute in 2008. After a one-year postdoctoral training at Columbia University, he joined the City University of Hong Kong as Assistant Professor in 2009 and was promoted to Chair Professor in 2021. Currently, he is Chair Professor in the Department of Mechanical Engineering at The Hong Kong Polytechnic University and concurrently serves as Associate Vice President (Research & Innovation) of the university.

Dr. Wang has made seminal contributions to the fundamental understanding of interfacial and transport phenomena that underpin various thermal processes and translating the insights towards the development of nature-inspired structured surfaces to improve the efficiency of heat transfer and energy conversion. Dr. Wang has demonstrated that the rational control of surface wettability and/or topography can fundamentally shape fluid-structure interaction, effectively harnessing the latent heat of water and dramatically improving heat transfer performances of dropwise condensation and boiling/evaporation processes. His innovation, the Structured Thermal Armor (STA), ingeniously combining insulation, conduction, and hydrodynamics, enables efficient liquid cooling even at extreme temperatures above 1150°C and shatters the limits of the Leidenfrost effect, a 266-year-old puzzle in thermal cooling. In addition to active cooling, he developed biomimetic porous ceramic featuring a near-perfect solar reflection of 99.6% that achieves continuous passive radiative cooling. He also invented the Droplet-based Electricity Generator that allows for efficient water energy harvesting.

Dr. Wang has published over 270 papers in international journals and gained more than 20000 citations. He is a Highly Cited Researcher (Cross-field) recognized by Clarivate (2022 and 2023). He has received many awards including the Falling Walls Science Breakthroughs of The Year 2023 (Engineering and Technology), BOCHK Science and Technology Innovation Prize (2022), Green Tech Award (2021), Xplorer Prize (2020), Hall of Fame (Advanced Engineering Materials, 2019), 35th World Cultural Council Special Recognition Award (2018), Outstanding Youth Award by the International Society of Bionic Engineering (2016), Materials Research Society Graduate Student Awards (2007).

Dr. Wang is a member of the Hong Kong Academy of Engineering Sciences and Hong Kong Young Academy of Sciences, a fellow of the International Society of Bionic Engineering and the Royal Society of Chemistry. He is currently the Executive Editor-in-Chief of Droplet journal (Wiley), and Associate Editor and Advisory Board Member for ten journals (Langmuir, Advanced Engineering Materials, iScience, Journal of Bionic Engineering, and others).

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
2016 Mamoru Tanahashi
2018 Ruzhu Wang
2020 Ronggui Yang
2022 Junichiro Shiomi

Board of the 2022 Nukiyama Memorial Award

K. Suga (Chairperson)	G. Chen
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C. Colin	C. Y. Zhao
M. Tanahashi	

Shiro Nukiyama 拔山 四郎 (1896–1983)

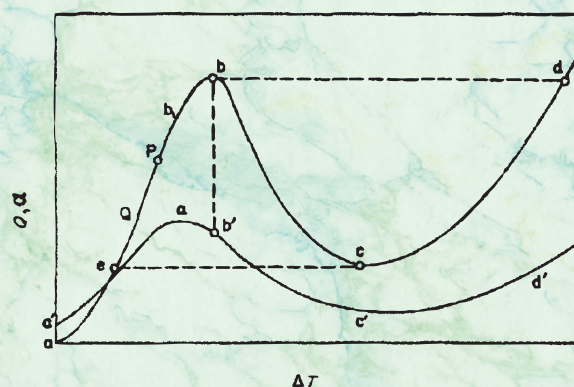
Shiro Nukiyama was born in 1896 in Tokyo, Japan. He graduated from Tokyo Imperial University, and immediately started his professional career as a Lecturer of Tohoku Imperial University (currently Tohoku University). He was appointed Associate Professor in 1921. He visited England, Germany, Switzerland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