Micro-Nanoscale Observation Techniques of Liquid-Gas Interface for Phase Change Heat Transfer

Koji Takahashi
International Institute for Carbon-Neutral Energy research (I2CNER), Kyushu University,
Department of Aeronautics and Astronautics, Kyushu University,
Fukuoka, Japan

Phase change heat transfer is a promising method to save the sky-rocketing cooling energy of data-centers. In addition, recent studies have demonstrated that nano-structured surfaces dramatically enhance the heat transfer performance. However, its understanding is not yet satisfying mainly because the development of experimental technique for observing the liquid-gas interface in micro-nanoscale is still on the way. In this talk, I will provide some new results obtained on tiny droplets and bubbles in micro and nanoscale using optical, atomic force and electron microscopies. For example, an optically-unobservable liquid film on solid surface plays an important role for droplet migration. A newest mode of AFM is applied to elucidate the mechanism of very tiny gas phases on solid surface, consisting of absorbed gas molecules, micropancakes, and nanobubbles. TEM is useful to explore the dynamic motion of liquid-gas interface in nanoscale and can give new insights to the nucleation and growth mechanism of vapor bubble. I believe these understanding is vital for us to design reliable cooling systems for big data in carbon neutral society.