PURDUE UNIVERSITY | School of Nuclear Engineering

Nuclear Engineering Seminar

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Boiling heterogeneous nucleation from the kitchen to nuclear reactors with experiments and simulation

Abstract

Even though the needs of the energy industry increase and we are so familiar with boiling phenomena, predicting exact boiling points is under discussion. Previous experiments observed bubble nucleation even at low superheat on ideally-smooth horizontal heated surfaces. These are contrary to the previous heterogeneous nucleation predictions, so to clarify this difference and the experimental results not explained by previous nucleation theories we adapt a new model based the thermal boundary layer. The model includes the kinetic dynamics of the superheated liquid and the thermodynamics stability of the generated vapors. Consequently, the incipient bubble nucleation on the ideally-smooth horizontal surface, with different wettability even at low superheats, is described and the prediction match the experiments fairly well. With a consideration of nucleation phenomena in boiling, in the presentation, the modeling and simulation efforts conducted in my research group will be introduced, e.g., using lattice Boltzmann method. And, the preliminary results simulating boiling phenomena in microgravity will be presented.

Dr. HangJin Jo, Ph.D. is an Associate Professor at Pohang University of Science and Technology in the Department of Mechanical Engineering & Division of Advanced Nuclear Engineering. He received his Ph.D., MS and BS from POSTECH.

Dr. Jo's research interests include Advanced modeling and simulation through science-based predictive for engineering applications, Thermal-hydraulic phenomena including two-phase flow and supercritical flow, Fusion system design and divertor cooling channel, Reactor thermal hydraulics including advanced reactor systems e.g., Fusion reactors, SFR, HTR, MSR, and Micro reactors.