Mechanical Engineering Department Seminar

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1130 Mechanical Engineering
111 Church Street SE, Minneapolis, MN 55455

Pool and Flow Boiling Heat Transfer in Variable Gravity Environments

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Knowledge of how gravity affects two-phase heat transfer is critical to the design of equipment (e.g., heat exchangers and nuclear reactors) that will be operated in variable gravity environments (high-g, low-g, lunar, and Martian-g). Relatively little is known about boiling mechanisms in these environments since data from long duration microgravity environments are limited due to high cost and limited flight opportunities. Although a few studies have been performed under high quality microgravity environments on board orbital platforms, most low gravity boiling research has been obtained using drop towers, aircraft, and sounding rockets. The relatively large g-jitter and/or the short periods of microgravity duration of these studies has resulted in confusion about the heat transfer mechanisms. The results of a recent International Space Station experiment the clarifies gravity effects on pool boiling mechanisms will be presented along with a model that can be used to scale boiling data. Recent investigations into flow boiling using temperature sensitive paints will also be discussed.

Bio: Jungho Kim is a Professor in the Department of Mechanical Engineering where he performs research and teaches courses in a broad range of thermal sciences areas. He developed the microheater array technique under NASA sponsorship to measure time and space resolved heat transfer rates during boiling, spray cooling, and within microchannels. He is developing other techniques to measure the heat transfer distribution within complex geometries using IR thermography and temperature sensitive paints. Other research includes the measurement of absorbance coefficient of reactants at high temperatures, and the development of fast response heat flux gages. He has received funding from NASA, NSA, NIST, Parker Hannefin, ONR, NSF, Northrup Grumman, WPAFB, ATEC, and Earth Networks. He is active in ASME, having served as Chair of the K-13 committee on Multiphase Heat Transfer. He has won numerous awards for teaching and instrumentation design, and is the holder of three patents.