Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Dropwise Condensation on a Radial Gradient Surface[1] ASHLEY MACNER, SUSAN DANIEL, PAUL STEEN, Cornell University — In transient dropwise condensation from steam onto a cool surface, distributions of drops evolve by nucleation, growth, and coalescence. This study examines how surface functionalization affects drop growth and coalescence. Surfaces are treated by silanization to deliver either a spatially uniform contact-angle (hydrophilic, neutral, and hydrophobic) or a radial gradient of contact-angles. The time evolution of number-density and associated drop-size distributions are reported. For a typical condensation experiment on a uniform angle surface, the number-density curves show two regimes: an initial increase in number-density as a result of nucleation and a subsequent decrease in number-density as a result of larger scale coalescence events. Without a removal mechanism, the fractional coverage, regardless of treatment, approaches unity. For the same angle-surface, the associated drop-size distributions progress through four different shapes along the growth curve. In contrast, for a radial gradient surface where removal by sweeping occurs, the number-density increases and then levels off to a value close to the maximum number-density that is well below unity coverage and only two shapes of distributions are observed. Implications for heat transfer will be discussed.

[1]This work was supported by a NASA Office of the Chief Technologist's Space Technology Research Fellowship.

Ashley Macner
Cornell University

Date submitted: 02 Aug 2013 Electronic form version 1.4