Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Ultrasound Measurement of Dynamic Film Thickness in Condensing and Evaporating Films[1] JERAMY KIMBALL, MICHAEL BAILEY, JAMES HERMANSON, University of Washington, JEFFREY ALLEN, Michigan Technological University — The stability and heat transfer characteristics of a cyclically condensing and evaporating n-pentane film were studied experimentally. The films were on a flat, horizontal, downward-facing copper plate. Film thickness was determined by an ultrasound technique capable of measuring film thicknesses as low as 15 microns. Surface heat flux was determined from the time rate of change of the film thickness. Spatially averaged heat flux was also measured using an embedded heat flux sensor and surface conditions inferred by a computational inverse method. The film was imaged using a double-pass shadowgraph system. Film thickness and heat flux appear to increase most rapidly during the initial formation of a thin film of condensate, as well as at the appearance of the Rayleigh–Taylor instability and pendant drop formation during a pressure ramp-up. Hysteresis was observed in the film thickness and heat flux over each pressure variation cycle, with different behavior apparent during condensation than during evaporation.

[1]Work supported by NASA Cooperative Agreement NNC04GA76G

Jeramy Kimball
University of Washington

Date submitted: 03 Aug 2007 Electronic form version 1.4