Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Experimental Investigation of the Effects of Surface Conditions on Natural Convection-Driven Evaporation[1] S.M. BOWER, J.R. SAYLOR, Clemson University, Dept. Mechanical Engineering — Presented are the results from an experimental investigation of the effects of surface conditions at an air/water interface on transport phenomena within the context of natural convection-driven evaporation. Experiments were conducted using tanks of heated water under several different surface conditions: 1) contamination with an oleyl alcohol monolayer, 2) contamination with a stearic acid monolayer, and 3) "clean" or surfactant-free. These surface conditions create the following hydrodynamic boundary conditions: 1) constant elasticity, 2) no-slip, and 3) shear-free. The effect of these boundary conditions on evaporation and air-side natural convection heat transfer is presented via the power law relationships between the Sherwood and Rayleigh numbers (for evaporation) and the Nusselt and Rayleigh numbers (for natural convection heat transfer). Additionally, infrared imagery of the water surface was collected during these experiments, yielding qualitative information on the effect of these boundary conditions on the flow near the interface. Few studies exist in which the effects of surface conditions on interfacial heat and mass transfer are investigated, making this work particularly relevant.

[1]Support from the National Science Foundation is gratefully acknowledged.

S. M. Bower
Clemson University, Dept. Mechanical Engineering

Date submitted: 07 Aug 2009 Electronic form version 1.4