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Convective Structure and Heat Transfer of Liquid Films Evaporating into a Pure Vapor Environment[1] J.T. KIMBALL, J.C. HERMANSON, University of Washington, J.S. ALLEN, Michigan Technological University — The stability, convective structure and heat transfer of upward facing, evaporating, thin liquid films were studied experimentally. Dichloromethane, n-pentane, and methanol films initially 5 mm to 50 μm thick were subjected to constant or impulsive superheat levels. The films resided on a temperature controlled, gold-plated copper plate in a closed, degassed test chamber. The dynamic film thickness was measured at multiple discrete points using ultrasound and instability wavelength and convective structure information was obtained by schlieren imaging. For films below the transition Rayleigh number there is little convective heat transfer present within the film. In films above this transition, the Nusselt number increases with increasing Rayleigh number. The transition in the heat flux occurs over a wide range of Marangoni numbers. Transient experiments reveal an initial rise in heat flux due to evaporation, followed by a decrease and then increase at the onset of convective motion.

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J.T. Kimball
University of Washington

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