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Heat transfer and convective structure of evaporating films under pressure-modulated conditions[1] JUAN CARLOS GONZALEZ-PONS[2], JAMES HERMANSON, University of Washington, JEFFREY ALLEN, Michigan Technological University — The interfacial stability, convective structure, and evaporation rate of upward-facing, thin liquid films were studied experimentally. Dichloromethane films approximately 2 mm thick were subjected to impulsive, time-varying superheating. The films resided on a temperature controlled, copper surface in a closed, initially degassed test chamber. Superheating was achieved by modulating the pressure of the saturated pure vapor in the test chamber. The dynamic film thickness was measured at multiple points using ultrasound, and the convective structure information was visualized by schlieren imaging. Two distinct raises in heat transfer rate under unsteady conditions were observed. The first transition appears to be associated with conduction within the film only; the second, to a change in the pattern of convection within the film. Different pressure-modulation cycles were studied to capture one or both of the observed rises in heat transfer. The total film thickness change over multiple cycles, as indicated by ultrasound, allowed determination of the total heat rejected into the evaporating films. Results suggest that there are cycle combinations that lead to an elevation in the average rate of heat transfer compared to films undergoing quasi-steady evaporation.

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