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Interfacial Dynamics of Condensing Vapor Bubbles in an Ultrasonic Acoustic Field THOMAS BOZIUK, MARC SMITH, ARI GLEZER, Georgia Institute of Technology — Enhancement of vapor condensation in quiescent subcooled liquid using ultrasonic actuation is investigated experimentally. The vapor bubbles are formed by direct injection from a pressurized steam reservoir through nozzles of varying characteristic diameters, and are advected within an acoustic field of programmable intensity. While kHz-range acoustic actuation typically couples to capillary instability of the vapor-liquid interface, ultrasonic (MHz-range) actuation leads to the formation of a liquid spout that penetrates into the vapor bubble and significantly increases its surface area and therefore condensation rate. Focusing of the ultrasonic beam along the spout leads to ejection of small-scale droplets from that are propelled towards the vapor liquid interface and result in localized acceleration of the condensation. High-speed video of Schlieren images is used to investigate the effects of the ultrasonic actuation on the thermal boundary layer on the liquid side of the vapor-liquid interface and its effect on the condensation rate, and the liquid motion during condensation is investigated using high-magnification PIV measurements. High-speed image processing is used to assess the effect of the actuation on the dynamics and temporal variation in characteristic scale (and condensation rate) of the vapor bubbles.

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