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A boiling heat transfer surface for creating a single stream of vapor bubbles.[1] ZACHARY W. DOUGLAS, MARC K. SMITH, ARI GLEZER, Woodruff School of Mechanical Engineering, Georgia Institute of Technology — The high heat transfer rate characteristic of boiling is limited by the vapor-bubble removal rate and a critical transition to film boiling. External forces, such as acoustic waves, can be used to enhance vapor-bubble removal and improve heat transfer. In order to explore such enhanced vapor-bubble removal processes, a boiling heat transfer surface has been designed to control the location, growth, and detachment of a single stream of vapor bubbles. The device consists of an insulating annulus surrounding a thermally conductive pin 1 mm in radius. The upper surfaces of the annulus and the pin have a thin polished electro-plated copper coating. When heated from below, the pin provides a thermal conduit that creates a local hot spot on the copper surface. The majority of all bubble nucleations occur within 3 mm of the center of the pin. A thin hydrophobic coating centered on the hot spot encourages the formation of a single vapor bubble that grows to a size determined by the radius of the hydrophobic coating. When the bubble detaches from the surface, a new vapor bubble forms in the same location. High-speed video and bubble-size and thermal measurements will be presented to document the characteristics and performance of this heat transfer surface.

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