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Effect of surface micro-texture on bubble dynamics and boiling critical heat flux[1] NAVDEEP DHILLON, JACOPO BUONGIORNO, KRIPA VARANASI, Massachusetts Inst of Tech-MIT — We present results of an experimental study on the effect of surface texture on the dynamics of bubble growth and departure in pool boiling of water and correlate them to the measured values of critical heat flux (CHF) on these surfaces. Although it is well known that surface roughness or micro-texture has a significant impact on macroscale boiling parameters such as boiling heat transfer coefficient (HTC) and CHF, the physics underlying these processes is not well understood. Using high speed optical and infrared (IR) imaging, we explored the mechanism of single bubble growth and departure on micro-textured surfaces fabricated using photolithography techniques. Interestingly, we observed that the introduction of the micro-texture not only completely changed bubble dynamics and boiling surface thermal characteristics but there was a clear correlation between the micro-texture parameters and the salient bubble characteristics such as the departure diameter and frequency. To explain these results, we propose a physical model based on micro-texture-induced surface microflows supplementing the conventional bubble growth and departure theory based on buoyancy and capillary pinning forces, and verify it using CHF measurements.

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Navdeep Dhillon
Massachusetts Inst of Tech-MIT

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