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Asymmetric Wettability Directs Leidenfrost Droplets[1] REBECCA AGAPOV, JONATHAN BOREYKO, DAYRL BRIGGS, BERNADETA SRIJANTO, SCOTT RETTERER, C. PATRICK COLLIER, NICKOLAY LAVRIK, Center for Nanophase Materials Sciences, Oak Ridge National Lab — Exploration of Leidenfrost droplets on nano- and microstructured surfaces are of great importance for increasing control over heat transfer in high power density systems using boiling phenomena. They also provide an elegant way to direct droplet motion in a variety of emerging fluidic systems. Here, we report the fabrication and characterization of tilted nanopillar arrays (TNPAs) that exhibit directional Leidenfrost water droplets under dynamic conditions. The batch fabrication of the TNPAs was achieved by glancing-angle anisotropic reactive ion etching of a thermally dewet platinum mask. In contrast to previously implemented macro- and microscopic Leidenfrost ratchets, our TNPAs induce *no* preferential directional movement of Leidenfrost droplets under conditions approaching steady-state film boiling. This suggests that the observed droplet directionality is not a result of asymmetric vapor flow. Phase diagrams were constructed for the boiling behavior upon droplet impact onto TNPAs, straight nanopillar arrays, and smooth silicon surfaces. Asymmetric wettability and directional trajectory of droplets was exclusive to the TNPAs for impacts corresponding to the transition boiling regime, revealing this to be the mechanism for the droplet directionality.

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Rebecca Agapov
Center for Nanophase Materials Sciences, Oak Ridge National Lab

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