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Leidenfrost Vapor Layer Stabilization on Superhydrophobic Surfaces IVAN VAKARELSKI, King Abdullah University of Science and Technology, NEELESH PATANKAR, Northwestern University, JEREMY MARSTON, King Abdullah University of Science and Technology, DEREK CHAN, University of Melbourne, SIGURDUR THORODDSEN, King Abdullah University of Science and Technology — We have performed experiments to investigate the influence of the wettability of a superheated metallic sphere on the stability of a thin vapor layer during the cooling of a sphere immersed in water. For high enough sphere temperatures, a continuous vapor layer (Leidenfrost regime) is observed on the surface of non-superhydrophobic spheres, but below a critical sphere temperature the layer becomes unstable and explosively switches to nuclear boiling regime. In contrast, when the sphere surface is textured and superhydrophobic, the vapor layer is stable and gradually relaxes to the sphere surface until the complete cooling of the sphere, thus avoiding the nuclear boiling transition altogether. This finding could help in the development of heat exchange devices and of vapor layer based drag reducing technologies.

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