Abstract Submitted
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Self-Propelled Jumping Drops on Leidenfrost Surfaces: Experiments and Simulations FANGJIE LIU, Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC 27708, GIOVANNI GHIGLIOTTI, JAMES J. FENG[1], Department of Mathematics, University of British Columbia, Vancouver, BC, Canada V6T 1Z2, CHUAN-HUA CHEN, Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC 27708 — Coalescing drops spontaneously jump on a variety of biological and synthetic superhydrophobic surfaces, with potential applications in self-cleaning materials and self-sustained condensers. To investigate the mechanism of the self-propelled jumping drops, a Leidenfrost collider was constructed on which drops floating on a vapor layer were guided to merge and subsequently jump on a heated substrate. Above a threshold drop diameter, we experimentally observed a constant energy conversion efficiency, which is the ratio of the kinetic energy of the merged drop to the surface energy released upon coalescence. This trend matched with prior reports of jumping condensate drops on a superhydrophobic surface. The capillary-inertial scaling of the jumping process was confirmed with a phase-field simulation of two equally-sized spherical drops coalescing on a flat surface with a contact angle of 180°. The numerical simulation revealed the role of viscous dissipation, leading to reduced energy conversion efficiency when the Ohnesorge number based on the drop diameter approaches unity.

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