Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

When does a viscous drop stop bouncing?[1] VATSAL SANJAY, PIERRE CHANTELOT, DETLEF LOHSE, University of Twente — Processes involving liquid drop impact on solid substrates abound in nature. For example, drops bouncing-off a repellent (superamphiphobic) substrate. As the drop spreads, its initial kinetic energy is transformed into surface energy. The recoiling stage follows spreading after the liquid has reached its maximal extent, where surface energy is transferred back into kinetic energy. A part of the system's initial kinetic energy is lost throughout the process because of the viscous dissipation: Inside the drop, in the air boundary layer around the drop, and in the thin air layer between the drop and the substrate.
Recently, [Jha et al. 2020, DOI: 10.1039/d0sm00955e] showed that drops with viscosity as high as 200 times that of water could bounce-off from repellent surfaces. Here, we delineate this bouncing to no-bouncing transition in the Weber (inertia vs. surface tension) - Ohnesorge (viscosity vs. surface tension) numbers regime map. We also show that the liquid drops' viscous dissipation is as vital as other dissipation modes. As the Ohnesorge number increases, this dissipation dominates and controls the transition mentioned above. The present work provides information on the physics of the bouncing of viscous drops and closure about viscous dissipation's modes and location.

[1]We acknowledge the ERC Advanced Grant no. 740479-DDD

Vatsal Sanjay
University of Twente

Date submitted: 10 Aug 2020 Electronic form version 1.4