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Modeling Oblique Impact Dynamics of Particle-Laden Nanodroplets XIN YONG, SHIYI QIN, State University of New York at Binghamton — A fundamental understanding of the impact dynamics of nanoscopic droplets laden with nanoparticles has important implications for materials printing and thin film processing. Using many-body dissipative particle dynamics (MDPD), we model nanometer sized suspension droplets imping on dry solid substrate with oblique angles, and compare their behavior with pure liquid droplets. Equilibrated floating droplets containing two types of nanoparticles, namely fully-wetted hydrophilic particles and surface-active Janus particles, impact onto the solid surface with varying initial velocities and impact angles. The velocity components in the normal and tangential directions to the substrate defines normal and tangential Reynolds and Weber numbers, which are used to classify impact regimes. Droplets with nanoparticles dispersed in the bulk and covering the droplet surface (resembling liquid marbles) exhibit quite different behavior in the course of impact. We also reveal the influences of substrate wettability and its interaction with nanoparticles on the impact dynamics. In addition, the vapor film beneath an impinging droplet shows no significant effect on the impact dynamics in our MDPD simulations.

Xin Yong
State University of New York at Binghamton

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