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Simulation of splashing of micro-scale droplets on a dry surface

ARNOUT BOELENS, ANDRZEJ LATKA, MICHELLE DRISCOLL, IRMGARD BISCHOFBERGER, CACEY STEVENS, SIDNEY NAGEL, JUAN DE PABLO, University of Chicago — Results are presented for the simulation of micro-scale droplets splashing on a dry surface. The simulations are performed using a Volume Of Fluid approach and a Finite Volume technique. The contact line is described using a fixed microscopic contact angle. Both the gas phase and the liquid phase are assumed to be incompressible, and represent a two-phase system of ethanol in air. As the droplet approaches the wall, it changes shape and forms a dome over a thin gas layer between the droplet and the wall. As the gas gets squeezed out from under the droplet, it reaches velocities of up to 300 km/h, and there is a very large pressure spike at the edge of the droplet. The formation of a thin sheet of liquid is observed upon impact, which thickens near the edge of the sheet to reduce curvature. As the sheet begins to spread apparent contact angles are observed to approach 180 degrees. When lowering the gas pressure in the system, a higher gas velocity and relative pressure are observed on impact, and again a thin sheet forms. However, at low pressure the thin sheet stays closer to the wall. These observations are shown to be consistent with experimental measurements.

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