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Optimal Splashing

Edwin Poorte[(1)], Yngve Belsvik[(2)]

(1) *Shell Technology Norway, Oslo, Norway*
(2) *NTNU, Trondheim, Norway*

Keywords: drops, instability, atomization, experiment, passive flow control, scaling theory Abstract: The splashing process that occurs when a droplet impacts on a solid surface with sufficient speed was studied. The objective was to determine the conditions at which the splashing is optimal, i.e. as a means of atomizing the primary drop into many small secondary drops. The splashing process was studied experimentally by a liquid jet impinging on a rotating disk. Atomization efficiency and secondary droplet size distribution were measured using a photographic method. Measurements were analyzed in a dimensionless form suggested by scaling theory. It was found that secondary droplet size distribution and atomization efficiency could be described as a family of curves that depend on only two dimensionless groups. The analysis demonstrated that viscous-, inertia- and surface tension forces are important, as well as details of the topography of the solid surface. It is demonstrated at which conditions more than 75% of the primary drop can be atomized in many, very small, secondary droplets.

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