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Thin water film rise on a rough surface of a vertical plate in water entry[1] NAYOUNG KIM, HYUNGMIN PARK, Seoul National University — A three-phase contact line is formed as a liquid film moves over the solid surface, and the maximum velocity at which the film does not separate from the surface is affected by several liquid properties, such as viscosity, density and surface tension. In addition, it has been shown that surface roughness can also encourage the early separation of a liquid film, but the detailed mechanism still remains unclear. In this study, we investigate the effect of surface roughness on the contact line rise on a falling the acrylic plate (70×150 mm^2) into the water tank vertically, using high-speed imaging. The thin liquid film is emitted while the plate passes through the free surface, and initial speed of the film can reach up to $\boldsymbol{O}(10)$ m/s. We roughened the plate surface with an array of spanwise grooves (width and depth of 400 μm, spacing of 800 μm) and also considered smooth surface as a reference. The motion of liquid film on the rough surface is slower than that of the smooth surface, and the difference increases with increasing impact velocity of the plate. We also vary the wettability (hydrophilic, intermediate and hydrophobic) of the surface and discuss the dynamics of liquid film moving over rough surfaces.

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