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Experimental and numerical study of wetting liquids rising up on the outer surface of a nozzle in the dripping regime ERFAN SEDIGHI, ABOLFAZL SADEGHPOUR, Department of Mechanical and Aerospace Engineering, University of California, Los Angeles, HANGJIE JI, CLAUDIA FALCON, Department of Mathematics, University of California, Los Angeles, Y. SUNGTAEK JU, Department of Mechanical and Aerospace Engineering, University of California, Los Angeles, ANDREA BERTOZZI, Department of Mathematics, University of California, Los Angeles — Well-wetting liquids exiting small-diameter nozzles in the dripping regime rise up along the outer nozzle surfaces. This is problematic for certain fuel injectors and direct contact heat and mass exchangers that incorporate a dense array of nozzles to distribute liquids. Such flows along nozzle outer surfaces are governed by the interplay of surface tension, non-uniform pressure within a pendant drop, gravity, and viscous forces. We experimentally and numerically (by solving the full Navier-Stokes equations) study these flows for nozzle outer diameters ranging from 0.7 to 3.2 mm, mass flow rates ranging from 0.0002 to 0.035 grams/second (g/s), and liquid viscosities ranging from 4.6 to 970 mPa.s. The apparent height of a liquid meniscus on the nozzle surface was determined by analyzing video images. We also develop an approximate analytic model to capture the dynamics of meniscus rising. Our results show that, for a single nozzle, while the mass flowrate is relatively low, the rate of initial rise decreases with further decreasing the mass flow rate. On the other hand, for flow rates higher than 0.006 g/s and viscosities less than 100 mPa.s, the rate of initial rise is almost constant.

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