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Droplets in microchannels: dynamical properties of the lubrication film AXEL HUERRE, MMN, UMR CNRS 7083, ESPCI ParisTech, 75005 Paris, France, OLIVIER THEODOLY, LAI, INSERM U600, CNRS UMR 6212, Case 937, 13009 Marseille, France, ALEXANDER LESHANSKY, Department of Chemical Engineering, Technion-IIT, Haifa, 32000, Israel, MARIE-PIERRE VALIGNAT, LAI, INSERM U600, CNRS UMR 6212, Case 937, 13009 Marseille, France, ISABELLE CANTAT, IPR, UMR CNRS 6251, Universite de Rennes 1, 35000 Rennes, France, MARIE-CAROLINE JULLIEN, MMN, UMR CNRS 7083, ESPCI ParisTech, 75005 Paris, France — The motion of droplets or bubbles in confined geometries has been extensively studied; showing an intrinsic relationship between the lubrication film thickness and the droplet velocity. When capillary forces dominate, the lubrication film thickness evolves non linearly with the capillary number due to viscous dissipation both in the droplet and between meniscus and wall. However, this film may become thin enough (tens of nanometers) that intermolecular forces come into play and affect classical scalings. Our experiments yield highly resolved topographies of the shape of the interface and allow us to bring new insights into droplet dynamics in microfluidics. We find and characterize two distinct dynamical regimes, dominated respectively by capillary and intermolecular forces. In the first regime, we also identified a model with interfacial boundary condition considering only viscous stress continuity that agrees well with film thickness dynamics and interface velocity measurement.

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