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Viscous extensional film withdrawal ERNST A. VAN NIEROP, BENOIT SCHEID, Harvard University - School of Engineering and Applied Sciences, MARTIN HELLER, HENRIK BRUUS, Technical University of Denmark, HOWARD A. STONE, Harvard University - School of Engineering and Applied Sciences — When a viscous film is withdrawn from a bath of fluid the dominant flow in the film is extensional, unlike the shear flow which occurs in e.g. thin films wetting solid objects that are withdrawn from a bath of fluid. Previous work revisited theory describing the thickness of a soap film withdrawn from a bath, and found that it scales as $h \propto Cs^{2/3}$, where Cs is the surface capillary number which accounts for surface viscosity. For viscous films without surfactants, and hence no surface viscosity, film thickness was found to scale as $h \propto Ca^2$ for $Ca << 1$. In this work, we compare the theoretical predictions to experimental and numerical investigations of viscous film thicknesses, and furthermore we consider regimes where other contributions to the stress balance are important, such as gravity for $Ca = O(1)$.

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