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Asymptotic Analysis of the Selective Dip-Coating of Non-Newtonian Fluids onto Chemically Micropatterned Surfaces NAVEEN TIWARI, JEFFREY DAVIS, Department of Chemical Engineering, University of Massachusetts Amherst — The dip coating of a chemically micropatterned surface bearing a wetting vertical strip surrounded by non-wetting regions is analyzed for a non-Newtonian power-law fluid. The microscopic surface heterogeneity selectively confines liquid to the narrow strip. Asymptotic matching is used to determine the thickness of the liquid film deposited on the 10 μm-scale strip at small capillary numbers. In the absence of an imposed length scale on uniformly wetting surfaces, the governing length scale in the dynamic meniscus is found from a balance of viscous and capillary forces and depends on fluid properties. The power-law dependence of the viscosity can therefore have a considerable effect on the coating process. On micropatterned surfaces the effect of the power-law index on the thickness of the entrained liquid film is greatly reduced because of the dominant effect of the lateral fluid confinement by micropatterning, which imposes a geometric length scale that replaces the dynamic capillary length in the analysis. This greatly diminished effect of power-law behavior is therefore also expected to hold for other non-Newtonian fluids coated onto micropatterned surfaces because the governing (geometric) length scale is independent of fluid properties.

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