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Impact of Elasticity on Coating Flow near A Moving Contact Line
YULI WEI, STEPHEN GAROFF, Carnegie Mellon University, ENRIQUE RAMÉ, National Center for Space Exploration Research, LYNN WALKER, Carnegie Mellon University — The impact of fluid elasticity and shear thinning on the dynamic wetting of polymer solutions is important because many fluids, even those that are normally considered Newtonian, exhibit non-Newtonian behaviors in the high shear environment of the wedge-like geometry near a moving contact line. Even though this behavior is on the microscopic scale, it has significant impact on wetting on the millimeter scale. Shear thinning dramatically modifies the flow field near a moving contact line and results in a reduced curvature of the free surface. In this talk, we will focus on the effects due to fluid elasticity. Both experimental and theoretical results are presented. The fluids we use are the dilute solutions of high molecular weight polyisobutylene (PIB) which exhibit elasticity-dominated rheology with minimal shear thinning. Their wetting behaviors are compared to their oligomer "solvent," which is considered Newtonian based on standard rheometry. We will also discuss a lubrication analysis of the wedge-like flow field using an Oldroyd-B constitutive relation to mimic the stress evolution of the elastic solution.

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