Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Drop formation, pinch-off dynamics and liquid transfer of simple and complex fluids JELENA DINIC, VIVEK SHARMA, University of Illinois at Chicago — Liquid transfer and drop formation processes underlying jetting, spraying, coating, and printing – inkjet, screen, roller-coating, gravure, nanoimprint hot embossing, 3D – often involve formation of unstable columnar necks. Capillary-driven thinning of such necks and their pinchoff dynamics are determined by a complex interplay of inertial, viscous and capillary stresses for simple, Newtonian fluids. Micro-structural changes in response to extensional flow field that arises within the thinning neck give rise to additional viscoelastic stresses in complex, non- Newtonian fluids. Using FLOW-3D, we simulate flows realized in prototypical geometries (dripping and liquid bridge stretched between two parallel plates) used for studying pinch-off dynamics and influence of microstructure and viscoelasticity. In contrast with often-used 1D or 2D models, FLOW-3D allows a robust evaluation of the magnitude of the underlying stresses and extensional flow field (both uniformity and magnitude). We find that the simulated radius evolution profiles match the pinch-off dynamics that are experimentally-observed and theoretically-predicted for model Newtonian fluids and complex fluids.

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Date submitted: 06 Nov 2015 Electronic form version 1.4