Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Non-Newtonian Fluids Spreading with Surface Tension Effect: 3D Numerical Analysis Using FEM and Experimental Study BIN HU, SARAH KIEWEG, University of Kansas — Gravity-driven thin film flow down an incline is studied for optimal design of polymeric drug delivery vehicles, such as anti-HIV topical microbicides. We develop a 3D FEM model using non-Newtonian mechanics to model the flow of gels in response to gravity, surface tension and shear-thinning. Constant volume setup is applied within the lubrication approximation scope. The lengthwise profiles of the 3D model agree with our previous 2D finite difference model, while the transverse contact line patterns of the 3D model are compared to the experiments. With incorporation of surface tension, capillary ridges are observed at the leading front in both 2D and 3D models. Previously published studies show that capillary ridge can amplify the fingering instabilities in transverse direction. Sensitivity studies (2D & 3D) and experiments are carried out to describe the influence of surface tension and shear-thinning on capillary ridge and fingering instabilities.

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Date submitted: 05 Aug 2010 Electronic form version 1.4