Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Dynamic Wetting Failure in Curtain Coating: Comparison of Model Predictions and Experimental Observations SATISH KUMAR, CHEN-YU LIU, Department of Chemical Engineering and Materials Science, University of Minnesota, MARCIO CARVALHO, Department of Mechanical Engineering, PUC-Rio — Dynamic wetting failure of Newtonian liquids in a curtain-coating geometry is studied using a hydrodynamic model to predict the onset of wetting failure with curtain heights consistent with prior experimental setups. In the model, a Navier-slip boundary condition and constant contact angle are used to describe the dynamic contact line (DCL). The governing equations are solved with the Galerkin finite-element method and the critical substrate speed is identified at which wetting failure occurs. A boundary of a coating window is constructed which outlines the critical substrate speed for different flow rates of the liquid curtain. The model predictions are compared with prior experimental observations reported by others, and it is found that the model reproduces the non-monotonic behavior of the critical speed as the liquid flow rate increases. When surfactants are absent, our results suggest that the experimental observations can largely be explained with a model that uses the simplest boundary conditions at the DCL and accounts for the air stresses there to accurately calculate interface shapes. When surfactants are present, our results suggest that Marangoni stresses may play an important role (Liu et al., Chem. Eng. Sci. 195 (2019) 74).

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Date submitted: 25 Jul 2019 Electronic form version 1.4