Effect of Viscoelasticity on Stability of Curtain Coating

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Successful curtain coating window is limited by two factors: the minimum flow rate below which liquid curtain breaks up and maximum substrate speed above which air entrains in the liquid film deposited on the substrate. These two factors introduce limitations on the speed of curtain coating and the thickness of the deposited liquid film. In this work, we analyze the relative importance of shear and extensional viscosity on stability of curtain coating.

Aqueous solutions of polyethylene oxide (PEO) of different concentrations were used as model liquids to obtain fluids with different levels of extensional thickening behavior. The results show that the minimum flow rate for stable curtain falls significantly by adding small amounts of high molecular weight polymer. Both shear and extensional viscosities have stabilizing effect on stability of curtain; however, extensional viscosity has much stronger effect.