

Evolution of Unyielded Region inside Slot Coating Flow with Viscoplastic Material

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Continuous liquid coating is used to produce various films or sheet-like products, such as adhesive tapes, optical films, display panels, etc. It is also a strong candidate for nanoparticle assembly film production. Slot coating is a popular high-precision coating methods, because the film thickness is directly controlled by the flow rate and substrate speed rather than coating liquid properties.

Coating liquid used in this study shows complex non-Newtonian behavior including viscoplasticity, i.e., exhibiting little or no deformation up to a certain level of stress, called yield stress, and the area exhibiting little or no deformation is called unyielded region. From flow visualization and coating window computation, we found that the location of the unyielded region is a function of the gap to thickness ratio. To find out the threshold value for detaching unyielded region from the coating die lip, a simple viscoplastic channel flow model is proposed and analyzed.