Ultra-thin slot coating simulator for mapping the low-flow limit

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To be presented at the 18th International Coating Science and Technology Symposium,
September 18-20, 2016, Pittsburgh, PA

Slot-die coating is a precision pre-metered, film-deposition process compatible with a wide range of materials, including low-molecular weight polymers and thermosets. Of topical interest is the application of high-cost nanomaterial inks over moderately sized patches with sub-micron film thicknesses. In these applications coating speed can be moderate and start-up and shut down transients are important. A two-dimensional model has been developed to understand the limits of the process and to predict the thinnest possible film achievable for these applications. Coined as the low-flow limit, this boundary represents the minimum uniform, defect-free film achievable and is sensitive to the properties of the liquid and geometry of the die. In this work, we exhaustively explored the low-flow limit with our model to aid in the design and optimization of slot die coating of nanomaterials.

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1 Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy’s National Nuclear Security Administration under Contract DE-AC04-94AL85000
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