Slot Coating of Micro-scale Heterogeneous Stripe Patterns

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Slot coating has been increasingly adapted in recent years toward deposition of patterned films, particularly narrow stripes and patches. These efforts represent significant progress toward a unique and highly scalable additive-only manufacturing approach. However, for various emerging technologies such as flexible electronics, display devices, sensors, and wearables, the feature size capability of patterned slot coating remains a persistent challenge. In this talk, we present a novel technique for slot coating of narrow features at or below 50 μm. Our approach features simultaneous deposition of two miscible coating fluids as a single heterogeneous film, in order to overcome some of the wetting behaviors that otherwise limit the patterned slot coating process.

We provide a straightforward analysis of our technique to address the minimum feature size that can be expected, as well as the sensitivity of the output pattern geometry to process conditions and coating fluid properties. Here, pattern morphology is quantified in terms of the width and spacing of narrow stripes of two alternating materials. In-process imaging of outflow from the coating tool shows that this pattern morphology is robust across a range of process inputs. Based on preliminary results, wetting effects unique to this approach appear confined to the edges of the coated area. Considering our experimental observations in conjunction with the operational principles for our process, we also provide guidelines for material selection and expectations for future development of our patterned coating technique.

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