

The fundamentals of micro- and nano-replication manufacturing: challenges and opportunities

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Scalable roll-to-roll routes for high-throughput micro- and nano-scale feature replication via printing, imprinting or embossing are critical to a variety of important technologies, including electronics/photonics, power sources, and additional areas critical to energy applications. These forms of additive/subtractive manufacturing are receiving considerable attention in terms of research and development and application. Advancing these processes to achieve wider-area, higher throughput, and smaller features share many of the same challenges as achieving ultra thin (less than one micron), uniform films. Additional complications arise in applications that require multiple layers of discrete features (e.g. printed logic devices for electronics). In this presentation we will examine these challenges and highlight some of the efforts to bring high-end modeling and simulation tools to bear on scale-up and design. We will also examine the limits of thin residual layer thickness (ultra thin film coating) and some challenges and possibilities of nanomaterial integration through printing techniques. Finally, this presentation will set the stage for those to follow in this special symposium, in terms of technology coverage and outstanding challenges.

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