A Materials-First Approach to Device Fabrication using Imprint Lithography

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Nanoimprint lithography offers high-throughput patterning of nanoscale features with exceptional resolution. The vast majority of NIL applications involve the use of polymer resists, which often lack the electrical, optical, magnetic, catalytic or physical properties required for a truly functional device. Over the past several years we have been developing materials and methods based on polymer/nanoparticle hybrid resists and metal oxide nanoparticle-based inks to enable the direct imprint patterning of a finished devices. The use of the metal oxide nanoparticle-based inks, for example, enables the fabrication of purely inorganic device components. Example applications include microbatteries, sensors, optical components, flat lenses, high performance electrodes, antimicrobial films, and durable masters for injection molding and imprinting. This talk will describe our approaches, including resist/ink development and post-patterning processing strategies, that enable the rapid and efficient manufacturing of next generation devices on batch and roll-to-roll process platforms. Scalability of these approaches is demonstrated with examples from our Advanced Print and Roll-to-Roll Manufacturing Demonstration Facility.

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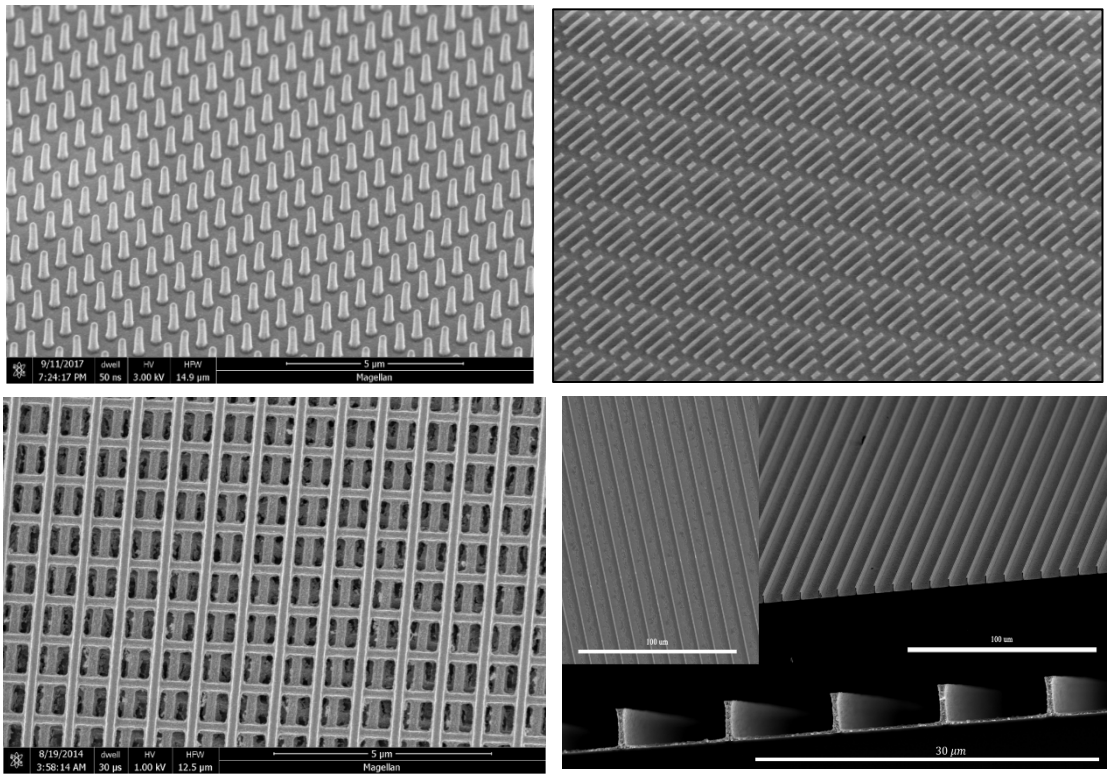

Figure 1. Examples of all-inorganic device components fabricated by NIL. High aspect ratio, high refractive index TiO_2 posts (upper left), anti-microbial ceramic surface (upper right), TiO_2 log-pile structure (lower left), $LiMn_2O_4$ micro-battery anode (lower right).