

High-throughput and Low-cost Nanostructuring of Thermoplastics

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Inmold A/S is a company specializing in the modification of tools with nanoscale surface structures, and for replication of such in thermoplastic polymers by injection molding and roll-to-roll (R2R) processing.

Our novel ToolGloss® coating technology provides a hard and durable glass-like layer on steel mold inserts or rollers, with nanostructures embedded in the surface. The coating has demonstrated lifetime of at least 100.000 injection molding cycles without damaging the nanostructured surface while maintaining full replication in the plastic part. The coating improves replication compared to a nickel mold [1], and provides surface chemistry compatible with silane-based anti-stiction agents.

Our R2R process combines advantages of injection molding and nanoimprint lithography, for short cycle time and high throughput. We have demonstrated fabrication of nanostructures by R2R imprinting arbitrary structures such as pillars, holes, lines, and spirals with an aspect ratio of more than 1 (e.g. Fig.1c: 410 nm wide and 600 nm high pillars) at a speed of 60 m/min.

With our technology, we have demonstrated functional plastic surfaces with antireflective, structural colors, self-cleaning, superhydrophobic, and omniphobic (with post-functionalization) properties. We anticipate that these nano- and microstructured polymer substrates and foils will act as a technology enabler for the further development and industrialization of a wide range of applications.

Reference: 1. T.C. Hobæk, J. Micromech. Microeng. **25**, 035018 (2015)

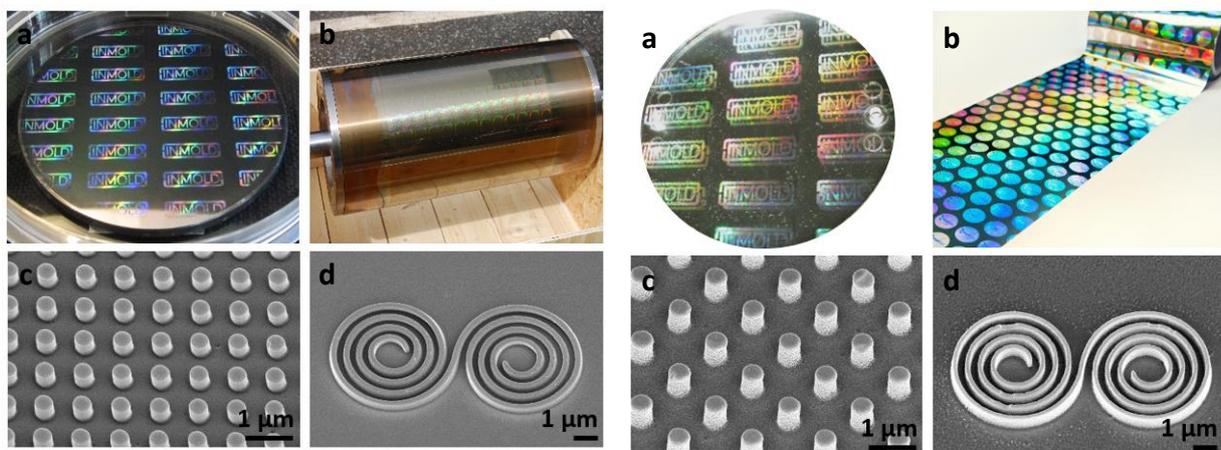


Figure 2: Nanostructured ToolGloss® coating on a steel disc (a) and a steel roller (b). SEM images of imprinted structures (c, d).

Figure 1: Structural hologram replicated into a transparent COC disc (on a reflective background) (a) and PP foil (b). SEM images of structures replicated into PP (c, d).