Smart plastic functionalization by nanoimprint and injection molding

In this paper, we present a route for making smart functionalized plastic parts by injection molding with sub-micrometer surface structures. The method is based on combining planar processes well known and established within silicon micro and sub-micro fabrication with proven high resolution and high fidelity with truly freeform injection molding inserts. The link between the planar processes and the freeform shaped injection molding inserts is enabled by the use of nanoimprint with flexible molds for the pattern definition combined with unidirectional sputter etching for transferring the pattern. With this approach, we demonstrate the transfer of down to 140 nm wide holes on large areas with good structure fidelity on an injection molding steel insert. The durability of the sub-micrometer structures on the inserts have been investigated by running two production series of 102,000 and 73,000 injection molded parts, respectively, on two different inserts and inspecting the inserts before and after the production series and the molded parts during the production series.

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