Challenges in high accuracy surface replication for micro optics and micro fluidics manufacture

Patterning the surface of polymer components with microstructured geometries is employed in optical and microfluidic applications. Mass fabrication of polymer micro structured products is enabled by replication technologies such as injection moulding. Micro structured tools are also produced by replication technologies such as nickel electroplating. All replication steps are enabled by a high precision master and high reproduction fidelity to ensure that the functionalities associated with the design are transferred to the final component. Engineered surface micro structures can be either distributed, e.g., to create an optical pattern, or discretised, e.g., as micro channels for fluids manipulation. Key aspects of two process chains based on replication technologies for both types of micro structures are investigated: lateral replication fidelity, dimensional control at micro scale, edge definition. The parts investigated are a micro retroreflector and a micro fluidic system, typical applications of injection moulded parts with micro structured functional surfaces.

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