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Injection Moulding of Micro Structures and Micro-structured Surfaces

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Communication and information technologies as well as medical technologies are branches of industry with a high potential of growth and innovation. Micro-structured light guiding elements made from plastics can help to improve the display technology referring to the illumination. As another example micro-fluidic structures and micro well-plates with structures in size of a few µm gives the advantage to save time and money in medical analysis because different processes can be parallelised. The injection moulding of polymer materials is an economic way to produce those precise micro-structured parts with functional surfaces. To ensure the highest precision and reliability, the whole process chain must be analysed carefully.
The investigations carried out at the IKV considered on the one hand different polymers (PMMA, PC, POM, COC) and several test structures on the other hand. Furthermore, within the investigations the use of a dynamic inductive heating system was analyzed to heat the cavity surface efficiently. Based on these examinations new mould concepts could be developed with an integrated dynamic inductive heating system to increase the moulding accuracy and reduce the formation of orientations in the moulded part dramatically.
In addition to that, new demoulding technologies have been examined to realise a demoulding process without deformation of the moulded part. In this context different principles were tested, e.g. a highprecision guided retraction of the micro-structured cavity, as well as ultrasonic- and vacuum-assisted demoulding techniques.
To determine the moulding accuracy, the final step of the process chain includes the measurement and analysis of the micro-structured moulded parts. For the analysis of the microscopic deviation between mould cavity and the surface of the moulded part, a special software-prototype was developed. This software-tool allows the calculation of so called “differential surfaces” to show the influence of shrinkage and warpage on the micro-structures and the macroscopic part geometry.