Investigating the deviations between micro-injection moulding experiments and simulations of micro-structured micro-optical components

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Abstract

Micro-injection moulding (µIM) with the highest level of accuracy is a crucial goal for the manufacturing industry as the demand for acquiring small plastic parts unceasingly increases. Simulations for such miniaturized parts however are still under investigation with conventional injection moulding (IM) simulation software. Commercially available software solutions are continuously moving towards closing the existing gap between the micro and macro parts simulation capabilities. In this study, the results of simulations of a micro-optical component with micro-lenses are investigated as a case study to understand where the results were different and to hypothesize how the existing deviations could be further decreased. Short shots mouldings were molded with Cyclo Olefin Polymers (COP) Zeonor 1060R using a Wittmann Battenfeld MicroPower 15t µIM machine using a pressure-controlled switch-over point. By using the Moldex3D® IM software, simulations were carried out with the same settings as those implemented during the experiments, and the results were compared and analysed. A difference between the different simulations and samples was observed due to limitations in terms of repeatability of the µIM short shots when moulding the single-digit milligram mass micro components. These preliminary results show deviations ranging from 9% to 20% between the different filling stages of moulded parts with that of the simulation.

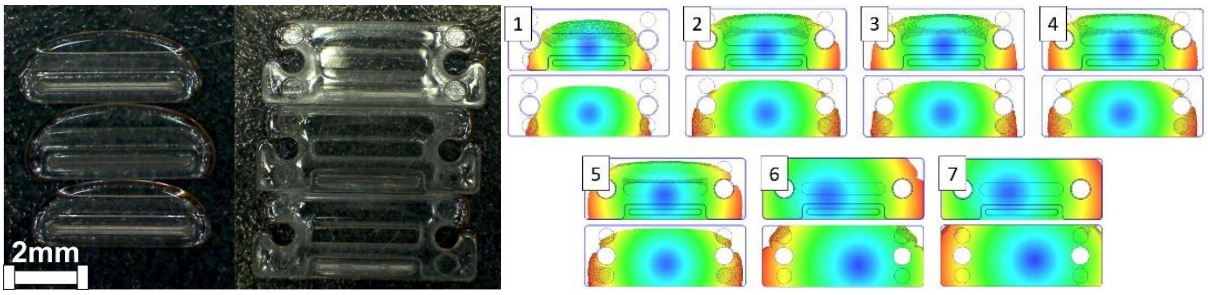

Figure 1: Micro-injection moulded microlenses (left); Injection moulding simulations to demonstrate the flow patterns (right)