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Ultrasound-assisted Injection Molding for Improving Mold Filling and Mechanical Strength of Flow Lines

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We report two new ultrasound applications to the injection molding process concerning (i) the ultrasound-assisted filling of microparts and microstructures and (ii) the ultrasound-assisted increase of mechanical strength of flow lines.

Micro and micro-structured mold cavities are often filled unsatisfactory, and therefore, the resulting parts may have low quality. This incomplete filling effect is due to the solidification of the polymer melt reaching the cold wall of the mold. One experimental improvement can be made by using a variothermal process. However, the necessary heating and cooling are time consuming resulting in uneconomical long cycle times. We describe a new technique supporting the filling process of micro cavities and microstructures based on ultrasound. In this technique, the ultrasound energy is coupled directly into the polymer melt resulting in a temperature increase of the melt and a lowering of its viscosity. We describe our technical solution for the mold design. The influence of the ultrasound energy on part weight and filling-out of microstructures is discussed.

Flow lines are weak points of polymer parts and may cause failure of the parts during their practical operation. To increase the bond strength of flow lines appearing for one and two components, we couple ultrasound directly into the mold cavity at the position, where the flow line appears. Again, we describe our technical solution of the mold design. Experimental results are discussed concerning the influence of the ultrasound energy including different technological arrangements.

Our positive experience of the ultrasound-assisted injection molding showing potential promise for manufacturing high quality parts.