SL 2.8

Experimental and Numerical Study of Transcriptability of Micro Structures in Injection Molding

J.G. Lee, B.-K. Lee and T.H. Kwon
Department of Mechanical Engineering, Pohang University of Science and Technology
San 31 Hyojadong, Namgu, Pohang 790-784, Korea

Experimental and numerical studies were carried out in order to investigate the processability and the transcriptability of the injection molding of micro structures. For this purpose, we designed a mold insert having micro rib patterns on a relatively thick base part. Mold insert has a base of 2mm thickness, and have nine micro ribs along the flow direction. Width and height of the rib are 300 μm and 1200 μm, respectively. We found a phenomenon similar to "race tracking", due to "hesitation" in the micro ribs. As the melt flows, it starts to cool down and melt front located in the ribs near the gate can not penetrate further because the flow resistance is large in that almost frozen portion. When the base is totally filled, the melt front away from the gate is not frozen yet. So it flows back to the gate direction through the ribs. We also verified this phenomenon via numerical simulation. We further investigated the effects of processing conditions, such as flow rate, packing time, packing pressure, wall temperature and melt temperature, on the filling pattern. The most dominant factors which affect the flow pattern and the transcriptability of the micro rib are flow rate and wall temperature. High flow rate and high wall temperature enhance the transcriptability of rib structure. High packing time and high packing pressure increase total weight of the sample, but resulting in insignificant dimensional variations in the rib. Numerical simulation also confirms that low flow rate causes a short shot of micro ribs and high wall temperature helps the filling of the micro ribs.