SL 2.15

Does the Fountain Flow Influence Molecular Orientation in Injection Molded Parts?

T. Nguyen-Chung and G. Mennig
Institute of Mechanical Engineering and Plastics Technology, Chemnitz University of Technology, D-09107 Chemnitz, Germany

In injection molding the filling stage is characterized by a transient free surface flow of a hot polymer melt into a cold cavity. The high deformations of the polymer molecules during the mold filling and the incomplete relaxation result in a frozen-in molecular orientation in the finished parts. Simulations of the isothermal and non-isothermal filling of a rectangular cavity were carried out for polystyrene using a Giesekus viscoelastic constitutive equation, whereby in the non-isothermal case the thermal resistance at the mold wall was modeled by different heat transfer coefficients to investigate the effect of the thermal resistance on the development of the molecular orientation. Results for stress development along the flow front and the cold wall were compared showing that the principal stress differences in the middle area of the flow front were lower than those at the mold wall. In case of the non-isothermal filling, the latter one will increase further while the melt is gradually cooling down, which is especially true if the thermal resistance at the mold wall has been considered. Consequently, the high molecular orientation at the wall seems to be rather a result of the non-isothermal shear flow than of the extension at the advancing front as usually assumed.