Tribological Properties of Plastic Injection Molds

CATEGORY OR KEYWORD
Energy/Environment/Manufacturing

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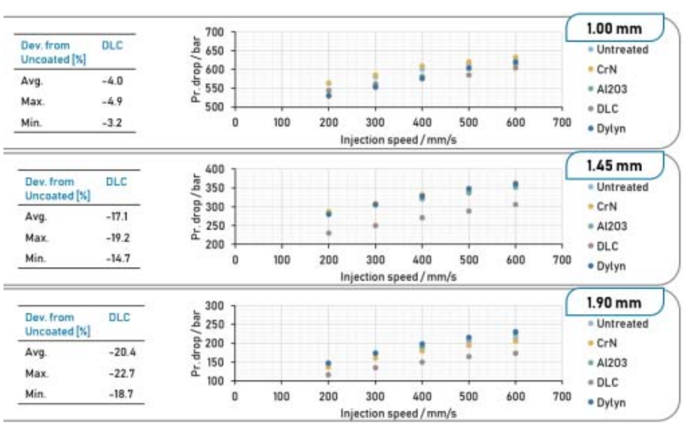
INTRODUCTION

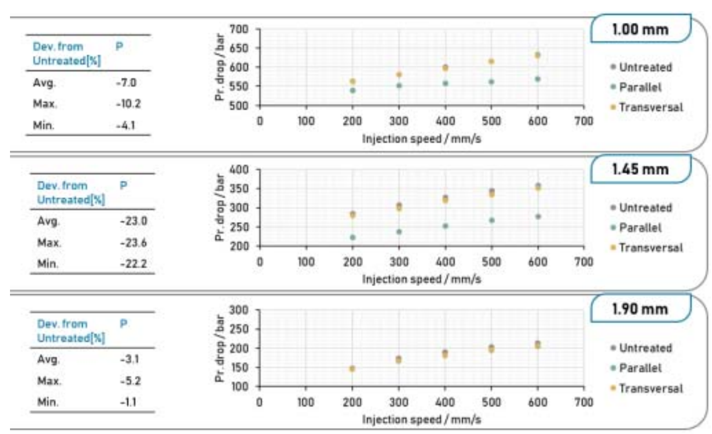
The increasing competitiveness of the current industrial environment constantly pushes the plastics industry towards the design of lighter and thinner parts [1]. In general, reducing the wall thickness of injection molded parts leads to reductions of both product cost and environmental impact [2]. The main feature of thin-wall injection molding is the high flow-length to thickness ratio, which requires a high cavity pressure at the gate during the filling phase, to drive the Poiseuille flow and achieve the flow length [3]. For reduction of the melt flow resistance, different solutions have been considered in the literature, focusing mostly on optimization of the most significant process parameters [4]. In this work, the tribological properties of mold surface are investigated considering their effect on the non-isothermal polymer flow.

ABSTRACT

The mold cavity designed for this study is a thin-wall slit-die channel. The mold was designed to allow mounting of interchangeable inserts with different topographies. The design of the moving half comprised two pressure transducers, which were flush mounted along the flow channel to allow characterization of the pressure drop. Different mold surface coatings were selected according to their tribology, hardness and thermal properties. Other mold inserts were treated using an ultrashort laser to generate Laser-Induced Periodic Surface Structure (LIPSS) on steel surfaces. The generated and modified mold topographies on the mold cavity surfaces were analyzed using Scanning Electron Microscopy and Atomic Force Microscopy.

Compared to the uncoated mold surface, only the DLC coating significantly reduces the melt flow resistance of PET. The DLC coating reduces the injection pressure by thermal insulation of the melt flow.





CONCLUSIONS

This work focused on the effects of mold surface engineering on the filling flow resistance in thin – wall injection molding. The results showed that surface modification and generation are both efficient strategies to decrease the injection pressure at different cavity thickness.

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