Replication of micro and nano-features on iPP by injection molding with fast cavity surface temperature evolution - DTU Orbit (17/12/2018)

Replication of micro and nano-features on iPP by injection molding with fast cavity surface temperature evolution

The production of polymeric components with functional structures in the micrometer and sub-micrometer range is a complex challenge for the injection molding process, since it suffers the use of low cavity surface temperatures that induce the fast formation of a frozen layer, thus preventing accurate replication of micro and nano-features.

In this work, a thin heating device allowed reaching and maintaining the desired temperature on the cavity surface, by joule effect. A nickel insert with micro and nano-features in relief was located on the cavity surface, and the replication by isotactic polypropylene of the features was analyzed, by Atomic Force Microscopy, under several process parameters. The increase of holding pressure enhanced the replication, but accurate replication was achieved only increasing the cavity surface temperature. A heating time comparable with cavity filling time was sufficient to obtain accurate replication, with adequate surface temperatures.

In the case of nano-features, the replication accuracy was affected by the morphology developed on the molding surface, that is aligned along the flow direction with dimensions comparable with the dimension of the nano-features. Therefore, their formation on the surface reduced the accuracy of replication in the direction orthogonal to the flow front.

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Contributors: Speranzaa, V., Liparotia, S., Calaon, M., Tosello, G., Pantania, R., Titomanlio, G.
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