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Experimental Determination of the Polymer Flow Profiles in Injection Mould Channels

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The velocity profiles of the polymer flow in a 16-cavity injection mould, with geometrically balanced runners, were examined. The mould has 4 sections with different cavities, but in each section cavities are of the same shape. Two sections were designed with obstacles so that meld and weld lines in moulded parts were formed.
LDPE filled with talc (10% wt.) was used for the visualisation of flow velocity profiles in cross-sections of the runners and cavities of the mould. The packing angle of talc particles is dependent on the polymer flow velocity and allows to observe the differences of the flow in particular areas of a runner cross section. This analysis was realized by a microscopic observation, using solidified moulded parts.
To prepare a homogeneous LDPE – talc composition, a double extrusion of the material, prior to injection moulding was applied. The samples were cut out from runners and cavities, and examineded by a scanning electron microscopy (SEM). The talc packing angle in the cross-section of runners and cavities was analysed. It was found that even the geometrically balanced runners cannot assure the simultaneous filling of all mould cavities. The difference in the temperature distribution on the mould surface and changes of the molten polymer flow direction are the probable reasons of not symmetrical velocity profile in runners' cross-sections. As a result the cavities are not filled simultaneously. The cavities placed in hotter mould areas or at the end of faster flow path in runners are filled earlier.