G09.18

The Numerical Analysis of Injection-Compression Molding of Thermosets

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In this paper, the injection-compression molding process of thermoset materials is simulated numerically.

In the injection-compression molding process, the molding cavity initially has lager thickness than the final one. This allows flow to proceed readily to the extremities of the cavity under relatively low pressure and stress. At some time during or after filling, the mold cavity thickness is reduced by a compressive force, forcing the resin into the unfilled portions of the cavity and producing a more uniform packing pressure across the cavity. This results in more homogeneous physical properties and less molded-in stresses compared to conventional injection molding. Therefore, this process is often used to produce dimensionally stable, relatively stress-free parts, at a low clamp tonnage. Using CAE simulation tools, alternative process conditions can be explored without embarking on expensive molding trials. The cycle time can be potentially reduced, resulting in substantial operational cost savings. Furthermore, possible molding problems can be detected early in the mold-design stage, prior to mold-making.

We use generalized Hele-Shaw formulation to simulate the thermoset injection-compression process. A few example cases will be used to test the program. Using our simulation program, the comparison can be made between regular injection molded thermosets and injection-compression molded thermosets in terms of the clamp tonnage and dimensional stability.