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Reduction of Injection Pressure in Injection Moulding Using Cavity Pre-heating

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Advantages of injection into a hot cavity are well recognized. The resulting lower melt viscosity reduces injection pressure at a given injection rate, and further reductions are possible by reducing injection rate without plastic freezing. This translates into lower clamp forces and lower tonnage machines. Plastic wall thickness can also be reduced without the penalty of excessively high pressures. Additionally, benefits in surface finish are available. No information has, however, been previously available to quantify the expected pressure reductions. As part of a project developing efficient methods for cavity pre-heating, computer simulations of mould filling have been carried out for two idealized geometries: flow in a slit, as for a fan-gated plaque; and radial flow, as for a centre-gated disc. A dimensionless injection pressure is defined and correlated with: the Fourier number measuring injection time; the Pearson number, which measures the effect on viscosity of the difference between melt injection and cavity wall temperatures; and the power law index, which measures the degree of shear thinning. Results are presented in an easy-to-use form, allowing immediate estimation of injection pressures as a function of cavity wall temperature for a wide range of processing conditions and materials.