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Modelling the Melting Process in Reciprocating Screw Injection Moulding Machines Especially Considering the Transporting Effects after Screw Idle Time

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In addition to the melting process during screw rotation in single screw reciprocating units melting also takes place in the holding pressure and cooling time of the injection molding cycle. When melting by screw rotation, a melt pool is formed on the pushing screw flight and melt films occur both on the barrel and the screw surface. During the holding pressure and cooling time, the idle time of the screw, the films grow bigger due to pure heat conduction from the heater bands. With the beginning new screw rotation period, parts of the melt are transported into the melt pool. The melting process in the idle time is described by solving Fourier's equation for transient heat conduction. When starting the new rotation period, most calculation models assume that the melt is transported immediately from the melt films into the melt pool. This assumption is investigated in this paper. First a study is carried out to determine the number of screw rotations which are necessary to transport the melt from the melt films into the melt pool after the idle time. Then two calculation models are presented to describe melt transport into the melt pool after idle time. The first one assumes immediate melt transport, the second one melt transport dependent on time. The calculation results for the solid bed profile, the melting length and the melt film thickness of both calculation models are compared.