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DEVELOPMENT AND VALIDATION OF A PHYSICAL MODEL FOR THE EXPANSION INJECTION MOLDING PROCESS

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In present injection molding, the key words used are faster cycles, thinner wall thicknesses with the part weight from 0.1 g to 50 g and more precise high-quality parts. In modern electronic and communication devices, a wall thickness of less than 0.3 mm and a flow length/wall thickness ratio up to 450:1 is common. When producing such thin-walled parts, the whole cavity has to be filled in very short time to avoid solidification of the melt. To fill the cavity with high injection speed, the injection molding machine is equipped with a separate hydraulic accumulator. In the testing stage of these machines, surprising results were seen, although the screw reached a speed of 1000 mm/s, the melt flow front of the material did not match the screw speed and part of energy was consumed by the melt compression. Based on this investigation, ENGEL Austria GmbH developed an alternative process for thin wall injection molding namely the ENGEL “X-melt” process, which can be described as an expansion injection molding process. The main feature of this process is the separation of the melt compression and the injection phase. At first the melt is compressed to a maximum compression pressure of approximately 1800 to 2500 bar in the space in front of the injection screw. When the pressure is relieved, melt will expand explosively inside the cavity, thus filling the cavity at a high flow rate.
To reduce development times in the field of expansion injection molding, it is intended to use a simulation program. Based on the physical model for the expansion injection molding, simulation software was developed. The simulation program allows for the calculation of a maximum compression pressure with regard to the amount of compressed melt to meet the required amount of shot weight. For a chosen thin-walled part, the simulation results in comparison with experimental results will be presented.