Three-dimensional numerical modeling of an induction heated injection molding tool with flow visualization - DTU Orbit (09/11/2017)

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Using elevated mold temperature is known to have a positive influence of final injection molded parts. Induction heating is a method that allow obtaining a rapid thermal cycle, so the overall molding cycle time is not increased. In the present research work, an integrated multi-turn induction heating coil has been developed and assembled into an injection molding tool provided with a glass window, so the effect of induction heating can directly be captured by a high speed camera. In addition, thermocouples and pressure sensors are also installed, and together with the high speed videos, comparison of the induction heating and filling of the cavity is compared and validated with simulations. Two polymer materials ABS and HVPC were utilized during the injection molding experiments carried out in this work. A nonlinear electromagnetic model was employed to establish an effective linear magnetic permeability. The three-dimensional transient thermal field of the mold cavity was then calculated and compared with the experiments. This thermal field was transferred to an injection molding flow solver to compare simulations and experimental results from the high speed video, both with and without the effect of induction heating. A rapid thermal cycle was proved to be feasible in a mold with an integrated induction coil. Furthermore, it was shown that the process can be modeled with good accuracy, both in terms of the thermal field and of the flow pattern.

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