Product:

Intellimold™ IMC-Integrated Melt Controller

View:

Description:

The relationship between the melt state (pressure, temperature and composition) during filling of the mold and the unpredictable internal structure of the mold itself is the key to any successful process control for molding. This is the reason the resin suppliers to deliver their material with suggested processing conditions expressed in psi melt pressure, melt temp and time for the fill, pack and hold stages. The major issue is the non-linear behavior of the melt, which complicates the task of controlling the filling speed.
The most common and simplest method of specifying the molding conditions is to control the screw position and speed, as professionals can easy correlate linear movement of the screw with the need of three dimensional flow and pressure into the cavity.
The temperatures of the melt, its viscosity, and the peak melt pressures from the nozzle of the machine to the last place to fill in the mold are critical parameters in evaluating and controlling mold operations.
The synthesis of control information which relates injection speed to its true effect on melt pressure and temperature in the cavity is the new direction to obtain the deepest feedback for close loop control of injection.
On the other side, the material manufacturers are suggesting constant material density at desired levels of melt pressures in order to obtain the best structural properties of their materials in molded part.

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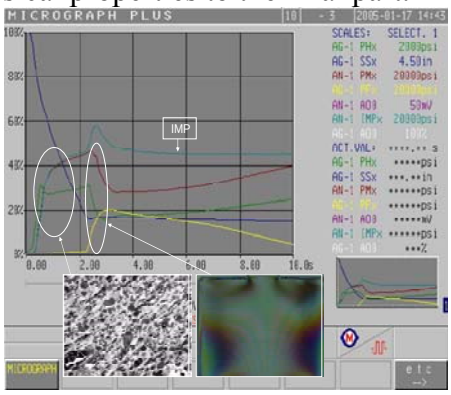
Analyzing all measurables in one molding system consisting of IMM, mold and plastic material of choice, it is easy to conclude that all melt variables are not incorporated into the control loop. Thus, most of machine and mold variables will impact process setup time and consistent molding. Effects from mechanical wear and the use of recycled materials will be transferred to the final part's quality.

All above showing the need of additional measurables and relocation of the feed back for close loop control of an IMM in order to meet the basic principles for real-time control.

Although Intellimold™ is a very impressive system the way it is, we decided to further increase the measurability of your process by introducing "Soft Sensor Technology" or SST. SST uses the current measuring system that forms the backbone of Intellimold™, but uses additional patented algorithms within our controller to give real-time, value added read-outs such as cooling rate, melt viscosity, melt flow index, Δ injection energy, injection work, shear, stress etc. All of these variables can be used for cycle and process optimization and control to sustain your material's physical properties to the final part.



Process Description

The process relies on real time measurements, from the injection nozzle to last place to fill in the mold cavities, under which any subsequent pressure transitions (injection, pack and hold) are measurable in real time and controlled accordingly. Pressure/temperature transducers in the machine nozzle and the cavity's last place to fill continuously provide signals to the controller, and through calculations, a core variable (CV) representing the dynamic pressure of the melt (Internal Melt Pressure) in the cavity is derived. This variable is based upon flow rate, melt temperature, modulus, shrinkage factors, part configuration and the level of stress as the part is constrained in the cavity during solidification. The Internal Melt Pressure (IMP) is the minimum dynamic pressure existing within the melt to counterbalance the shrinkage forces and air resistance in the cavity during fill and final solidification. A closed loop control (PID) signal is generated and sent to the hydraulic unit, resulting in injection pressure adjustments, which in turn automatically and continuously control the Internal Melt Pressure. Pressure peaks are eliminated and each section of the part is filled with balanced flow and solidifies with equal IMP pressure, thus reducing stress. Basically, the process control tries to equalize the pressure at the injection nozzle and the melt pressure at the cavity's last place to fill at molten state of the melt in the cavity. As soon as the cavity transducer is exposed to the melt and the IMP starts to reach set point, the pressure signal is processed at a very high speed into the Intellimold™ controller. The core variable is modified to limit and reduce the Nozzle melt to the level of IMP or controllable difference.

Based on these conditions, one does not have to set an injection velocity profile, no boost cut-off condition and no hold/pressure profile and hold time.

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Required Components:

For a basic ground-up integration, you will need a signal conditioning unit, and a sensor package. An optional pneumatic system is also available depending on the type and size of product you are molding.

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