



Why Intellimold???

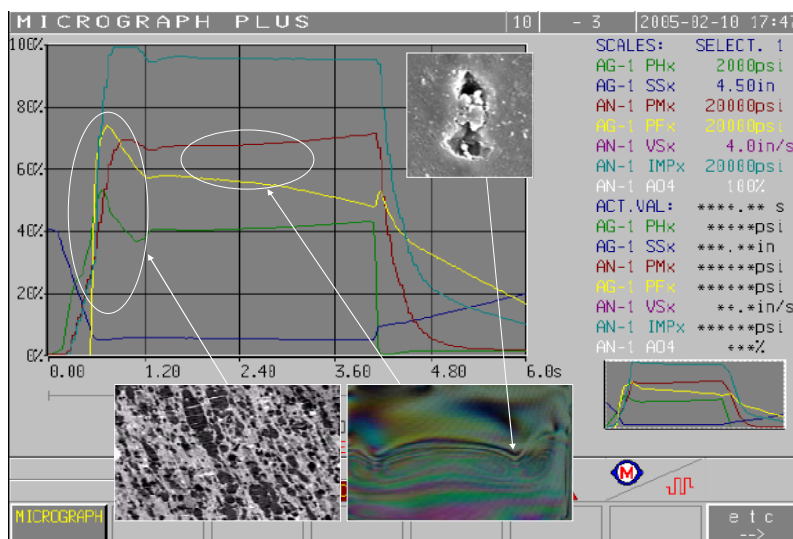
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Methodology:

What is Intellimold? Simply stated Intellimold is a complete real time closed loop system that gives you the ability to control molding processes from the materials point of view. This is accomplished by bridging the gap between material supplier molding recommendations and machine controls. Up to this point in time material suppliers deliver material to their customers with documentation that contains recommended processing conditions. These processing conditions are to be obeyed in order to reduce the opportunity of material degradation and deformation, which directly correlates to part performance. If you aren't familiar with these processing conditions they are listed and explained below.

1. Injection Pressures (1st stage = dynamic fill, 2nd stage = pack & hold)
2. Melt Temperature(s)
3. Injection Time(s)

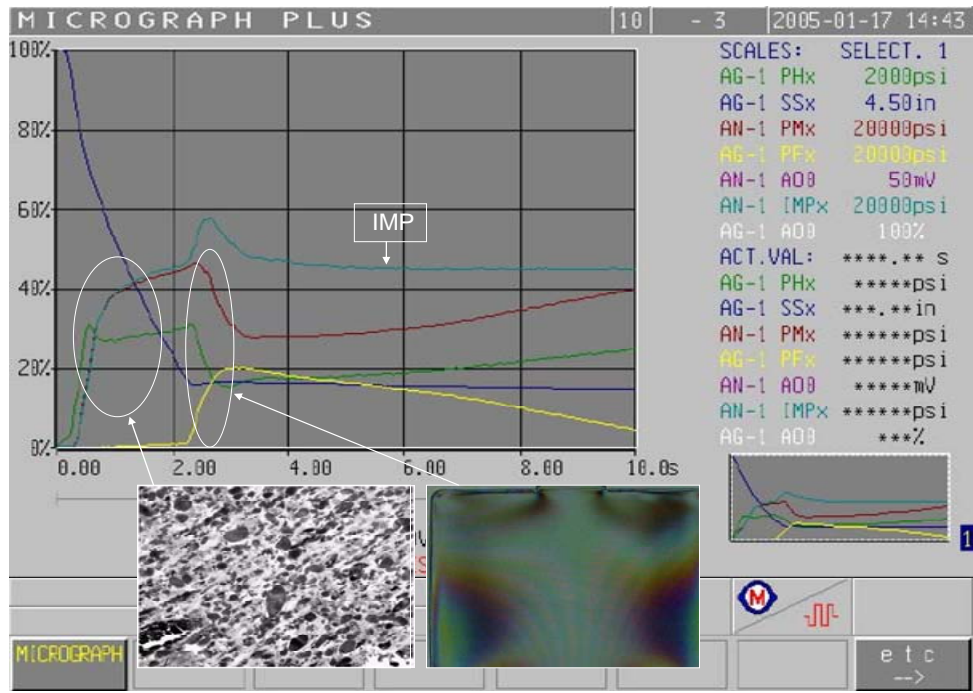
Melt temperature(s) and injection time(s) are parameters that are achievable because they are fixed values that you can directly input into an operator interface on the machine. Injection pressures are a different story, conventional molding attempts to achieve recommended injection pressures by means of a velocity profile. However, this is a false practice because a constant velocity does not correlate to a constant internal melt pressure due to the non-linear behavior of the material. A few common results of a velocity profile include; linearization of the polymer during the dynamic fill stage up to 10:1 in comparison to the pre-molded spherical structure, residual stress & micro cracks from the pack and hold stage, and excessive shear (See fig. 1).



(Figure 1)

The key in molding is to control the internal melt pressure in real time in order to give the material optimal molding conditions to solidify in a state of designed morphology. Internal melt pressure is a combination of shrinkage forces, resistance of the tool steel and resistance of the air that is trapped in the tool.

Internal melt pressure is relentlessly varying throughout the cycle and Intellimold compensates for these variations in real time by oscillating the proportional control valve allowing more flow when there is a drop in pressure and restricting the flow when there is an increase in pressure, thus maintaining a constant IMP. When the flow front reaches the last place to fill you can control the degree of reduction in applied pressure at the nozzle through a process factor. This is done to equalize the pressure at the nozzle and the last place to fill, which satisfies the material suppliers 2nd stage pressure recommendations. The process factor allows you to compensate for the non-linear behavior of the material and variances in complex part geometries. This is required in order to achieve the most effective conditions for the material to relax into its designed low stress environment while in the molten state (see figure 2).



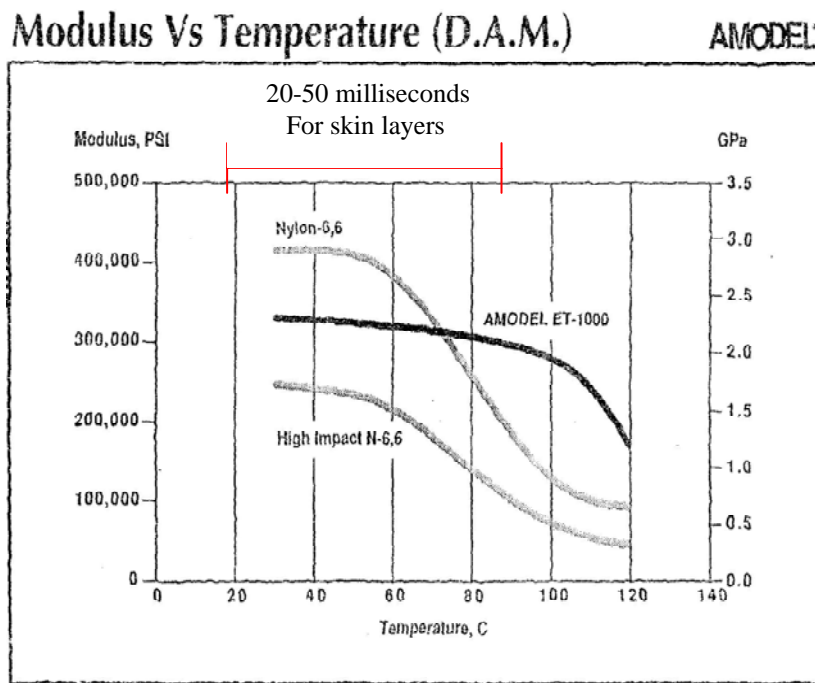
(Figure 2)

Technical Description:

Real time pressure readings are acquired from either pressure or pressure & temperature transducers. One transducer is placed in the nozzle body and one transducer is placed in the cavity (last place to fill). Users can utilize piezoelectric transducers and/or strain gauge transducers. The signals from these transducers are scanned every millisecond and from these signals a process variable known as IMP or internal melt pressure is mathematically derived. This variable is then compared to a set-point and subsequently a signal is sent to the proportional control valve to compensate for changes in material viscosity and variances in complex part geometries. To a novice this technology may appear to be rather slow when actually it is quite the contrary. Intellimold has the ability to automatically influence a cycle 1000 times for every second of fill time (1 sec. = 1000 updates, 2 sec. = 2000 updates, etc...).

Material:

Leaving your material unattended for more than 30 milliseconds while subjected to temperature and pressure during fill, pack, and hold is permanently damaging to the material (see fig. 3). What the previous statement means is that when you are carrying out a cycle it is necessary to have concurrent feedback from the material to compensate for the skin layers passing through the T_g (glass transition). A conventional cycle disregards this occurrence, thus further linearizing the molecular structure of the surface causing irreversible degradation and deformation to the skin. Skin degradation, skin deformation and micro cracks created from conventional molding are stress concentrators that adversely affect part performance.



(Figure 3)

Summary:

Intellimold is a tool that allows you to bridge the gap between material supplier recommendations and machine controls thus taking the guesswork out of molding. This tool allows the user nanometric control in millisecond resolution.

Questions or Comments?

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