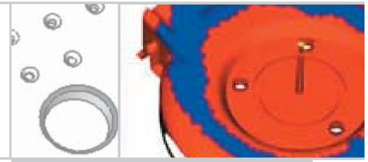
MPI/Simulations for Alternative Molding Processes



Moldflow Plastics Insight simulations for alternative molding processes extend the filling and packing analysis capabilities of MPI/Flow to simulate the co-injection, injection-compression and Microcellular (MuCell®) molding processes using thermoplastic materials.

It is now possible to analyze and optimize these alternative processes with proven Moldflow technology and evaluate the manufacturability of plastic parts using these processes compared to traditional injection molding.

Capabilities

Supported Model/Mesh Types:

- Finite-element midplane models

Supported Model/Mesh Types:

- Requires MPI/Flow
- Links to MPI/Cool
- Links to MPI/Fiber
- Links to MPI/Warp

FEATURES:

- Mold filling is modeled by the generalized Hele-Shaw flow of a viscous polymer melt under non-isothermal conditions
- Numerical solution based on a hybrid finite-element/finite-difference method for solving the pressure, flow, and temperature fields, and a control volume method to track moving flow fronts
- Comprehensive, 7-constant Cross-WLF viscosity model accounts for the effects of temperature, shear rate and pressure
- Definitive, 13-constant, 2-domain Tait equation pvT model captures the effects of temperature and pressure on density (specific volume)
- Accurate prediction of juncture pressure loss (due to abrupt change in runner/gate size) using Bagley correction
- Incorporates a conjugate-gradient (CG) pressure solver, the fastest and most accurate technology available for filling simulations

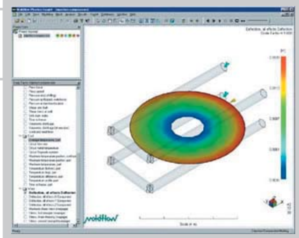
MPI/Co-Injection:

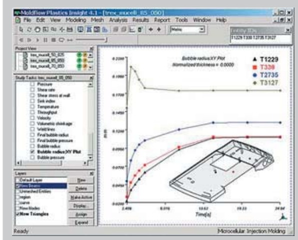
Co-injection is an ideal molding process for using recycled materials or achieving specialized cosmetic and structural objectives. MPI/Co-Injection provides an invaluable tool for simulating the sequential co-injection process, where a skin material is injected first, followed by the injection of a different core material.

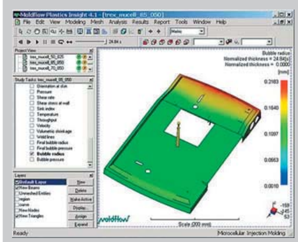
You can view the advancement of the materials in the cavity and see the dynamic, changing relationship between skin and core materials as filling progresses. Equipped with MPI/Co-Injection results, you can optimize the combination of two materials while maximizing the overall performance/cost ratio for the product.

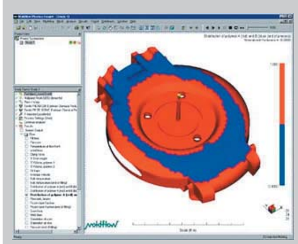
MPI/Co-Injection Allows You To:

- Evaluate the flow front pattern of two co-injected materials to aid in part design and gate placement
- Predict the extent of penetration of the core material and whether it will break through the skin material
- Determine injection pressure and clamp force requirements for proper molding machine selection
- Balance and minimize runner systems to achieve uniform cavity filling with reduced scrap or regrind material
- Determine the best transition point for switching from skin-material injection to core-material injection
Accurately identify weld and meld lines based on part design and gate placement

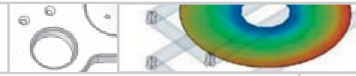








MPI/Simulations for Alternative Molding Processes Features



- Place gate locations to minimize injection pressure and clamp force
- Simulate different inlet melt temperatures for skin and core materials
- Automatically incorporate the recommended ram-speed profile from MPI/Flow to reduce overshearing of the plastic during filling
- Accurately identify weld and meld lines based on part design and gate placement

MPI / MuCell:

Microcellular (MuCell®) injection molding is a process in which a supercritical fluid (SCF) such as carbon dioxide (CO2) or nitrogen (N2) is mixed with molten polymer and injected into the mold to produce microcellular foam. Such foams have cell sizes ranging from 5-100 microns and exhibit superior properties compared to other foaming systems. The addition of SCF to the polymer melt reduces the melt's viscosity. Consequently a lower injection pressure is required and hence smaller machines may be used with this process. The clamp tonnage requirement is further reduced due to the fact that hydraulic pressure is not required to pack out the mold.

An amount of material is injected in the mold that is less than the part volume. Nucleation of cells and the subsequent cell growth cause the part to be packed out. Benefits of the MuCell process include lighter parts, improved dimensional stability, lower cycle time, and reduced warpage. In addition, due to the reduction in viscosity, MuCell is highly suitable for thin walled molding.

With MPI/MuCell, you can evaluate the feasibility and benefits of using this process versus traditional injection molding. Additionally, you can optimize the part design and the process settings by reviewing the various analysis results.

MPI/MuCell Allows You To:

- Evaluate the flow front pattern before and after the foaming (nucleation) begins
- Establish the volume of plastic and gas mixture (shot size) required to prevent short shot and achieve the desired part weight reduction
- Determine the initial concentration of the supercritical fluid in the polymer to prevent short shot and achieve desired cell size
- Predict the cell size variation through the thickness and as a function of time to achieve desired cell size
- Predict the cell pressure to ensure it is not too high to cause part warpage
- Link to MPI/Cool to evaluate mold cooling with the influence of the microcellular foam and minimize cycle time
- Link to MPI/Warp to estimate mechanical properties, part shrinkage and warpage due to the influence of cell distribution and cell size

MPI / Injection Compression:

The industry push for thin-wall and low-pressure molding is a perfect match for injection compression molding (ICM).

MPI/Injection Compression simulates all major process control schemes for a total evaluation of candidate materials, part design, mold design, and process conditions. You can simulate processes where polymer injection and mold compression occur simultaNeo™usly or sequentially. You can also program the compression phase to begin before, during, or after polymer injection using timer controls built into the software.

MPI/Injection Compression Allows You To:

- Evaluate the flow front pattern resulting from both material injection and compression due to mold closing
- Evaluate molding feasibility of extremely thin-wall parts
- Determine injection pressure and clamp force requirements for proper molding machine selection
- Display injection pressure at any point within the cavity at any time during the filling stage
- Place gates to minimize injection pressure and clamp force
- Graphically display the degree of frozen skin at all locations in the cavity at any time during cavity filling and packing
- Determine when the gate freezes to avoid unnecessary packing time
- Determine areas of high volumetric shrinkage and potential sink marks
- Accurately identify weld and meld lines based on part design and gate placement
- Accurately identify air traps for proper mold venting
- Vary the initial mold open distance prior to the compression stage
- Control the time to begin compression of the mold cavities: before, during, or after the injection of polymer
- Profile mold closing speed and distance settings during the compression stage
- Incorporate the recommended ram speed settings from MPI Flow for the injection stage
- Simulate combinations of hot and cold runner systems to optimize the flow pattern, pressure, and clamp force
- Simulate valve gate shut-off to avoid polymer back filling into the runner during the compression stage
- Use with both thermoplastic and thermoset materials.

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