

CELLMOULD®

Lightweight technology



CELLMOULD® is a process developed by WITTMANN BATTENFELD to manufacture structured foam parts through direct gas injection with physical foaming agents. Structured foam components feature a compact shell with a foamed core. CELLMOULD® lightweight technology enables the production of extremely light, highly rigid parts without sink marks.

WITTMANN BATTENFELD has more than 40 years of experience in structured foam technology and several hundred injection molding machines in operation for this purpose worldwide. More than 30 years ago, WITTMANN BATTENFELD was already manufacturing machines with direct gas injection technology to produce, for example, interior automotive parts.

The objective of CELLMOULD® lightweight technology is to produce both thin-walled and thick-walled structured foam parts with reduced weight and a fine, even foam structure. This is achieved with a continuously refined and optimized machine and process technology from WITTMANN BATTENFELD.

Material benefits of CELLMOULD® lightweight technology

- Reduction in weight.
- Reduction of frozen-in stress.
- Prevention of sink marks.
- Reduction of warpage.
- Narrow tolerances.
- Greater flow lengths through reduced viscosity.
- Higher rigidity with the same weight.
- Lower clamping forces.
- New scope for design.

Foaming agent systems

Either chemical or physical foaming agents are used in the production of structured foam parts. Chemical foaming agents are added to the plastics granulate in the form of master batches, powders or liquids. The foaming agent reacts by releasing gas, which is dissolved in the melt. When injected into the mold, the melt containing the foaming agent expands and fills the entire

cavity. The foam structure forms inside the molded part. Gases or liquids are used as physical foaming agents, which are injected into the barrel. The foaming agent used in the CELLMOULD® process is nitrogen. This technology is ideally suited for manufacturing light, structured components.

Machine equipment package for CELLMOULD® lightweight technology



CELLMOULD® screw and barrel

The screws have a length of 25 L/D. The barrel is equipped with drillings for the pressure and temperature control sensors, and the gas injector.

Gas injector

The gas injector injects the gas directly into the barrel. The CELLMOULD® screw has a special geometry to ensure intensive mixing of the injected gas with the melt.



Gas flow regulator module

In the discontinuous injection molding process with a reciprocating screw, special attention must be paid to the quantity of injected gas under the desired pressure. WITTMANN BATTENFELD has developed a special gas flow regulator module for CELLMOULD® to ensure controlled gas injection.

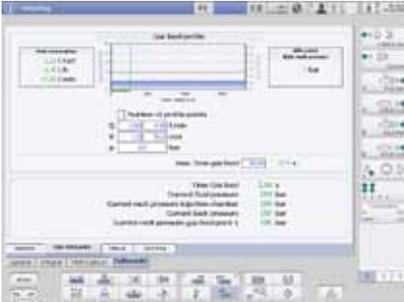
Needle shut-off nozzle

Pneumatic needle shut-off nozzles are used to prevent leaking of the melt with the foaming agent.

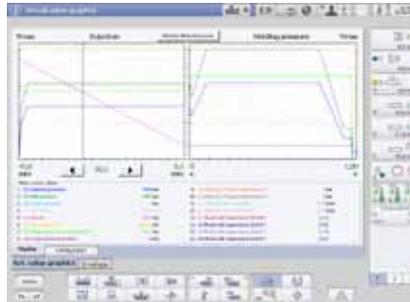


CELLMOULD® control system

Control and regulation of the CELLMOULD® process are integrated in the machine's UNILOG B6P control system. All parameters are set via the machine's control system and displayed on the screen. Separate control cabinets in front of the machine can be dispensed with, and all injection parameters for CELLMOULD® are saved together with the machine data.



Parameter settings for CELLMOULD®



Actual values graph for CELLMOULD® and machine parameters

Compressor units/Hydraulic accumulators



Combined nitrogen generator and compressor unit

Compressor units

For CELLMOULD®, the same equipment as in AIRMOULD® is used for nitrogen and pressure generation. Each compressor unit can supply several machines with nitrogen.

Hydraulic accumulator

Depending on the parts geometry and the material, extremely low densities with an even foam structure and good surface properties can be achieved by extremely high-speed injection.



Optional hydraulic accumulator for high-speed injection

Advantages of CELLMOULD® lightweight technology



Crossbar, PP with 20 % TV, compact



CELLMOULD®: no warpage, 5.4 % lighter, 16.7 % faster

Parts with low warpage

Since the gas takes over the function of holding pressure, the parts have only little frozen-in tension. The gas also prevents sink marks opposite ridges and with wall thickness variations.

High rigidity

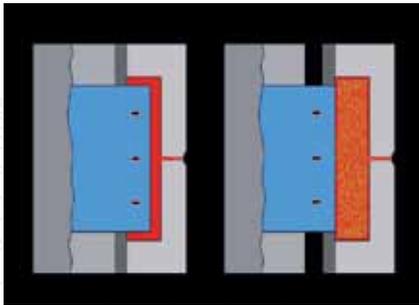
Compared to compact injection-molded parts of similar weight, structured foam parts are more rigid thanks to a greater wall thickness. This is not determined by the size of individual cells, but rather by the connection of both compact surface layers with an even foam structure.



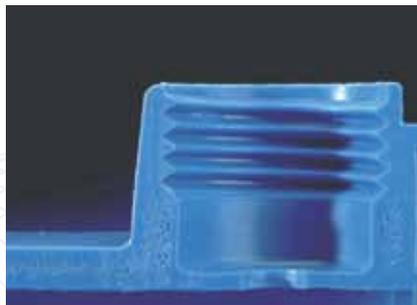
PA 6 with 30 % GF, 8 % lighter than compact version



Thick, compact outer shell with foam for flexural rigidity



Left: injection with a low initial wall thickness
Right: breathing until the final wall thickness has been reached



With back pressure: the foam structure forms as a result of volume contraction.

Photo: courtesy of Kunststoff-Institut Lüdenscheld

Improved surfaces

The slightly rough surface resulting from this process can be improved by special mold technologies:

- Breathing mold: injection into a low wall thickness which is subsequently expanded.
- Gas counter pressure process: injection against counter pressure in the tightly sealed mold.

Perfect surfaces

Through variothermic mold tempering with BFMOLD® technology in combination with WITTMANN temperature controllers from the Vario series, the mold is heated with water within a few seconds and subsequently cooled. The part surfaces reproduce the cavity surface with high accuracy.



Display: insert-molded glass panel, 2 mm, with variations in wall thickness

Photo: courtesy of Kunststoff-Institut Lüdenscheld



Cross-section of molded part. A perfect surface thanks to BFMOLD® and a structured foam core

Photo: courtesy of Kunststoff-Institut Lüdenscheld



Fracture pattern of thick-walled part made of PBTGF 30, 66 % lighter

Photo: courtesy of BARLOG plastics



Part on the left: plate made of PS, 3.5 mm, 22 % lighter / Part on the right: breathed from 3.5 to 8.5 mm, 66 % lighter

Highly rigid lightweight structures

CELLMOULD® lightweight technology is an effective way to manufacture light, thick-walled components. The "breathing core" technique is a method for producing extremely light, rigid parts. The melt is first injected into the reduced wall thickness, which is then wholly or partly expanded.

Co injection with CELLMOULD®

Using combinations of different types of material, reinforced or non-reinforced, with compact shells and foamed cores, lightweight parts can be produced with an excellent surface and custom-made product attributes.



Compact surface with foamed core: shell and core made of one material or of different materials



Wall thickness expanded by breathing core: 50 % lighter