Structural Foam Technology

Processes - Applications
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• Introduction
• Low Pressure Processes
• Gas Counter Pressure Process
• Multi - Component Injection Molding Process
• MuCell™ - Process
• Battenfeld Know How
Structural foam Technology

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Introduction

Compact skin

Foamed core

scaled up cross section of a structural foam molding
Introduction

Structural foam technology is used for about 40 years.

Elimination of sink marks by adding a small amount of blowing agents (i.e. baking powder)

Foam structure in core when adding more blowing agent

The pressure of the blowing agent works as holding pressure
Introduction

Advantages with structural foam:

• No sink marks
• Weight reduction
• No or low warping
• High rigidity
• Low internal stresses
• Viscosity reduction by blowing agent
• Reduced clamping forces
Introduction

Types of blowing agents used:

- chemical blowing agents
  - endothermic
  - exothermic
  - endo - exothermic
- physical blowing agents (Mucell™)
  - $N_2$
  - $CO_2$
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Low Pressure Injection Molding Processes

Injection into vented cavity
Short filling with plastic, complete filling by means of expansion of blowing agent
Blowing agent works as holding pressure
Very short filling times are mostly favorable
Low Pressure Injection Molding Processes

Cross section of a typical structural foam molding, PS
What is preferable:

Fast Injection?

Slow Injection?
Low Pressure Injection Molding Processes

Cavity filling with a mold having a window

PS: Slow filling
Slow motion 30 times

Big lost of blowing agent already when filling
Cavity filling with a mold having a window

PS: Extremely fast filling
Slow motion 30 times

Injection of melt is done after roughly 0.03 sec, die complete filling is done by foaming
Low Pressure Injection Molding Processes

Foam structure
Very short filling times are mostly favorable
Influence of filling time to foam structure for PC moldings

Filling time a) = 0.3 sec
Filling time b) = 0.6 sec
Filling time c) = 1.2 sec
Filling time d) = 1.5 sec
Use of chemical blowing agents

Reinforced polymers: Very fine cell structure

Very fine cell structure with chemical blowing agents: PS
Structural foam Technology

Low Pressure Injection Molding Processes

Applications

Less warping with structural foam
Low Pressure Injection Molding Processes

Applications

Less warping and smaller tolerances with structural foam
Structural foam Technology

Low Pressure Injection Molding Processes

Applications

Telephone kiosk
Material PC-GF
Weight 60 kg
Low Pressure Injection Molding Processes

Machine technology

Structural foam machine for production of telephone kiosks
vertical clamping unit, clamping force 26,000 kN
3 injection units with melt accumulators and nitrogen over oil
accumulators for rapid injection
Structural foam Technology

Low Pressure Injection Molding Processes

Machine technology

Structural foam machine for production of telephone kiosks
vertical clamping unit, clamping force 26,000 kN
3 injection units with melt accumulators and nitrogen over oil accumulators for rapid injection
Low Pressure Injection Molding Processes

Machine technology

Structural foam machine for production of telephone kiosks
vertical clamping unit, clamping force 26,000 kN
3 injection units with melt accumulators and nitrogen over oil accumulators
for rapid injection
Low Pressure Injection Molding Processes

Process

Molds with expanding cores
Better surface quality by injecting in lower wall thickness

Core in forward position
Complete filling with melt

Core in backward position
foaming of the melt in skin
lower density in the core
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Gas Counter Pressure Process

Battery housing, PP

Foam structure in the core is formed as compensation of volume shrinkage of the polymer
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Multi - Component Process

Two - Component Injection Molding

Multi - Component Injection Molding

Sandwich - Molding

Co-Injection

Different names for the same process
Structural foam Technology

Multi - Component Process

Foamed core

Compact skin
MuCell™ - Process

MuCell- Process:

Micro cellular foam means fine regular cell structure:

Injection of a physical blowing agent into the barrel:
The blowing agent is maintained under pressure and kept in solution.

Blowing agents:
Nitrogen or CO₂
Structural foam Technology

MuCell™ - Process

Foam Structure
Foam Structure of glass fiber reinforced plastic
MuCell™ - Process

Applications

Advantages with MuCell™
Weight reduction 22%

Bowl, PP
Wall thickness 2 mm
Structural foam Technology

MuCell™ - Process

Applications

Advantages with MuCell™
Weight reduction 6 %
Reduction of clamping force from 9500 kN to 6500 kN
Reduction of warping

Traverse
ABS, 900 g
Structural foam Technology

MuCell™ - Process

Applications

Advantages with MuCell™
Weight reduction
Reduction of warping

Housing
PS
MuCell™ - Process

Machine technology

Injection molding machine equipped for MuCell™
- Screw length 22 D with special design
- Barrier screw with mixing elements
- Hydraulically operated shut-off nozzle
- Nitrogen over oil accumulator for rapid injection
- Software for MuCell™
Structural foam Technology

MuCell™ - Process

Machine technology

Pressure generation unit for N\textsubscript{2} and CO\textsubscript{2}
Structural foam Technology

MuCell™ - Process

Machine technology

Multi-component injection molding machine
B side provided for MuCell™
Structural foam Technology

MuCell™ - Process

Machine technology

Gas injection valves
Structural foam Technology

MuCell™ - Process

Machine technology

Nitrogen over oil accumulator for rapid injection:
350 mm/sec
For perfect surface quality:

Combination of MuCell™ with gas counter pressure process

Combination of MuCell™ with multi-component injection molding
Structural foam Technology

MuCell™ - Process

Multi-Component Injection Molding with MuCell™

Advantages with MuCell™
No Warping
Weight reduction 10 to 15 %
Lower clamping forces

Panel: 520 x 520 x 2 mm, PP
Skin - core - ratio 50 to 50 %
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Battenfeld Know How

Battenfeld has more than 30 years practical experience with structural foam with chemical and physical blowing agents.
Many thanks for your attention

more information under www.battenfeld.ru