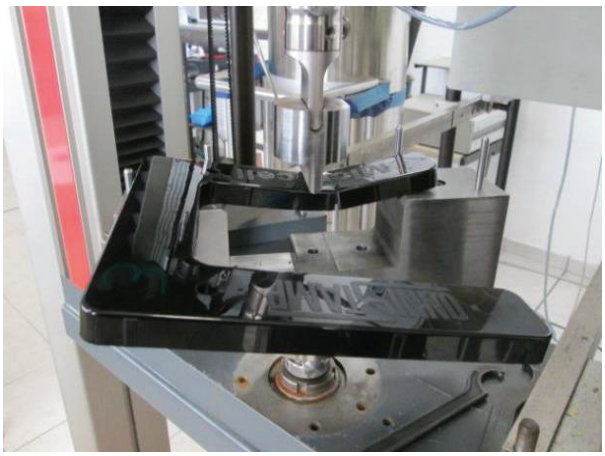
Case Study: Proplast

Accurate Modeling Reinforced Plastic Parts using MuCell(c) with Moldex & Digimat & Marc

Summary

Proplast launched a research program to support industries in the evaluation and finetuning of the innovative microcellular molding process. Inside the project, have been assessed and tested the simulation tools to support designers from the process simulation to the final structural verification.

The methodology of CAE analysis, which was developed and assessed at Proplast's, allows to accurately and reliably simulate the Mucell microcellular injection moulding process, the quality and morphology of expansion and the ultimate mechanical performance of the moulded part.
The flow simulation of Mucell components performed provides optimised process parameters and global moulding quality (possible weight reduction, volumetric shrinkage, sink marks and warpage) as well as local microstructural description of the cellular structure (size density and distribution of cells).



Accurate component's mechanical prediction

“A good predictive coherence has been observed regarding the here-mentioned study as far as process, Mucell expansion, weight reduction ability, warpage and structural performance are concerned.”

- Andrea Romeo, CAE Manager, Proplast
Project: Microcell - Partners: Maip, Mopla, Mista, Onni-stamp, Cornaglia

Challenge

The microcellular molding process allows to get plastic components with excellent mechanical properties, as internal voids has homogeneous distribution, reducing the residual stress. These benefits are more relevant on thin components, where deformation can be reduced.

To get these results the manufacturing parameters must be considered all along the design process, and new technology must complement traditional tools, defining a new design approach.

Solution

- Moldex 3D to simulate full molding process, getting a detailed mapping of voids size and distribution inside the matrix.
- Digimat to characterize the microcellular material model and map mechanical properties from the molding simulation to the structural verification
- MSC Marc to verify the mechanical behavior of the final part.

Results/Benefits

The results of the process simulation can be used to build, using Digimat, a material model sensitive to microstructure which is finally mapped into FEM models to run a wide range of highly-accurate structural simulations such as static, dynamic, vibrational simulations.
The workflow here highlighted allows to get, via a completely virtual and therefore quick and cheap approach, a large set of information suitable for part performance analysis (mouldability, conformity to specs and requirements, evaluation of the mechanical behaviour in operation etc.) and for economic analysis (investments, productivity, production costs, material and energy consumption).

Identified a consistent methodology to design new components considering the impact of the microcellular molding, getting information on:

- Material model sensitivity to microstructure
- Accurate Stiffness/ strength prediction
- Accurate Prediction of the component’s performance.

Key Highlights:

Digimat:
Digimat-MF, Digimat-MX, Digimat-MAP, Digimat-CAE

Customer:
proplast
PLASTICS INNOVATION POLE

CAE Technology:
MSC Marc, Moldex3D, ...

Industry:
R&D and Research, Automotive

Application:
Mucell

Performances:
Stiffness & strength, lightweight

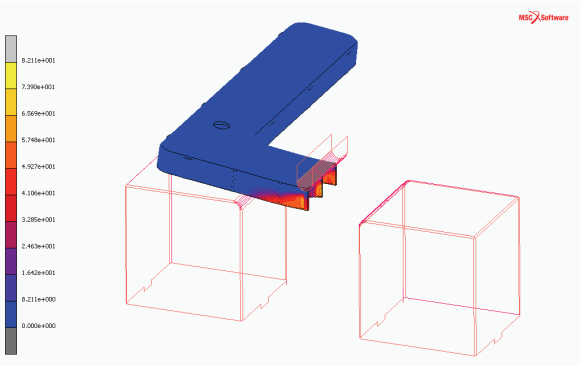


Figure 1: Von-Mises stress distribution computed in the 3-point bending simulation of Mucell component

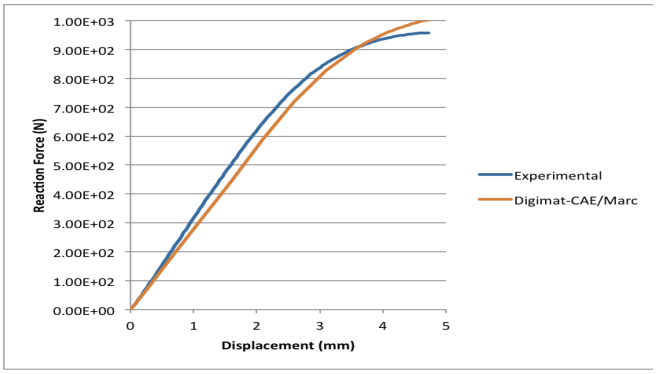


Figure 2: The multiscale material modelling approach used in the simulation leads to a perfect match between prediction and experiment

For more information on Digimat and for additional Case Studies, please visit www.e-Xstream.com

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