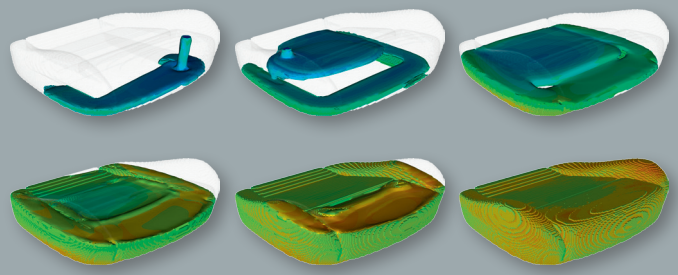

SERVICES AND CONTACT

Fraunhofer ITWM

FRAUNHOFER INSTITUTE FOR INDUSTRIAL MATHEMATICS ITWM

Required Input Data for PU Foam Simulation

Even though the expansion of polyurethane foams is a very complex process, we can start our simulations with only a small amount of information from simple foaming experiments performed in cylindrical tubes of different diameters. The minimum required information includes:

- the timing of the volume of expanding foam in each tube
- the temperature of the expanding foam, measured at a specific point in the containers
- the physical geometries of interest and other general process conditions
- the viscosity of the polymer emulsion before expansion

The Software Platform

- offers a user-friendly graphical user interface
- provides an integrated preprocessing tool for CAD-3D data
- enables interactive postprocessing using free software in *.vtk format
- uses multicore computing technology
- runs on Windows and Linux operating systems

General Services

The FOAM simulation can be supplemented or combined by our expertise in the field of numerical simulation of complex flow behavior, e. g. with our FLUID solver:

- Single-phase, free surface and multi-phase flows
- Injection molding and extrusion of fibre-reinforced materials
- Powder injection molding with particle migration
- Flow simulation of concrete formation process
- Coupling with granular flow simulation GRAIN
- Fast implementation of special rheological models and additional effects
- Scientific consulting for industrial flow problems with complex material behavior

Contact

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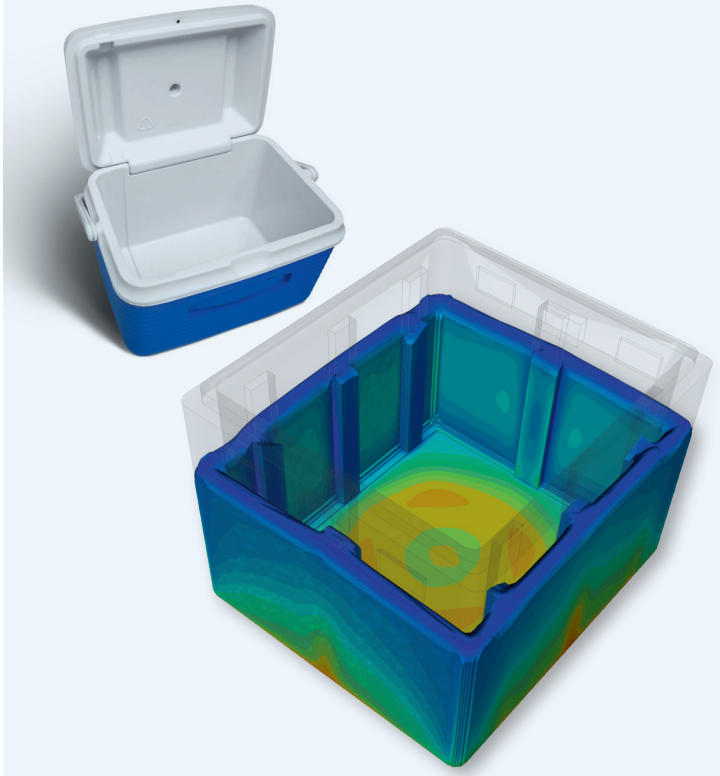
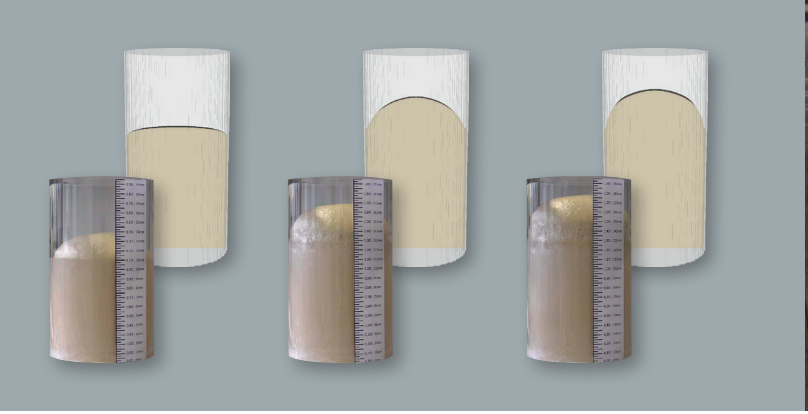
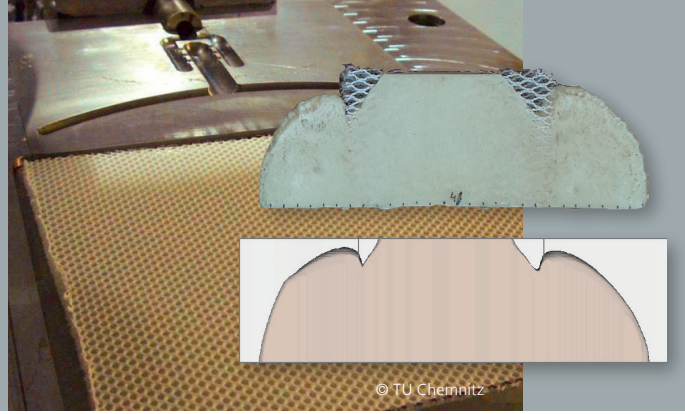
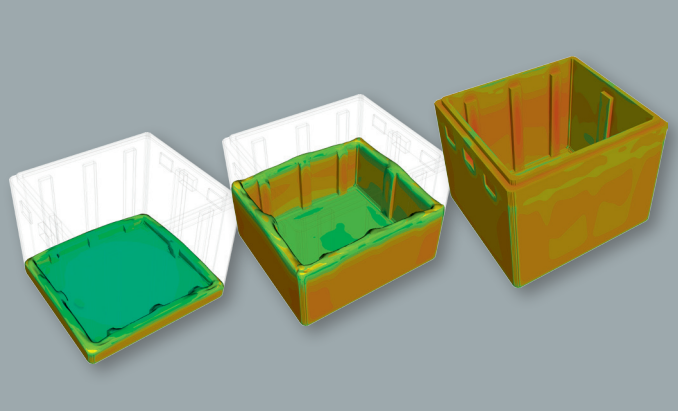
FOAM – SIMULATION OF PU FOAM



FOAM







Simulation of (PU) Foam Expansion Process

Polyurethane (PU) foam products exhibits various properties that makes them attractive for a wide variety of applications. They are useful in shock applications, acoustics and thermal insulation. Industries such as the automotive, aircraft, refrigeration, construction and packaging industries in particular benefit from these features in fabricating cost-effective products.

Our FOAM solver simulates the expansion process of PU foams in any given geometry and offers the possibility to calculate the foam formation process as well as the resulting foam density in closed molds in advance. In order to estimate the necessary parameters for the foam model, targeted ascent experiments in cylindrical containers with integrated temperature measurement are sufficient. On this basis, the model parameters are determined and used directly to simulate complex filling processes.

FOAM supplies:

- Flow pressure, velocity, temperature distribution
- Local foam density, degree of curing, gas content, spread of foam front

Simulation of Reaction Injection Molding Processes

The RIM (Reaction Injection Molding) process of PU foam mixture is commonly used in manufacturing certain lightweight structures. Due to their low density and improved physico-mechanical properties, reinforced PU composite materials are good substitute for heavy structural or mechanical systems.

FOAM simulates the RIM infiltration process of PU foam as well as its expansion through porous textile reinforcing structures (so-called structural RIM or S-RIM). Complicated requirements for mold filling such as vent locations, inlet position, amount of material needed to fill the cavity and the necessity to avoid entrapment of gas in the mold can be predicted by FOAM for both RIM and S-RIM. The simulation platform is an excellent tool for the design and optimization of RIM processes.

FOAM also supplies:

- Local foam density, foam front spread, degree of impregnation of the textile reinforcement structure
- Design information for the paths of the injection nozzles and the vent valves in mold design

Simulation of Industrial Foaming Processes

The major advantage of numerical simulation of industrial processes is to optimize product design and reduce production time. For example, FOAM can be used as a process tool to optimize the manufacturing process of cooling boxes or car seats. Different foam material and process design variants for the production of PU foam parts can be evaluated in advance using FOAM. The solver simulates PU foam processes on an industrial scale. The software is also able to predict the expansion of PU foam in continuous processes, such as the manufacture of sandwich panels with PU foam cores, and serves as a practical tool for process and product optimization.

FOAM simulates:

- Foaming of various PU foams (soft foam, rigid foam) in complex geometries
- Design of foam molds (path of injection nozzles, position of venting)
- Process design of continuous foaming processes (web material, sandwich panels…)
- Design of textile-reinforced PU foam composite structures