

Master's Thesis, Bachelor's Thesis, Term Project

Numerical investigation of the flow behavior of recycling Bulk Molding Compound with varying obstacles in automotive parts

Bulk Molding Compounds (BMC) is a type of long-fiber reinforced material, typically consisting of an epoxy or vinyl ester resin and 25 mm long glass or carbon fibers. The components are mixed, allowing the assumption of 3D isotropy, and put into a heated mold, where the bulk is compressed. Due to the high temperature, that decreases the viscosity significantly, the material flows into every cavity and fills even a complex part completely. This potential for complex shapes together with a very short cycle time of around 5 minutes have made this process wide spread in the automotive industry. Furthermore, it also has a great recycling potential, as the scrap from parts with endless fibers can be chopped to shorter strands. However, these recycled fibers have lower mechanical properties than new ones, making it necessary to integrate additional endless fibers and other inserts in the main load direction. These inserts constitute flow obstacles, making a complete and defect free filling more difficult. In order to save resources and time, this process can be simulated with the commercially available simulation software 3DTimon.

The aim of this Thesis is to perform process simulations for BMC parts made with recycled carbon fibers and resin, integrating unidirectional reinforcement fibers and inserts as flow obstacles. These results shall be compared to simulations with a commercially available Sheet Molding Compound material that typically shows 2D isotropy in the sheet plane.

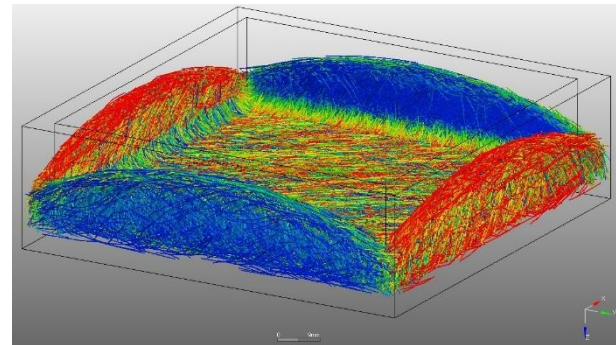


Figure 1: Rear door frame made of SMC [Toyota]

Figure 2: Flow and fiber orientation simulation in 3DTimon

Research Focus of the Thesis

- Literature research on SMC/BMC flow simulation with obstacles
- Definition of the material cards
- Design of Experiments with suitable simulative setups for the comparison
- Comparison of the outcomes of the simulations
- Documentation

Requirements

- Structured and precise way of working
- Experience with process simulation and CAD software is an advantage, but not a requirement

Starting date: Now

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