Fraunhofer ICT

Sheet Molding Compound

Material and process development at Fraunhofer

A material facing new challenges

Sheet molding compound (SMC) is one of the best-established material types within the group of thermoset composites. This is due to its formulation flexibility, the potential to mold large, complex structures with a high degree of functional integration, and the material's excellent mechanical performance and productivity. Tailor-made SMC formulations, allow optimal material performance for each target application.

However, recent developments toward increasing environmental responsibility present a challenge for SMC materials, especially in regards to resource efficiency, lightweight design and recycling. The recycling capabilities of thermoset materials such as SMC are extremely limited. New approaches are necessary to overcome this limitation. For lightweight applications, requirements regarding weight-specific mechanical performance are continually increasing. The SMC process is, however, prone to scatter, leading to insufficient consistency in material quality and relatively high scrap rates. Poor predictability of the resulting material performance means that the lightweight potential of SMC parts cannot be fully exploited.

Tailor-made materials and smart SMC processing

A data-driven approach enables optimized SMC processing. Intelligent process control and transfer of data throughout the whole SMC process chain, from the neat materials to the finished SMC part, lead to an improved process robustness and a better understanding of material properties-process parameter relations. This is enabled by next-gen SMC production equipment with extensive data acquisition and processing capabilities.

Fraunhofer ICT is developing new materials with novel resin systems and fiber types, aiming at high-performance applications. Playing into the strengths of the SMC process, Fraunhofer ICT also aims for a high degree of functional integration in part design to achieve optimal lightweight performance. Local continuous-fiber reinforcements are integrated into SMC parts by means of co-molding, reinforcing highly loaded part regions. Metallic inserts, such as fastener elements, may also be integrated. Further functionalization is possible through formulation modification, e.g. in order to achieve electromagnetic shielding and flame retardancy, both of which are important properties for SMC-based battery housings in electric vehicles.

Recycling of SMC parts can be achieved by using resin systems suitable for chemical recycling, or by introducing novel thermoplastic resins into the SMC process chain. Recycled carbon fibers in SMC as well as bio-based materials further improve the eco-footprint of SMC parts, pushing SMC further towards a circular economy.

The next generation in SMC production

With the next-generation SMC line CUBE 1600 by Schmidt & Heinzmann, Fraunhofer ICT is well-equipped to overcome any processing challenge. The holistic acquisition of process and material data generates in-depth process understanding. Adjustable line elements, including de-aeration-rolls, two impregnation zones, and multiple heating areas, offer precise process control for optimal material quality. Low-friction fiber feeding and a cutting unit optimized for carbon fiber enable robust production of carbon-fiber-reinforced SMC. Additionally, the line is equipped with an active feeding unit for textiles, e.g. for the processing of recycled carbon-fiber or natural-fiber nonwovens for prepreg production.

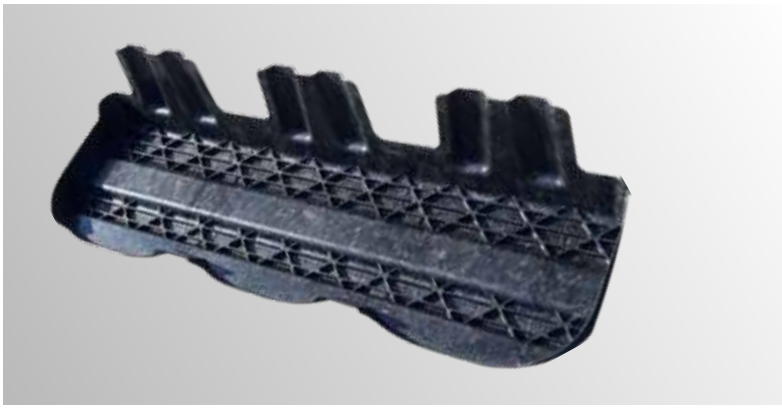
Features

- Acquisition of over 100 material and process-related parameters
- Universal cutting unit for up to 119 bobbins with low-friction fiber feeding
- Controlled high-precision doctor blades
- Active feeding of textiles
- Two independent impregnation zones
- Multiple heating zones, including impregnation zone

Our service offer

We offer our customers a variety of services, from baseline investigations, feasibility studies and part optimization through to procedural implementation. Fraunhofer ICT covers the full SMC process chain on an industrial scale, from the production of semi-finished materials to the compression molding of parts:

- feasibility studies incl. mech. testing
- benchmark trials
- material and process development
- consulting service in process and part configuration
- material production trials
- compression molding trials



Cover photo:
CUBE 1600 SMC production line

Above:
Carbon-fiber-based SMC for structural applications

Bottom:
Functional integration in SMC: Battery housing with metal inserts and local reinforcement

Contact

M.Sc. Sergej Ilinzeer
Phone +49 721 4640-797
sergej.ilinzeer@
ict.fraunhofer.de

Dipl.-Ing. (FH) Florian Wafzig
Phone +49 721 4640-145
florian.wafzig@
ict.fraunhofer.de

Fraunhofer ICT
Joseph-von-Fraunhofer Str. 7
76327 Pfinztal (Germany)
www.ict.fraunhofer.de