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1 *Core material: thermoplastic foam. Outer layers: continuous-fiber-reinforced polymer with thermoplastic matrix.*
2 *Core material: thermoplastic foam. Outer layers: continuous-fiber-reinforced polymer with thermoset matrix.*

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FIBER-REINFORCED FOAMS

LOCAL FIBER REINFORCEMENT IN PARTICLE FOAMS – SANDWICH COMPONENTS – LIGHTWEIGHT CONSTRUCTION – GLASS AND CARBON FIBER REINFORCEMENT – EXTRUSION FOAMS

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At present, thermoplastic foams are mainly used in the insulation, construction and packaging sectors, because the mechanical properties (pressure and bending strength) of pure foams limit their use in structural applications. Fiber-reinforced foams combine a low component weight with high specific strength and can be locally reinforced according to their requirement profile, thus enabling new approaches.

Advantages

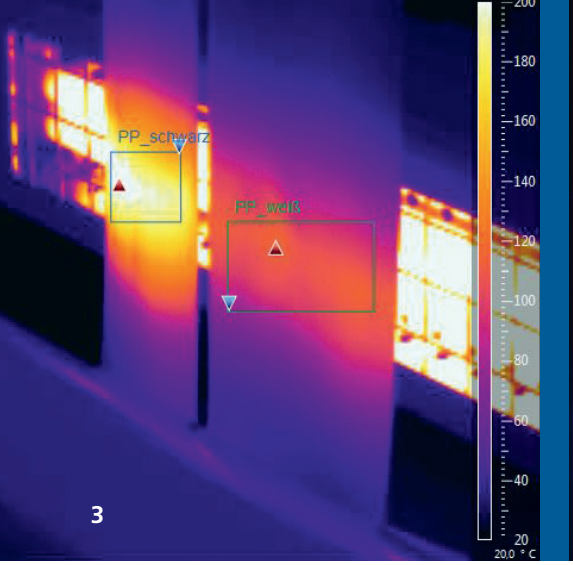
- High mechanical strength (pressure / bending stress)
- Material savings through high lightweight potential
- Local reinforcement

Production

At Fraunhofer ICT various methods for the fiber reinforcement of foams (particle and extrusion foams) have been established.

A variety of fiber geometries (e.g. winding/ honeycomb structures, loops) can be applied to the particle foam using our specially-adapted sintering process. At Fraunhofer ICT, molding production lines are available on a laboratory and industrial scale for the processing of tailored polymer compounds.

Using the Krauss Maffei Berstorff Schaumtandex laboratory line ZE 30/KE 60 in our pilot plant we can produce extrusion foams with various matrices in a continuous process. These can then be further proces-



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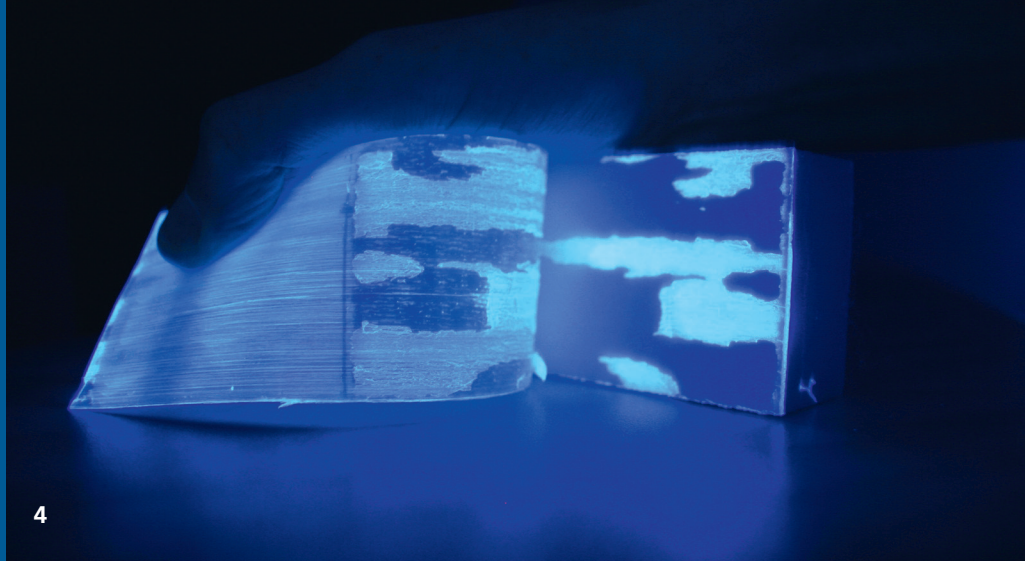
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sed into sandwich plates reinforced on both sides using a newly established technique. We can also use covering structures such as glass / carbon polymer tapes or foils.

Selection of fibers and fiber geometries

- Glass / carbon fibers in different polymer matrices (ABS, PP, TPU etc.)
- Woven fabrics
- Winding structures made of hybrid fibers (loops etc.)
- Tape non-woven fabrics (unidirectional, bidirectional etc.)
- Foils for reinforcement / surface treatment
- Natural fibers (hemp, sisal, jute etc.)

Investigation and characterization

The manufactured reinforced foams and foamed components are investigated and evaluated in the testing laboratories at Fraunhofer ICT. The following characterization methods are available:

- Mechanical value tests (traction, pressure and bending test)
- Fiber-matrix coupling, interfacial phenomena
- Climbing drum peel test
- Measurement of fiber length
- Light microscopy, REM

Application range

Reinforced foams, sandwich components and lightweight structures offer several advantages compared to unfoamed material. In transport engineering the high weight-specific bending strength leads to a significant weight reduction and thus lower CO_2 emission. In the construction industry, both the low weight and the integration of thermal and sound insulation play a major role.

Other fields of application:

- Components with high specific strength
- Automotive
- Lightweight construction
- Structural applications
- Decorative interior application

Our offer

- Material development for the production of tailored foams
- Production of sandwich structures
- Local fiber reinforcement
- Optimization of technical property profiles
- Process and material development
- Characterization of matrix materials and fiber-reinforced foams
- Tailored solutions

3 Infrared imaging of the heating curve of glass fiber tapes.

4 Mixed fracture of adhesive tape on extruded foams under UV radiation.