

Mono-material lightweight solutions

Morphology lightweight approach: enabling circular-ready components

Motivation and objective

In many cases fiber-reinforced polymers (FRP) are ideal for lightweight design. However, they are generally difficult to recycle and their hybrid structure as well as the inability to transform the reinforcing fibers back into continuous fibers inhibit a close-loop recycling. One possible alternative to conventional fiber reinforced composites are thermoplastic self-reinforced mono-materials. Their lightweight potential can be further increased by using specialized process technologies and combining them with thermoplastic foams.

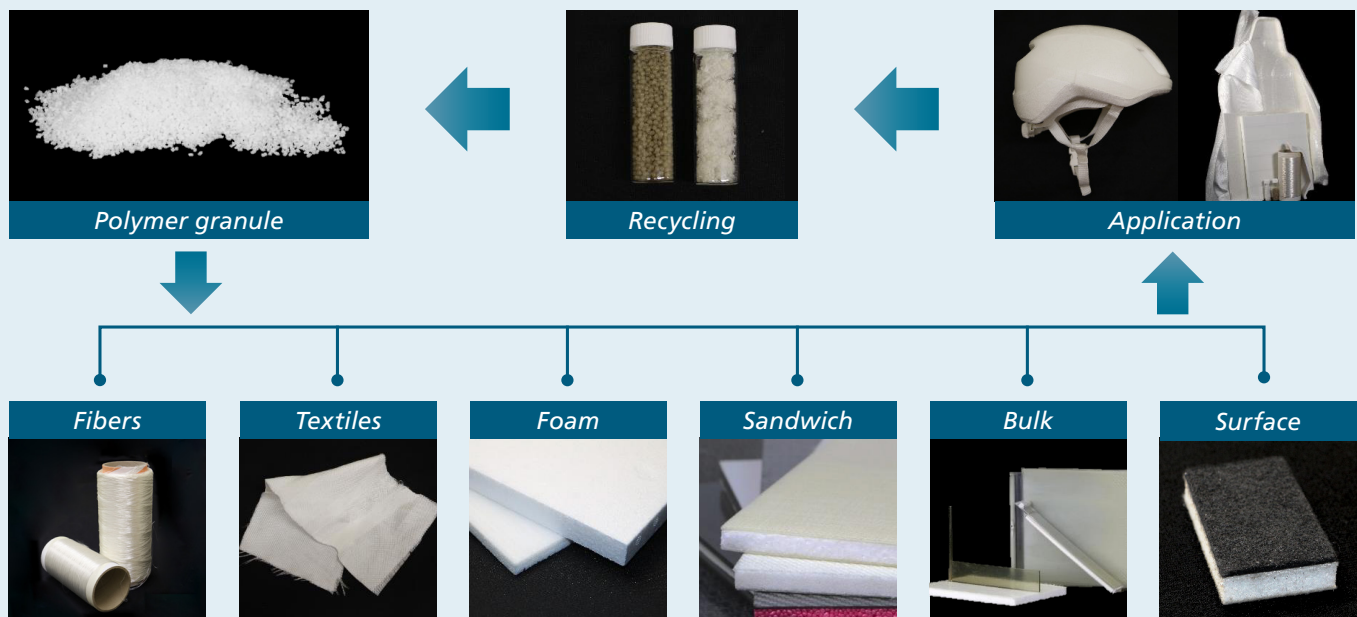
Materials and processes

Fraunhofer ICT is investigating processes for cores and face-sheets made from various materials. The work is carried out through parameter studies on industrial plants, paving the way for industrial transfer.

In addition to carbon and glass fiber-reinforced face-sheets, the focus is mainly on self-reinforced organo-sheets, in which fibers and matrix are based on the same polymer. The goal is to exploit the maximum lightweight potential from just one material. This is achieved through the combination of different material morphologies – foam, reinforcing fiber, textile structures, matrix, bulk material and surface. Depending on the respective requirements, the appropriate morphology building blocks are chosen. An example of this are mono-material sandwiches, which are characterized by their significant advantages in terms of recyclability and sustainability. For the core materials, both conventionally available materials and in-house developments in the areas of extrusion and particle foams are used to pursue an optimal property profile for application in the sandwich. Application specific parts can be achieved by tailoring semi-finished sandwich structures and processes.

*Picture above:
Selection of thermoplastic
sandwich materials.*

One material in different morphologies enables a circular-ready lightweight design



Morphology lightweight design in application

1. Definition of requirements
2. Choice and optimization of morphologies
3. Choice of processes, e.g. fusion bonding, overmolding, thermo-forming
4. Adaption of processes and morphologies
5. Manufacturing of a sustainable part

Our range of services

We offer our customers expertise in the following areas:

- Benchmark tests
- Feasibility studies
- Process development in fusion bonding, forming, and overmolding on industry-relevant equipment
- Consulting in process and component design
- Characterization of individual components and the composite
- Recycling trials

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