



# COMPLEX TEXTILE THERMOPLASTIC HOLLOW PROFILES FOR LIGHTWEIGHT APPLICATIONS

## Ideas on utilisation

For the implementation of crash-stressed lightweight construction structures, for example in vehicle construction, materials with a high specific energy absorption capacity are of advantage. For this purpose, especially thermoplastic fiber composites are predestined. At the Institute for Lightweight Engineering and Polymer Technology of the TU Dresden, innovative technologies for the production of cross-section resolved profile structures were developed and tested within the framework of various research projects. The starting semi-finished thermoplastic hybrid yarns are used, which allow fully automated low-defect preform production. In particular, the braiding technology here allows the production of textile reinforcements with very high drapability, whereby highly complex profile structures can be realized with strong contour jumps. Both the consolidation and shaping of the profile geometry takes place in a downstream variothermic blow molding process. Since the cavity pressures in the cavity yarn processing are very low, thin-walled, medium-temperature lightweight tools with very low heat capacity are used, ensuring rapid heating and cooling rates. In combination with an adapted tool carrier, it is possible to modularly assemble the consolidation station depending on the desired number of items. This makes an attractive processing technology available, especially for small and medium-sized series, which enables the load-oriented production of complex thermoplastic lightweight hollow sections.



Figure: Textile-reinforced single- and multi-chamber profiles with different profile geometries. (©ILK)

## Potential adopters of technology

From the technology development can benefit a broad user group along the entire value chain:

- Engineering service provider for load-responsible component design and layout
- Toolmaker for the implementation of energy-efficient variothermic molds
- Plant manufacturer for the realization of automated manufacturing processes
- Processors of thermoplastics or composites
- End users of textile-reinforced lightweight structures in various industries such as vehicle / mechanical engineering, rail vehicles, aerospace or sports industry



## Advantages of technology

- Low tooling costs compared to press or injection molds (simple sealing systems, low wear, low process pressures, no costly sprue systems)
- Low process pressures allow low investment - no expensive presses necessary
- Advantages of thermoplastic materials can be used in many ways (weldable, thermoformable, recyclable)
- Manufacturing process modularly adaptable to quantity (from manual to fully automated) - good suitability also for small and medium-sized businesses

## Market and context of technology

The technical feasibility for the production of textile-reinforced thermoplastic hollow structures has already been demonstrated on different demonstrators.

- The performance of the materials has been demonstrated in experimental tests of low-stress, cyclic and highly dynamic conditions.
- The developed process layout is transferable or well adaptable to different products.
- The production of the textile preform in the braiding process has already been successfully demonstrated in a fully automated process.
- In order to further increase the maturity of the technology, further development activities in the field of tool technology, automation, energy efficiency and quality assurance make sense.