Shape Adaptive CFRP Crash Structure in Hybrid-Matrix-Design

Shape adaptive crash structures significantly enhance the performance of safety components by active geometry changes. The crash performance is increased by improved energy absorption, reduced structural weight and reduced dimensions. The presented innovation is a shape adaptive CFRP side door beam with the ability to change its cross-section geometry and stiffness properties due to high-dynamic inner pressurization. The geometry change takes place in 0.0057 seconds after the activation. The defined geometry change is enabled by the Hybrid-Matrix-Design. Based on this design approach elastomer and thermoset matrix materials are locally integrated into the continuous fiber reinforcement. The Hybrid-Matrix-Processing is used to simultaneously integrate the different matrix materials in a co-infiltration to realize defined matrix transitions in a co-curing process. This innovative design- and manufacturing philosophy offers new possibilities for the integration of function and for the efficient lay out of high performance fiber-reinforced polymers.

Fig.1: Concept and Design of the Shape Adaptive CFRP Crash Structure
Fig. 2: Shape Adaptive CFRP Crash Structure in Hybrid-Matrix-Design