A NEW HYBRID MATERIAL FOR INCREASED IMPACT TOLERANCE

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A newly developed Hybrid Composite shows outstanding impact results, as proofed by several test of the German Bundeswehr. According to the testing results an increase of impact strength up to ~60% could be achieved by reinforcing common carbon fibre reinforced plastics (CFRP) with a metallic chain mail.
In this work a new hybrid based on metallic chain mail and fibre composites is investigated. Titan Grade 2 and steel alloy 1.4306 is used for the chain mail. The fibre composite is made out of carbon fibres, unidirectional with polyetheretherketone matrix or woven with epoxy matrix. This new material is in the following named CarbonICE. A scheme of the new material is shown in figure 1.
The scope of this work is the investigation of the impact behavior of fibre composites reinforced with metallic chain mail, especially the field of high velocity impact. Besides the first production of samples of the new material combination experimental investigations are carried out on coupon testing level. These include 3-point-bending tests, Charpy-Impact tests and ice impact tests at high velocity on a self-developed gas gun. Testing is accompanied by looking at the possibilities of numerical simulation of the new material and the impact event with the help of the finite element method (FEM). Based on the experiments and simulations first material values and characteristics could be obtained. For reference, non reinforced carbon fibre reinforced plastics (CFRP) are investigated additionally. Based on the experimental work of the German Bundeswehr a common FE-code was used for a first successful attempt of modeling the new material, especially at high speed impact.

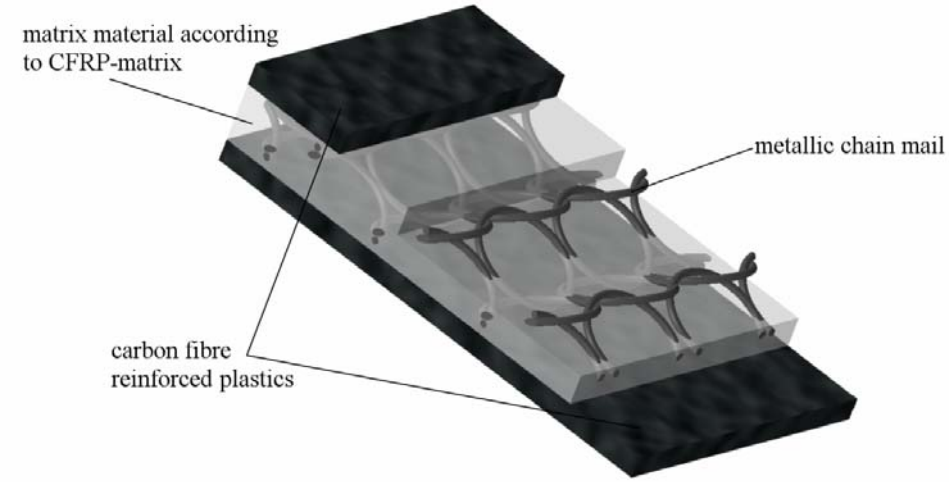

Figure 1: Principle lay-up of the new hybrid material