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PROCESSING OF HYBRID ENDLESS FIBER REINFORCED TAPES

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PROCESSING OF HYBRID ENDLESS FIBER REINFORCED TAPES

Technical task:

Due to their high specific mechanical properties, fibre composites offer an enormous lightweight construction potential. This potential is already being used in many ways in the aerospace industry. The automotive industry has so far lacked economic solutions for the widespread use of this group of materials. Thanks to their short cycle times and their combination with the injection moulding process, endless fibre-reinforced thermoplastic tape scrims offer great potential for economical use in large series. Thanks to the thermoplastic matrix, the tape scrims can be processed in the thermoforming process. The thermoforming process is combined with the injection moulding process or the impact extrusion process for functionalisation (e.g. attachment of ribs, load introduction elements, etc.). In both cases, a complex (but established) system technology is required to functionalize the materials. Nevertheless, the combination of expensive tapematerials and long cycle times (heating up + forming + back injection) is often not economical for automotive mass production.

Initial situation:

- Endless fibre reinforced material very expensive
- Process chain including back injection of tape scrims is complex and cycle times cf. long
- Only rarely economical in mass production (hardly any applications so far)

Solution:

Manufacture of thermoplastic tape scrims from pure matrix and combination with fibre-reinforced tapes. The resulting hybrid tape (Fig. 1) can be composed of various plastic tapes and various endlessly reinforced tapes. By heating (locally lower heating fields for lower plastics) the material becomes molten and can be pressed in a press to a compact component and also formed.

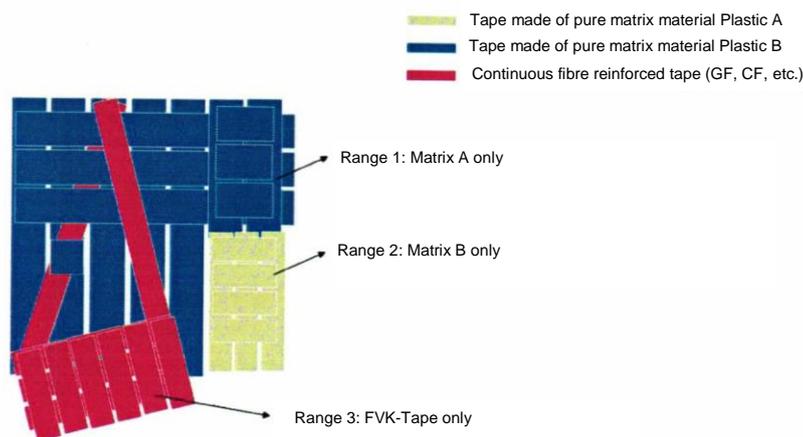


Figure 1: Thermoplastic tape scrim made of pure plastic tapes and endless fibre-reinforced tapes.

Advantages:

This results in a wide range of design options, such as

- **Section 1 (Fig. 2) - Areas made of plastic A:**
 - By closing the press/forming tool, the plastic is pressed or flows into the cavity. Very complex geometries can be produced (extrusion).
- **Step 2 (Fig.2) - Area of plastic A, plastic B and continuous fibre reinforced tape**
 - The pressing process consolidates both the endless fibre-reinforced material and complex geometries made of plastic A and plastic B can also be produced by impact extrusion.
- **Section 3 (Fig.2) - Area of endless fibre reinforced material incl. ribs**
 - The endless fibre reinforced material can be pressed and consolidated by closing the tool. At the same time it is also possible to form the tape fabric. Furthermore, ribs or load introduction elements made of matrix material can be produced by "overpressing" the tapes. This increases the proportion of fibre volume in the basic component and at the same time stiffens the tape through the ribs. This offers enormous lightweight construction potential without the tape having to be back-injected.

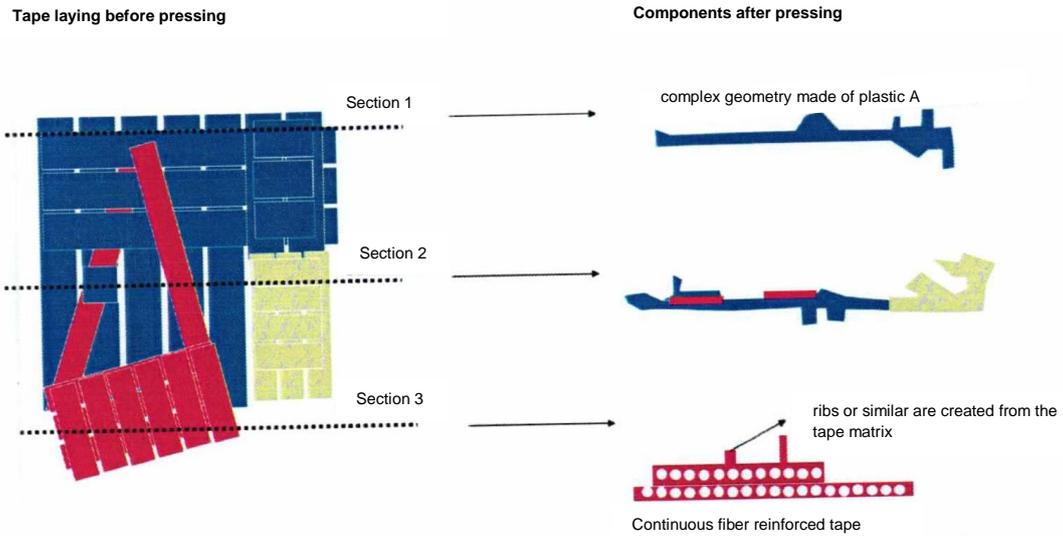


Figure 2: Hybrid tape before pressing (left) and after pressing (right). Areas are formed from pure plastic matrix, made of various plastics and endless fibre reinforced material.