

**Dissertation title:****Material- und Prozesscharakterisierung zur Herstellung von Sandwichbauteilen mit Papierwabenkern und thermoplastischen faserverstärkten Deckschichten für die Anwendung im Fahrzeuginterieur****Benno Stamp****Abstract**

Sandwich structures with honeycomb core and fibre-reinforced cover layers are widely used in the aircraft industry because of their potential in lightweight components. A transfer and implementation of these sandwich technologies into automotive applications is challenging due to high materials costs as well as the large quantity requirement. In the present work, a novel sandwich structure, consisting of thermoplastic fibre-reinforced cover layers and a paper honeycomb core, is analysed in consideration of the specific performance requirements of car interior parts.

Experimental as well as analytical calculation methods were investigated to analyse the mechanical behaviour of the cellulose paper honeycombs. Experimental results helped in formulating the approximate equations based on regression analysis to improve the prediction of the mechanical characteristics of paper honeycombs.

To understand the manufacturability of formed sandwich components, the deformability behaviour of the honeycombs as a function of their geometric parameters was investigated. For validating the theoretical results, experimental sensitive analyses were executed. The series of experiments showed, that the shaping potential of the honeycombs can be influenced positively by the humidity content.

Hybrid needle-punched non-wovens were predominantly considered as cover layer material, which contains glass and natural fibres as reinforcing materials, and polypropylene as matrix. The influences of various parameters on mechanical behaviour of the sandwich composite were examined by conducting quasi-static tests. A significant increase of the mechanical properties was observed through the experiments by adding a fusible foil layer between paper honeycomb and cover layer. Based on the material properties, generated in the experimental series, an analytical and a numerical approach were developed for calculating the sandwich stiffness.

For industrial implementation of the component manufacturing, different manufacturing concepts and tool concepts are presented. With the help of friction welding tests it was proven, that a connection between sandwich part and plastic support bracket is producible.

With the aid of material testing in environmental conditions, the combustion behaviour as well the mechanical degradation at high humidity were determined. The higher thermal insulation performance in comparison to conventional facing materials was observed during material tests.

The ecological relevance of this sandwich technology is shown through a life cycle assessment. For material recycling, a recycling process by compounding the sandwich

materials into injection moulding granulates was carried out and their mechanical characteristics was determined.