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HIOS - Highly Integrated Organic Sheets for Secondary Structures in Aviation

Objective

The manufacturing approach developed in the project integrates component design into the production of organic sheets with variable thickness and localized functionalization, based on hybrid nonwovens containing recycled carbon fibers (rCF). The development of a two-step thermoforming and joining process for these organo sheets, including a customized moulding concept, enabled the production of an aerospace demonstrator with near-shape dimensions suitable for series production. The method enhances the cost-effectiveness and sustainability of organo sheet manufacturing.

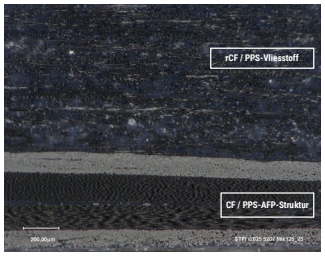
Approach and results

The basis for the variable-thickness organic sheets is formed by rCF hybrid nonwovens with a thermoplastic component and locally adapted structural and functional properties. These were manufactured on an continous compression sysystem using a shaped moulding tool with the following specifications:

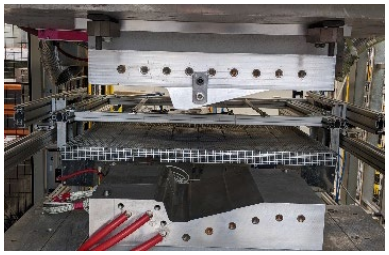
- Implementation of thickness steps (2–4–6 mm) across the width, thickness tolerance ± 0.2 mm
- Integration of load-path-optimized reinforcement structures
- Suitable for series production (production speed 0.6 m/min; throughput up to 155.52 kg/h)

The further development of the two-stage thermoforming process with a corresponding tooling concept enabled the thermoforming and joining of the organic sheets into the box structure to the final contour with process times of approx. 10 min in a modular mould.

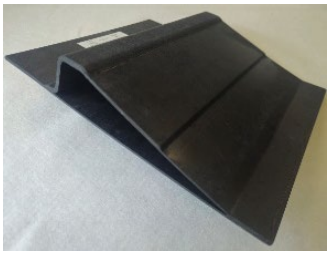
The technical potential for series production on the project partners' equipment was demonstrated. The integration of the joining processes with thermoforming offers economic advantages in terms of setup times, tooling, and energy consumption. Furthermore, prospects for the use of rCF-based components and the realization of closed material cycles were highlighted.



Microscopic image of rCF / PPS nonwoven fabric with an AFP



Thermoforming and joining tool



Molded spoiler segment

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