



LIGHT AS PLASTICS AND STRONG AS METAL

The quest for lighter components is part of everyday life. Cars, airplanes and sports equipment are constantly losing weight. Lightweight components often have to provide the same properties as heavier conventional materials, such as environmental and wear resistance. To achieve this balancing act, new process designs and strategies are needed, such as functionalized fiber-reinforced plastics with metallic properties.

With new materials and new developments in process design, lightweight construction lowers weight and results in reduced emissions when mass is moved. Frequently, lighter fiber-plastic composites replace heavy metal components. Nevertheless, it is impossible to completely replace metal, for example, if abrasion resistance or specific sliding characteristics are required. Fraunhofer IWS researchers have found solutions to introduce typical metallic functions into plastic-based components – locally and without joints. The surface texture of the component to-be-coated is essential for a reliable bonding of metallic sprayed coatings on plastic-based substrates. The rougher the surface, the more anchoring points are available for the metallic or ceramic particles in the coating procedure. Surface pretreatment methods established in metal processing, such as sand blasting, can only be used for fiber-reinforced plastics to a limited extent. The particles' high impact energy creates roughness, but also damages the fibers near the surface. These defects result in air locks during coating and in failure during use.

Customized solutions for a wide variety of requirements

Selective matrix removal, using a pulsed laser beam, exposes the fibers gently, creating anchoring spots for the sprayed particles. The coating material's splats enclose the load-bearing fibers. The generated form fit causes the coating to bond optimally. Fiber-plastic composite coating offers numerous opportunities for functionalization. Customized properties can be immediately integrated into the fiber-plastic composite. It is possible to implement various functions – from anti-wear for plain bearings via thermal insulation to heating functions, such as for battery

housings. Laser material processing with follow-up coating is based on established and economically attractive subprocesses. Combining lasers with thermal spraying allows fabricating diverse components with various functionalities without additional tools or masking. This method enables, for instance, the intentional exposure of highly limited functional surfaces. The coating material only bonds in the pretreated zone thanks to local laser roughing. Using this approach, Fraunhofer IWS has engineered a highly flexible process capable of integrating various functions with an exact fit into each substrate.

1 *Fiber-plastic composite functionalization by coating laser-structured surfaces.*

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