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Project title:	EMSHIELD - Development of a material made of recycled carbon fibres for shielding, reflection and absorption of electromagnetic radiation
Partner:	IHE (Institut für Hochfrequenztechnik und Elektronik des KIT) ITA Augsburg gGmbH
Duration:	01.01.2019 – 31.12.2020
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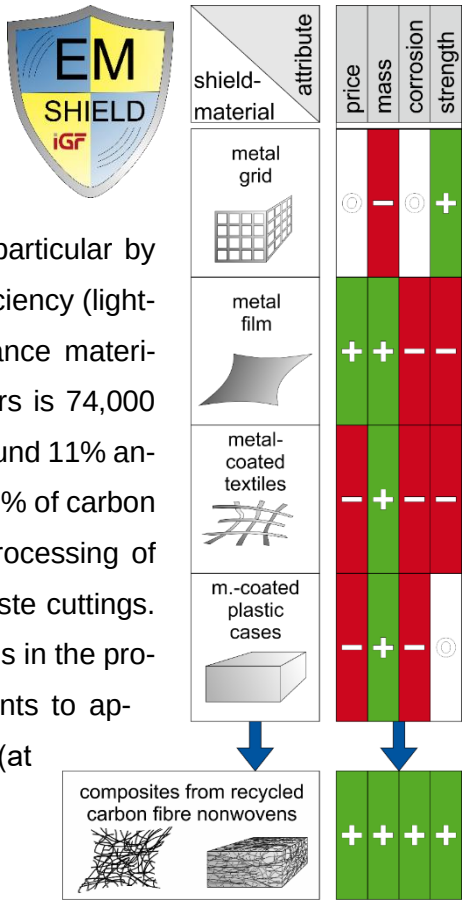

Mission Statement

Demand for carbon fibers is driven in particular by the trends of electromobility, energy efficiency (lightweight construction) and high-performance materials. The global demand for carbon fibers is 74,000 t/a in 2017. Demand will increase by around 11% annually to 120,000 t/a by 2022. Around 35% of carbon fibers are processed in Europe. The processing of carbon fibers results in around 40% waste cuttings. The unused potential due to fiber cuttings in the production of components therefore amounts to approx. 336 million €/a in Europe in 2022 (at a C-fiber price of 20 €/kg).

Approach

The approach of the EMSHIELD project was to use the electrical conductivity of carbon fibers to influence electromagnetic (EM) fields. The goal was to develop materials that have good strength, high corrosion resistance and low weight. For reasons of sustainability and price, recycled carbon fibers were used because they are comparatively inexpensive and have a good life cycle assessment.

Since recycled carbon fibers are no longer available as continuous filaments, they can only be further processed using fewer processing methods. A particularly efficient and inexpensive process for producing a flat textile from the

rCF is nonwoven production. Therefore, the rCF were carded and blended with polypropylene fibers to form hybrid nonwovens. The hybrid nonwovens were then thermoformed, in which the polypropylene fibers melt and impregnate the rCF fibers, forming a fiber-matrix composite upon cooling.

Various rCF sheet materials were produced and tested for their electromagnetic properties (including shielding effectiveness) in a test rig developed and commissioned at the IHE as part of the project. Based on the results, a physical model was developed to represent and simulate the electromagnetic properties of nonwovens. With the help of the model, a design tool for electromagnetic shielding materials was created and validated. The design tool enables rCF nonwoven materials to be designed based on the desired shielding effect.A design tool was created and validated using the results. The design tool makes it possible to design rCF nonwoven materials on the basis of the desired shielding effect.

In addition, the contacting of the manufactured sheet materials was also investigated as part of the project. For this purpose, various concepts were developed, evaluated on the basis of their relevance for practical applications, and then implemented and tested. Finally, an economic analysis of the production process for the developed material was carried out.

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