Project title:	Development of a material made of recycled carbon fibres for shielding, reflection and absorption of electromagnetic radiation - EMSHIELD
Partner:	Institut für Textiltechnik der RWTH Aachen, Aachen Institut für Hochfrequenztechnik des KIT, Karlsruhe Institut für Textiltechnik Augsburg gGmbH, Augsburg
Duration:	01/2019-12/2020
Funding Agency:	AiF/IGF

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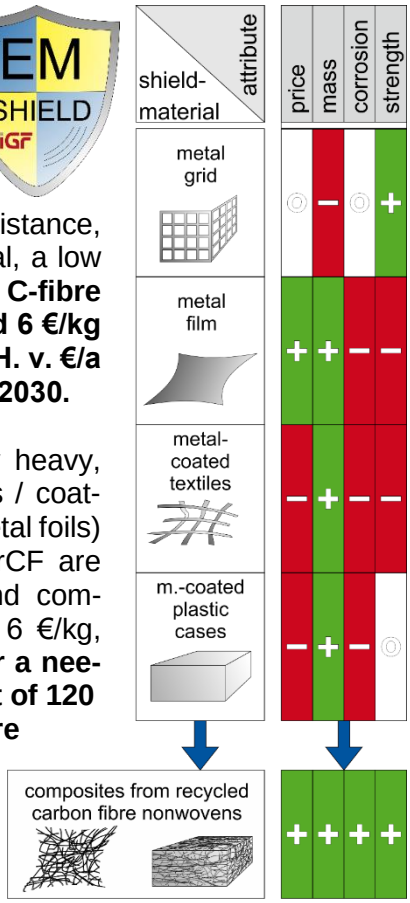
01.01.2019

Mission Statement

The demand for carbon fibres is driven in particular by the trends towards electromobility, energy efficiency (lightweight construction) and high-performance materials. Global demand for carbon fibres in 2017 will be 74,000 t/a. By 2022, demand will increase by around 11 % annually to 120,000 t/a. Around 35% of carbon fibres are processed in Europe. Processing carbon fibres produces around 40 % waste. **The unused potential through fibre trimming in component manufacture in 2022 in Europe is therefore approx. 336 million €/a (at a C-fiber price of 20 €/kg).**

The approach in the EMSHIELD project is to recycle the carbon fibres (rCF) and use the electrical conductivity of the fibres to influence (shielding, reflection, absorption) electromagnetic (EM) fields. The materials developed in this way have good strength, high corrosion resistance, low weight and, due to the recycled material, a low price and high sustainability. **The use of C-fibre waste and EoL fibres at a price of around 6 €/kg corresponds to added value in Europe i. H. v. €/a 156 million in 2022 and €/a 295 million in 2030.**



Current shielding materials are particularly heavy, subject to strong corrosion or wear (metals / coatings), have low mechanical strength (e.g. metal foils) and are expensive. Nonwovens made of rCF are light, corrosion-resistant, wear-resistant and comparatively inexpensive (fibre price approx. 6 €/kg, see chapter 3.1). **The production price for a needled nonwoven fabric with a basis weight of 120 g/m², 80 % rCF and 20 % PET is therefore around 0.98 €/m² without overheads**. The suitability of rCF nonwovens for EM shielding has already been proven in preliminary tests at RWTH Aachen University.

Approach

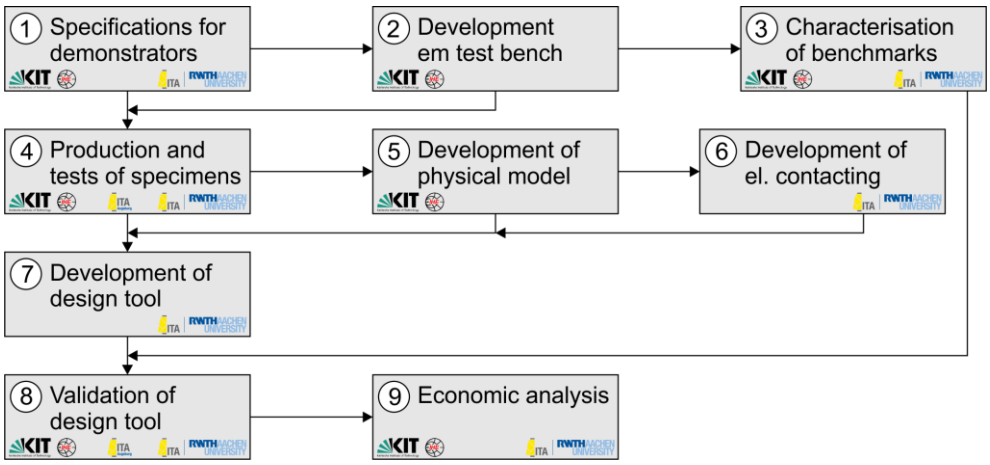
With nonwovens made of rCF, a high weight-specific damping is achievable at a favourable price. **The properties of rCF nonwovens as a shielding material are currently not usable by SMEs, as no design guidelines for rCF nonwovens as an EM material are yet available**. The development of these guidelines in individual projects is not economically feasible for SMEs. **One result of the EMSHIELD research project is therefore a design tool on the basis of which components can be designed to measure**. This enables shielding effects to be achieved to a degree of over 80 dB and within a frequency spectrum of 20 MHz to over 80 GHz (radio, microwave, WLAN, mobile phone networks, radar).

In EMSHIELD, an EM test rig is being developed by the research centres to investigate the EM performance of rCF nonwovens and single- and multi-layer composite components. Based on these investigations, a physical model and a design catalogue will be developed. The project results will enable SMEs to develop cost-effective and sustainable EM-functionalized assemblies.

In addition to the pure shielding effect, other fields of application are also of interest and can be addressed by SMEs after project completion. These are:

- Directional reflection of EM waves, e.g. to make children / road workers visible for driver assistance systems
- Diffuse reflection of EM waves, e.g. for camouflage purposes
- Absorption of EM waves, e.g. for heating or very sensitive measurement technology, hospitals, etc.

The following work plan has been defined to achieve the project objectives (design catalogue and physical model):



Acknowledgement:

The IGF-project 20293N of the Research Association was sponsored by the AiF within the scope of Förderung der industriellen Gemeinschaftsforschung (IGF) from Bundesministerium für Wirtschaft und Energie, following a decision of the Deutscher Bundestag.

Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag