

ReCarboSize – Improved sizings for recycled carbon fibres to optimise adhesion with polymer matrices and improve processing behaviour for composite manufacturing

Objective

Carbon fibre reinforced plastics (CFRP) have been subject to growing demand for lightweight construction applications in recent years. In view of the limitation of natural resources and legal requirements, it is desirable to recycle the energy-intensively produced carbon fibres (CF). With the current recycling technologies for CFRP, e.g. by pyrolysis or solvolysis, not only the polymer matrices but also the sizing is removed from the carbon fibres. This is the limiting factor for the reuse of recycled carbon fibres (rCF) in reinforcement structures to improve the mechanical properties in composites.

Approach and results

The aim of the ReCarboSize project was the development of a concept for the resizing of recycled carbon fibres (rCF) and the adaptation of the sizings themselves for the selected thermoset (epoxy resin, polyurethane) and thermoplastic (polyamide, polyphenylene sulphide) resin systems. The material basis was CF production waste provided by industrial partners and recycled through pyrolysis. Various sizing application methods (spraying, dipping, and impregnation) were analysed and evaluated. The rCF equipped with adapted sizings were processed into fibre nonwovens, which were used in combination with the matrices to produce carbon fibre-reinforced plastics (CFRP). The mechanical properties of the materials were extensively tested and compared with reference materials.

As a result of the project, it was found that the resizing of the rCF improved the processability of the fibres and made them more resistant against mechanical stress. As far as the mechanical properties of the composite are concerned, it can be stated that the test values for flexural strength and tensile strength of the FRP sheets made from nonwovens with single fibre sizing show slightly higher results. The values of the original nonwovens (reference materials) made of 100 % CF could not be achieved for the CFRP sheets made of resized fibres/nonwovens.



SEM image of a resized carbon fibre (left), production of nonwovens from carbon fibres (centre) and test stand for resizing nonwovens from carbon fibres (right)

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The final report on this project is available on request.

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