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Projekt title:	Production of recycled C-fibre-reinforced organo sheets by application of the surface coating with additive matrix materials **-** RezyTiv
Duration:	01/2017 - 06/2019
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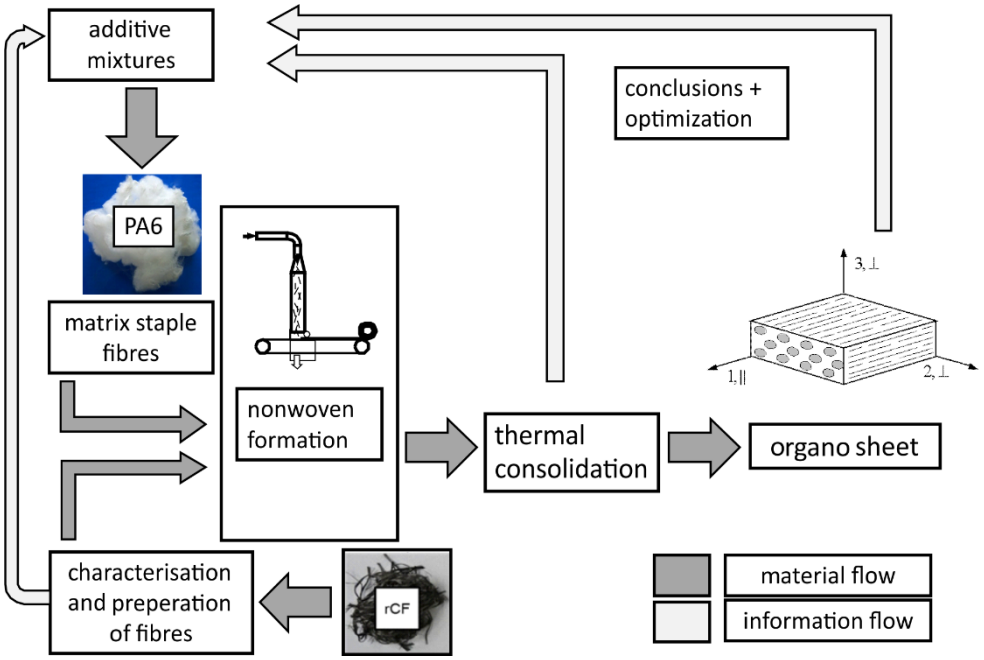
Mission Statement

Organo sheets are semi-finished products based on thermoplastics with reinforcements based on natural, glass and carbon fibres. For the production of organo sheets with carbon fibre reinforcement, new filaments, at a price of up to 30 €/kg, are cut into staple fibres. An alternative are recycled carbon fibres (rCF). These are usually obtained from secondary waste by pyrolysis. During the process, the matrix and the sizing on the surface of the fibres get removed. However, a sizing is necessary for good fiber-matrix adhesion.

The aim of the project was to reduce the costs for the production of organo sheets with carbon fibers as reinforcing structure. To achieve this, the focus was on various measures to reduce costs. On the one hand, the aim was to use recycled pyrolized carbon fibers as reinforcing fibers instead of cut carbon new filaments. On the other hand, the aim was to save the re-application of sizing on the recycled carbon fibres by adding polyamide-6 (PA6) matrix fibres in such a way that the sizing can be substituted on the recycled carbon fibres. In addition, ultrasonic calendering was investigated as an alternative to the previous consolidation of the organo sheets.

Approach and results

First, the recycled carbon fibers were analyzed and characterized. With the knowledge gained, various additives were selected to improve fibre-matrix adhesion and their suitability as additives was investigated. For this purpose, the additives were first compounded into the PA6 material and then tests were carried out on the spinnability of the produced material. Based on the results, the most promising compound variants were selected for the further procedure.



On the basis of single fiber pull-out tests it could be shown that the interlaminar shear strength and thus the fiber-matrix adhesion can be increased by adding PA6. In some cases, values similar to those obtained with sized new fibres were achieved. The produced hybrid nonwovens were then consolidated to organo sheets by hot pressing and examined with regard to their mechanical properties. Depending on the manufacturing parameters, mechanical properties were in some cases better than those obtained with variants without additives.
In addition, the ultrasonic calendering process was investigated as an alternative to conventional consolidation processes such as needling and calendering. The process is up to 23 % cheaper in operation than mechanical consolidation by needling. The ultrasonic process does not require start-up times or heating as is necessary with other thermal processes. However, the investment costs are considerably higher.

It has been shown that the addition of additives to matrix fibers (here PA6) offers potential for certain applications, provided that the process chain is precisely matched to the additives and the process parameters. The cost saving by the additiveing of PA6, compared to the recoating of rCF, is relatively low. If the additives are further adapted and tuned to specific applications and materials, it can be assumed that the properties can be further improved.

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