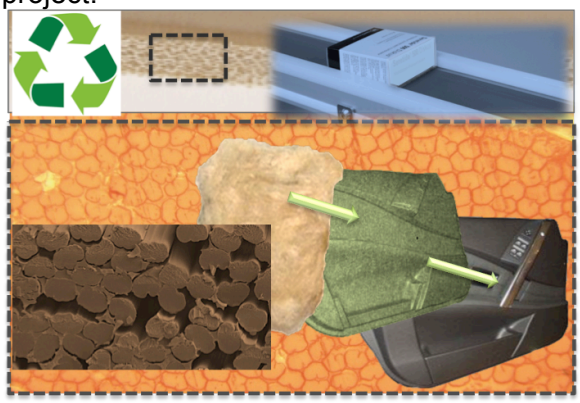
Principles for the production of adhesive-free fiber composites from bio-based polymers.

Fiber-reinforced composites are increasingly being used in the design of highly stressed components and consumer products. Bio-based products have the potential to be used in high-performance composites, but often have deficiencies in terms of fiber-matrix adhesion and damping. This is particularly true for composites composed of hydrophilic fibers and hydrophobic matrix polymers.

Usually, this problem is solved by chemical modification of the fibers or matrix polymers. This achieves high adhesive forces, but at the cost of poor damping properties of the composite material.

Recent biomimetic approaches are trying to optimize this by so-called graded transitions between fiber surface and matrix. As in plant models, thin intermediate layers result in "soft" force transmission and superior damping behavior.

The proposed research project now aims at a photochemically achieved, direct crosslinking of fiber and matrix polymer, resulting in an interlayer with a controlled degree of crosslinking. By adapting the process conditions, there is the prospect of the graded transitions described without additional auxiliaries. The following current trends are thus taken into account in the project:



- Use of bio-based fibers, e.g. regenerated cellulose or polylactic acid (PLA), to replace petroleum-based fibers.
- Use of polyolefins as matrix polymers.
- Elimination of auxiliaries to improve adhesion.
-

Direct photo-crosslinking is achieved by irradiating a thin layer of the polymeric matrix on the textile substrate, resulting in layer crosslinking and covalent bonds with the fiber surface. In fundamental studies, in addition to the macroscopic composite properties, the microscopic properties and structures at the fiber-matrix interface are to be investigated in particular. The latter concerns, among other things, the layer crosslinking, dimensions of the photochemically crosslinked interlayer and, desirebly, mechanical transitions.

Project Information:

Title (German):	Grundlagen zur Herstellung haftmittelfreier Faserverbundwerkstoffe aus biobasierten
Acronym:	Biobasierte Faserverbunde
Project number:	21818 N
Project duration:	01.05.2021 - 30.04.2023

Project Partners: Deutsches Textilforschungszentrum Nord-West gGmbH, Krefeld
Hochschule Bremen, Bremen


HSB
Hochschule Bremen
City University of Applied Sciences

Forschungskuratorium
textil
iGF
Industrielle
Gemeinschaftsforschun

Gefördert durch:
Bundesministerium
für Wirtschaft
und Klimaschutz
aufgrund eines Beschlusses
des Deutschen Bundestages

Contact DTNW: Dr. Habil. Larisa Tsarkova,
Tel.: +49-2151-843-2016, e-mail: tsarkova@dtnw.de