Enzymatic Surface etching of Biogene Heavy Tows (bHT) to enhance bHT-matrix interaction in High-Performance Composites

Holger Fischer*[1], Esther Dederer[1], Elke Thiele[2], Corinna Falck[2], Jan Marek[3], and Martin Kyselka[3]

[1]Faserinstitut Bremen – Germany
[2]Sächsisches Textilforschungsinstitut e.V. (STFI) – Germany
[3]INOTEX spol. s r.o. – Czech Republic

Abstract

The project '*EnTreHeaT - **En**zymatic Surface **Tre**atment of Biogene **Hea**vy **T**ows (bHT) for use in High-Performance Composites*' aims to improve the surface interaction between non-retted green peeled hemp bark stripes ('biogene Heavy Tows', bHT) and common thermoset matrices.
A biotechnological approach has been selected to uncover the surface-near hemp fibres in the hemp bark by a type of 'enzymatic etching'. This enables a direct coupling between the hemp single fibres at the hemp bast surface and the applied composite matrix to ensure high mechanical performance. The enzyme system is optimized to preserve the function of the natural binders of hemp barks tripes, which contributes to the optimal mechanical / physical properties of the reinforcement. The process can be performed by a modified spray method using minimal amounts of liquid compared to standard enzyme-driven reactions.

Three research partners are engaged in this CORNET project, coordinated by WNR e.V. (DE) and CLUTEX (CZ):
FIBRE is developing a method to assess hemp bark stripe-Matrix interaction and performs the Enzyme test in laboratory scale to validate the enzyme's effect.
STFI is focusing on all steps of processing hemp bast barks to semi-finished products. After the enzymatic treatment by the research partners STFI produce the composites and test the mechanical properties of all the samples.
INOTEX works on enzyme development and scale-up of the corresponding processes.

The poster describes the set-up of an adapted analytical method using a modified pull-out test and the results of enzyme screening. Suitable enzymes have been identified enhancing the pull-out force from initially 50 N/mm^2 by a factor of up to 2.
Ongoing work is to identify best suitable matrix systems and application parameters. The final results are expected at the end of the project in mid of 2027.

Keywords: Biogene Heavy Tows (bHT), fibre, matrix, interaction, pull, out test, enzymatic treatment, surface modification

*Speaker