

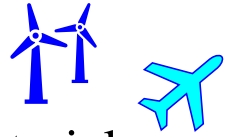
Aligned Discontinuous Natural Fibre Epoxy Composites Produced with the HiPerDiF Method

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Aim of Project



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□ to demonstrate the **capability** of **HiPerDiF** to contribute to the **sustainability** of composite materials.

Fibre



Carbon fibres



Glass fibres

Polymer (Matrix)



Epoxy resin

✗ renewable

✗ easy to recycle

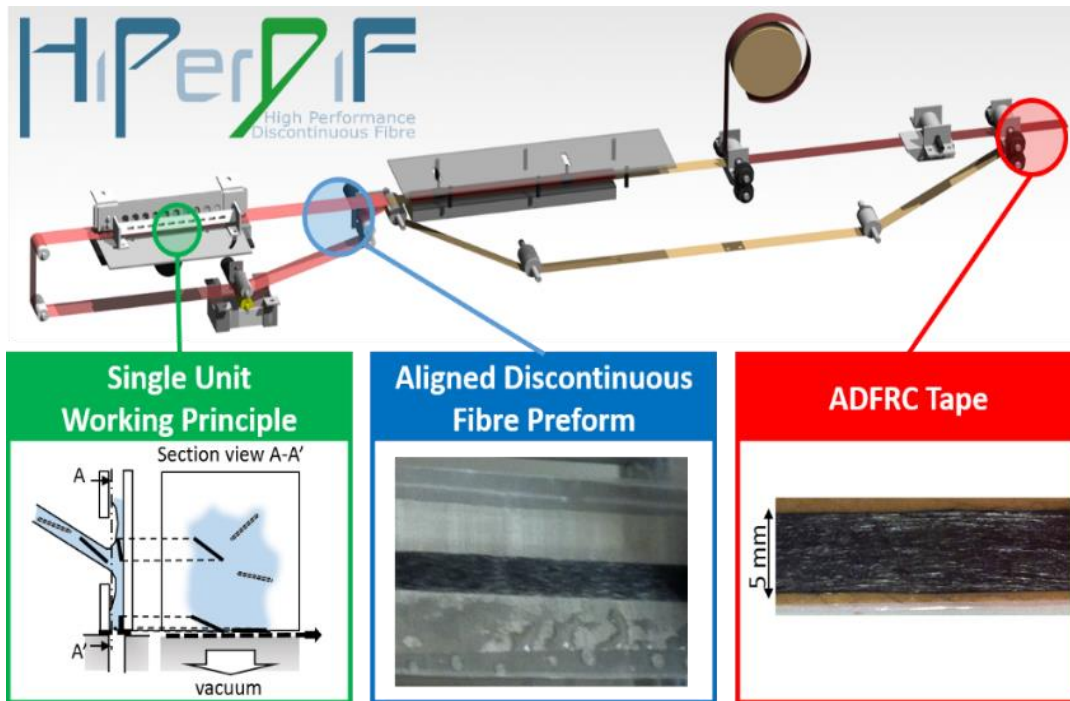
✗ low environmental impact

✗ biodegradable

✗ sustainable

- Selection of sustainable **reinforcement materials** that is compatible for the HiPerDiF method

- Selection of sustainable **matrix materials** that is compatible for the HiPerDiF method



HiPerDiF is a **water-based** process has a potential to produce high performance structures by using **eco-friendly**, **low impact**, **green**, and **renewables** constituents. The main **alignment** mechanism is a **sudden momentum change** of **fibre-water suspension**.



materials

Article

Characterisation of Natural Fibres for Sustainable Discontinuous Fibre Composite Materials

Ali Kandemir ^{*}, Thomas R. Pozegic, Ian Hamerton , Stephen J. Eichhorn and Marco L. Longana



Flax



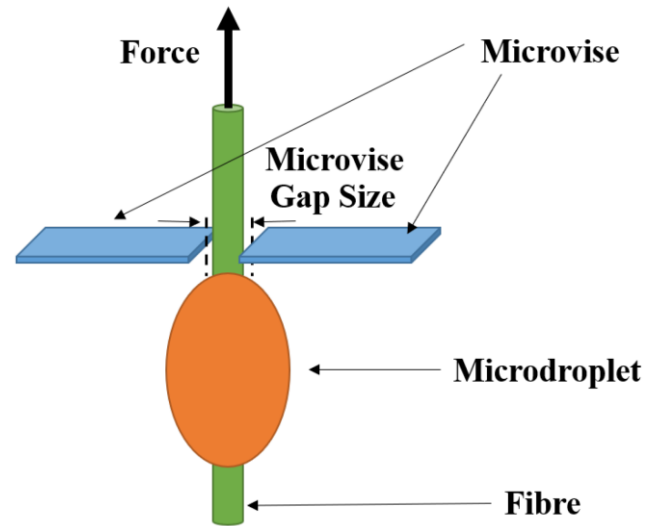
Curaua



Jute

- In previous study, the microbond tests were performed to obtain the critical lengths of NF that are important for defining the mechanical performances of discontinuous and short fibre composites.
- The obtained data determined the cut length of fibres and aligned discontinuous NF preforms were produced by the HiPerDiF method.
- The preforms were impregnated with epoxy resin film to form a prepreg ply and 4 plies were laid up to form NF epoxy composites.

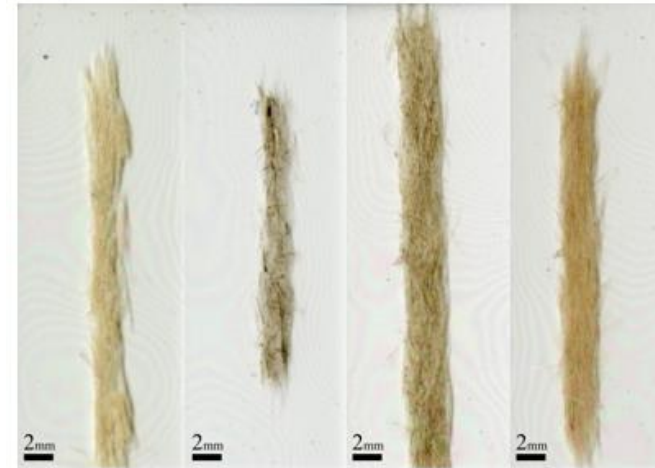
$$IFSS(MPa) = \frac{F_d(N)}{A_e(mm^2)} \quad \frac{l_c}{d} = \frac{\sigma_f}{2 \times IFSS}$$



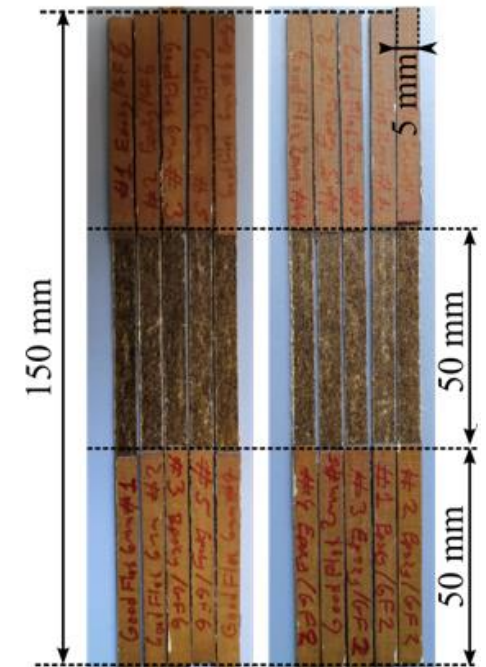
A schematic setup of the microbond test.

Table 1: Constituent Properties. (No data sheets were given by the providers and flax-cu fibres were too short to perform any mechanical or interfacial tests.)

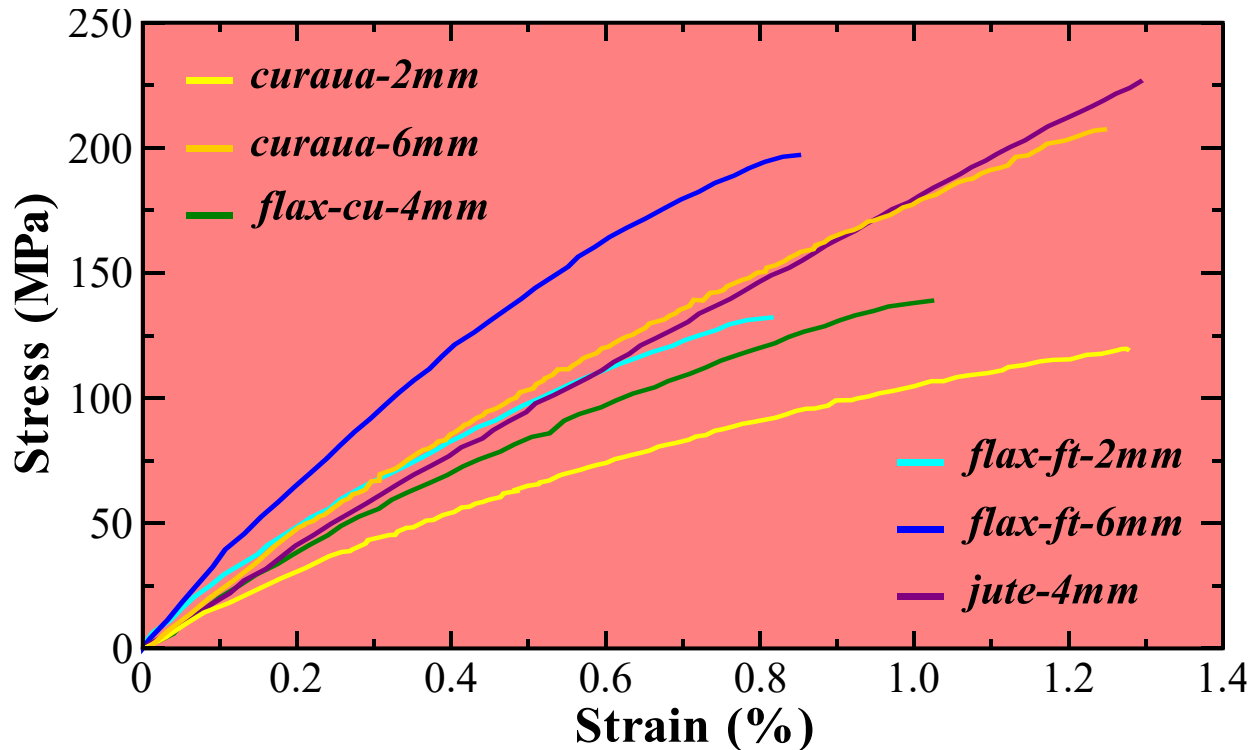
| Constituent | Density (g cm ⁻³) | Elastic Modulus (GPa) | Tensile Strength (MPa) | Critical Length (mm) |
|-------------------------|----------------------------------|--------------------------|---------------------------|-------------------------|
| <i>Fibres</i> | | | | |
| curaua | 1.50 | 39 | 660 | 2.22 |
| flax-ft (French origin) | 1.54 | 52 | 580 | 1.56 |
| flax-cu (Poland origin) | 1.40 | - | - | - |
| jute | 1.51 | 27 | 300 | 0.84 |



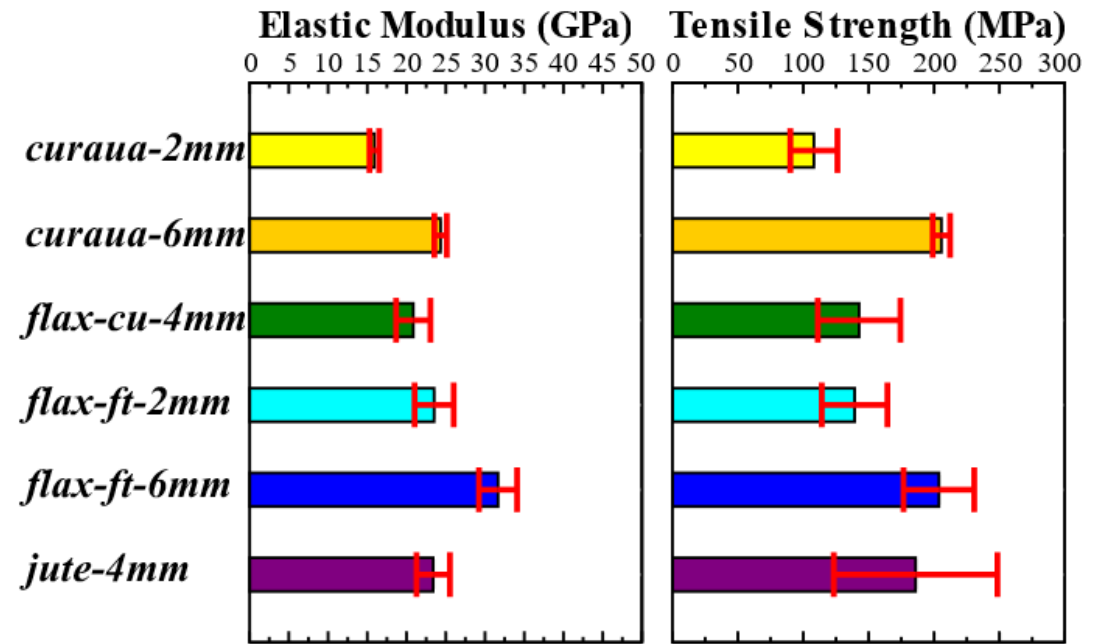
curaua flax-cu flax-ft jute
Top view of aligned discontinuous NF preforms processed by the HiPerDiF method before matrix impregnation.



Top view of aligned discontinuous NF epoxy composites.



Representative stress-strain curves of aligned discontinuous NF epoxy composites.



The mechanical properties of aligned discontinuous NF epoxy composites.

- flax-ft-6mm is the stiffest (~32 GPa) among all fibre types.
- curaua-6mm is the strongest (~205 MPa), the 2nd strongest is flax-ft-6mm (~200 MPa).
- Among the studied fibres, flax fibres were found to be the most promising candidate owing to their mechanical performance in the composites and current market status for sustainability.

Thank You for Your Attention



**KEEP CALM
WASH YOUR HANDS
AND
STAY ALERT**

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