

# Multiscale modelling of the elastic properties of a plant fibre using image-based Voronoï cells

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- **Context:**

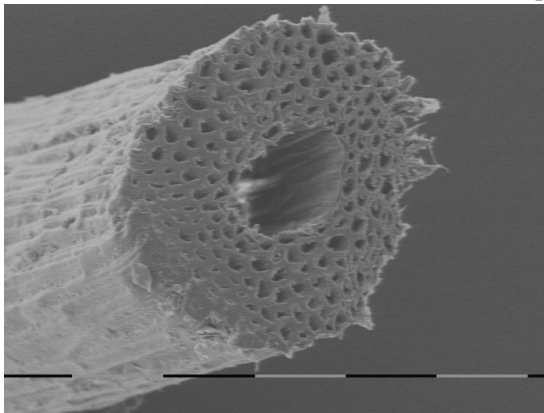
- Stringent environmental regulations
- Increased interest in the preservation of natural resources

⇒ Substitution of synthetic fibres (fossil carbon) by natural fibres (renewable carbon)

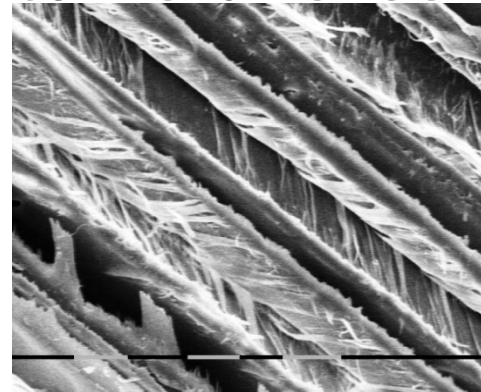
⇒ Looking for new plants that enable easy and cost-effective fibre extraction

⇒ Need to estimate the properties of new fibres based on their real structural arrangement

- **Material: "*Rhectophyllum camerunense*" fibre**

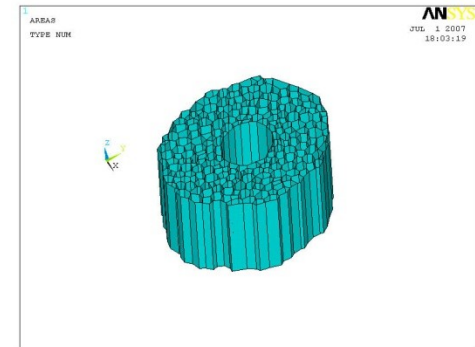
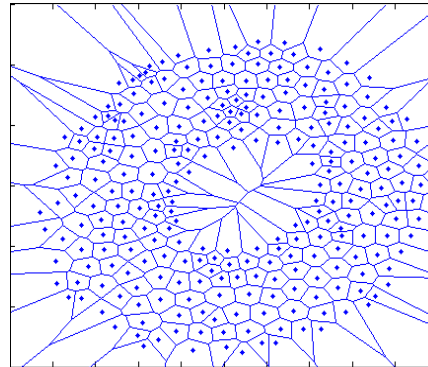


*Cross section of the fibre (X 212)*



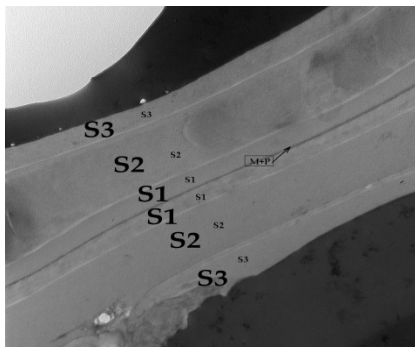
*Longitudinal section showing microfibrils (X 1150)*

- Image-based modelling



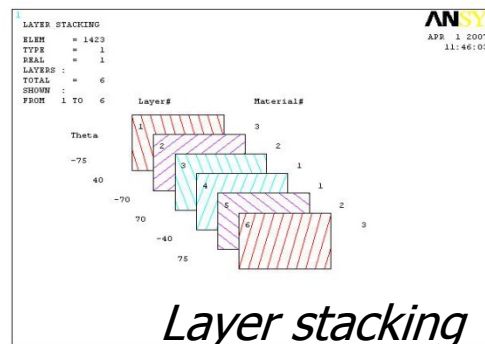
*Reconstruction of the fibre by image processing*

- Numerical simulations

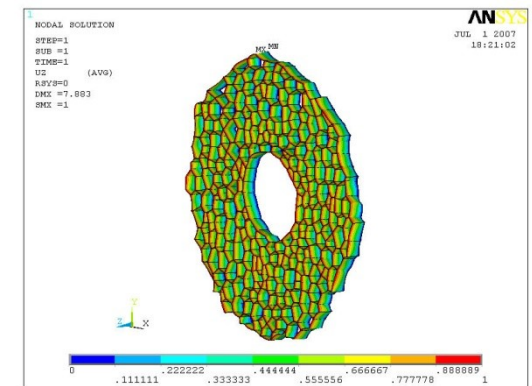


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coupe trans 03 03 07  
Print Mgj: 3480x @ 150 mm  
9/22 03/09/07

500 µm  
HV: 80kV  
Direct Mgj: 15000x  
GLSC CLUBMONT-FRIBRAND



*Layer stacking*



Layers	P+M+S1	S2	S3
Average thickness (nm)	530	1600	670

	Num.	Exp.
E longitudinal	20 GPa	15 GPa