EUROPEAN SUMMER SCHOOL
ON BIO-BASED COMPOSITES

DYNAMIC BEHAVIOR OF PLANT FIBER COMPOSITE

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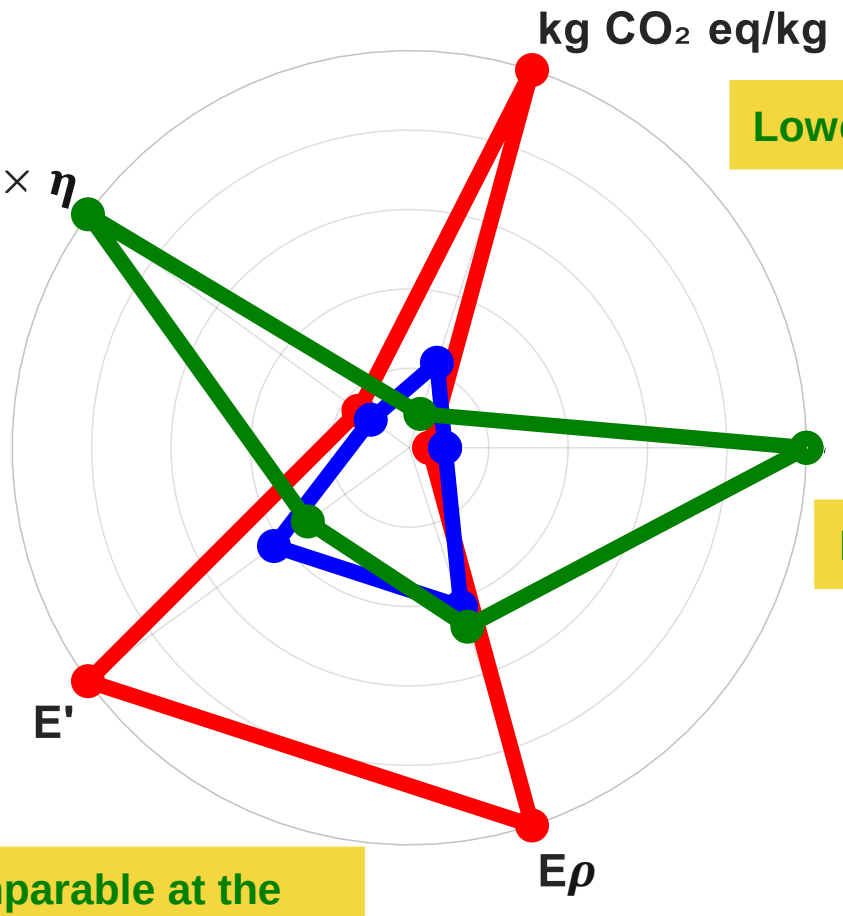
Why plant fiber composites?

Plant fiber composites Vs. synthetic fiber composites



Lower CO_2 footprint

Good trade-offs between stiffness and damping

High damping behavior

UD Flax-epoxy

UD Glass-epoxy

UD Carbon-epoxy

Comparable at the structural level

E′: Storage modulus

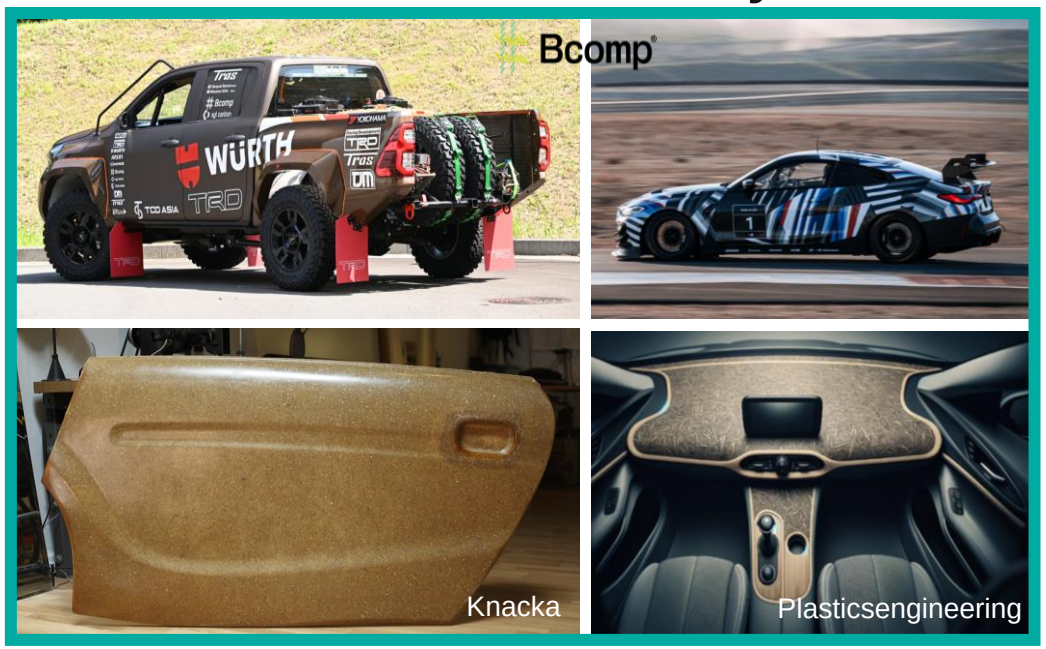
Eρ: Specific modulus

η: Loss factor

E′ $\times$ η: Loss modulus

Why only leisure applications?

Automotive industry



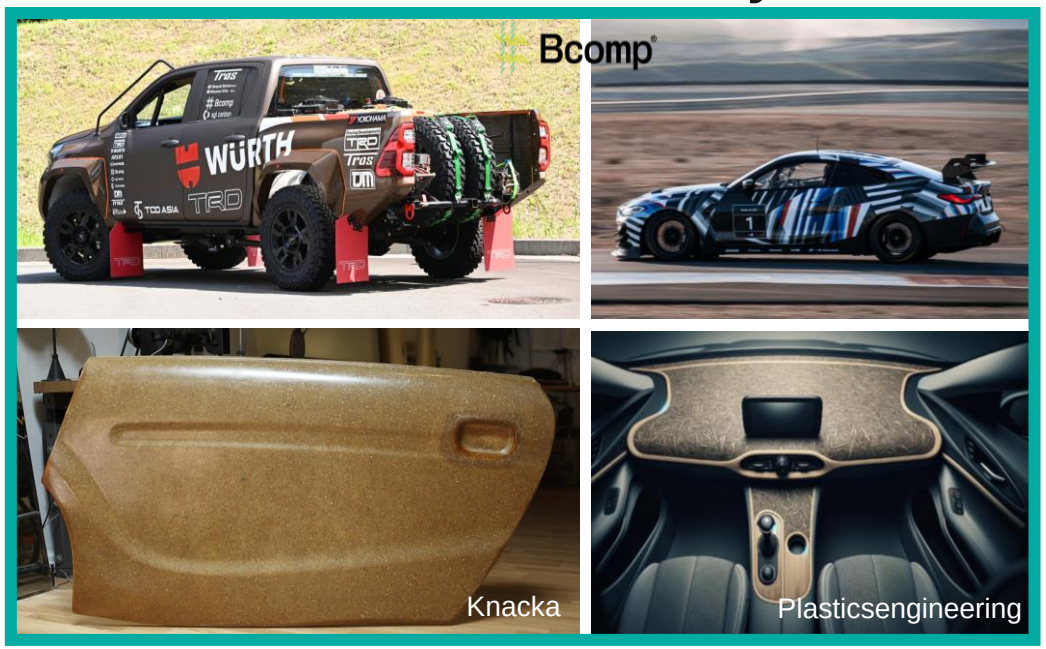
❖ **Origin not clarified**

Musical instruments

Sports sector

Why only leisure applications?

Automotive industry



Musical instruments

Sports sector

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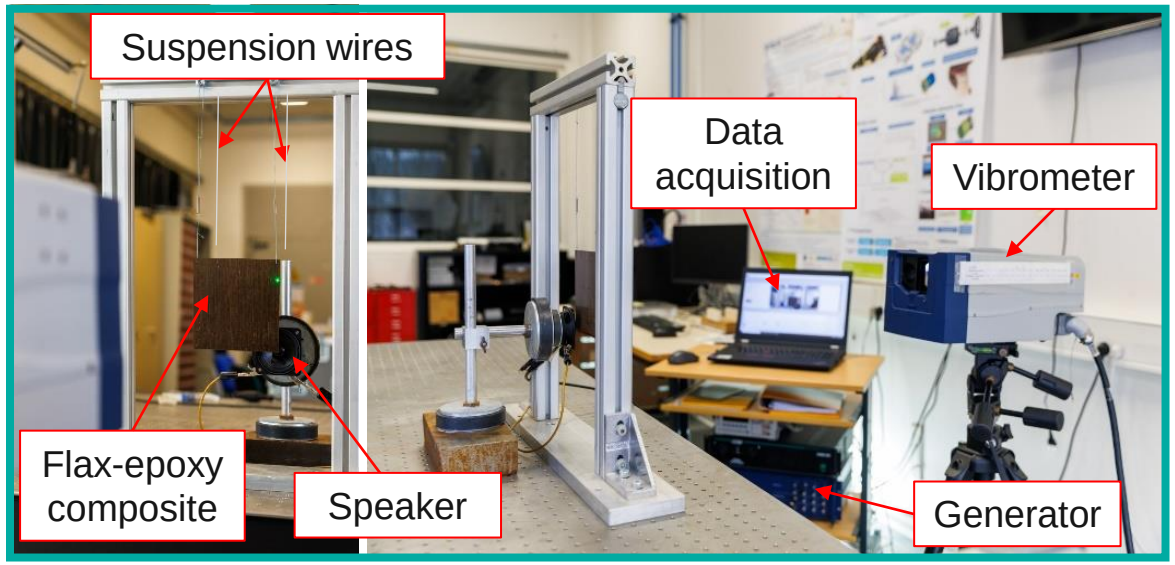
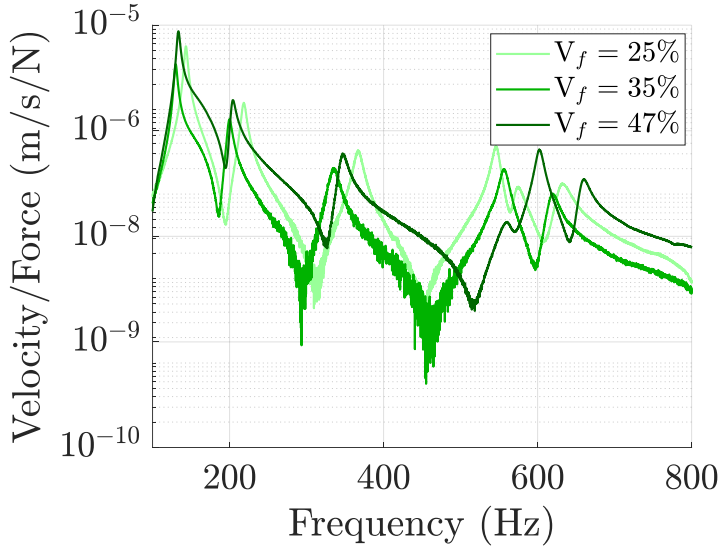
How does volume fraction shapes dynamic behavior?

Dynamic response of flax composite at different fiber fractions

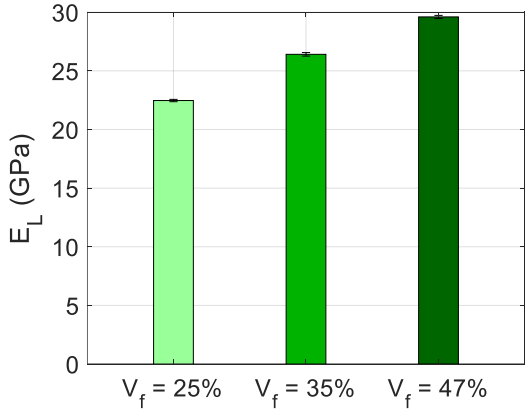
Vibration test experimental setup

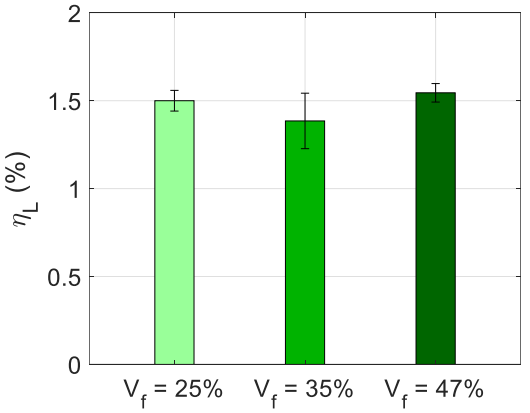


Frequency response function



Storage modulus and damping in the direction of the fiber





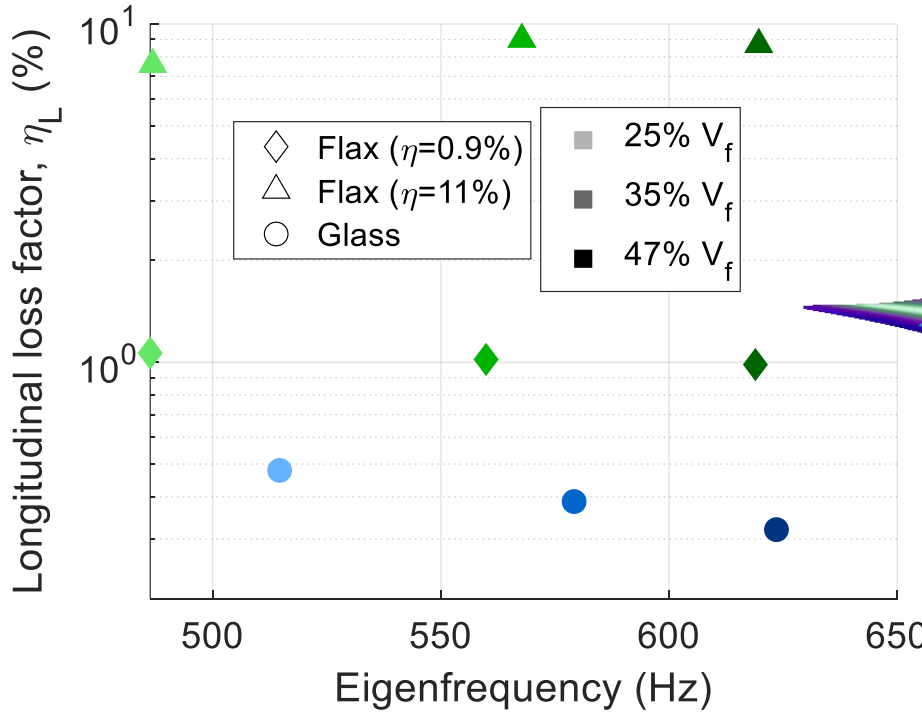
$\nearrow V_{f_{fiber}} = \nearrow E_L \rightarrow \eta_L$

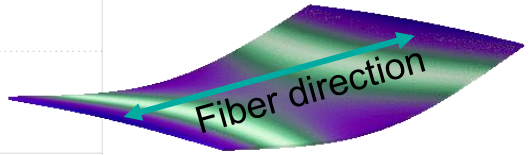
Multiscale modeling for predicting dynamic properties

Material	E (GPa)	η (%)	ν
Glass	72.5[1,2]	0.18[2]	0.2[1,2]
Flax	60[3]	0.9[4] - 11[5]	0.35[3]
Epoxy	3.2[1,2]	1.5[2]	0.39[1,2]

Microscale to macroscale reliable prediction of properties

Complex eigenfrequency study





1st bending mode

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2. Rezaei, A., Goroz Gómez, D., Gilabert, F., Desmet, W., & Van Paepegem, W. (2016). Micro-scale finite element simulation of the viscoelastic damping in unidirectional fiber reinforced composites.
3. Bensadoun, F., Verpoest, I., Baets, J., Müssig, J., Graupner, N., Davies, P. & Baley, C. (2017). Impregnated fibre bundle test for natural fibres used in composites. Journal of Reinforced Plastics and Composites, 36(13), 942-957.
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Thank you for your attention !

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