Dynamical characterisation at fibre scale

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KEY-WORDS

Plant-fibre reinforced composites – Damping – Fibres

BACKGROUND

I am a first-year doctoral student specializing in dynamic characterization of natural fiber composites at the Applied Mechanics department of FEMTO-ST in the Mat'éco team. I hold an international Master's degree in Smart-Mechanics and my research aims to investigate the dynamical behavior of plant fibers and their interface with the matrix in natural fiber composites. The project aims to improve dynamic properties of these materials.

PROCEDURE

The measurement of individual fiber properties is complex, leading to uncertainties in their mechanical characteristics such as modulus and damping. These uncertainties can result in suboptimal design choices and reinforcement strategies [1]. To address this knowledge gap regarding fiber-scale mechanical properties, this work builds upon Perrin et al.'s [2] method and proposes the utilization of vibrational analysis techniques for plant fibers. By exciting a single fiber (Figure 1a) near its first natural frequency and employing high-speed camera image processing to evaluate displacements along the fiber, it becomes feasible to determine intrinsic dynamic properties such as the loss factor and storage modulus. The coupling between loss factor and storage modulus is presented in Figure 1b.

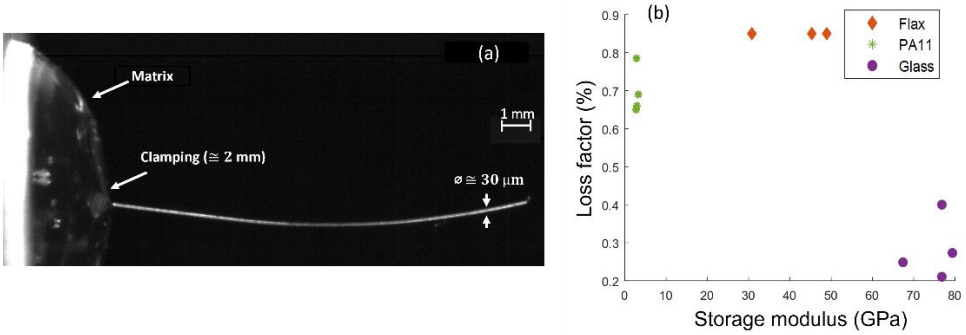

Fig. 1. (a) PA11 fibre, (b) loss factor with storage modulus for flax, PA11 and glass fibres in free vibration

KEY FINDINGS

- An experimental protocol is developed for dynamical characterization at fibre scale
- Dynamic properties (loss factor and storage modulus) are found on three types of fibre (flax, PA11 and glass)

REFERENCES

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