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# Influence of moisture uptake on the static, cyclic and dynamic behaviour of unidirectional flax fibre-reinforced epoxy laminates

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## ABSTRACT

This paper aims to characterize the influence of moisture uptake on the mechanical behaviour of unidirectional flax fibre-reinforced epoxy laminates. Monotonic and cyclic tensile tests and free vibration characterization are carried out. Results show that UD flax-epoxy composites, when exposed to hygrothermal conditioning at 70°C and 85% RH, exhibit a diffusion kinetic which follows a one dimensional Fickian behaviour. The mass uptake at equilibrium is approximately 3.3% and the diffusion coefficient  $6.5 \cdot 10^{-6} \text{ m}^2 \text{ s}^{-1}$ . Water vapour sorption is shown to induce a significant change in the shape of the tensile stress-strain curve, a decrease in the dynamic elastic modulus of about 20% and a 50% increase in the damping ratio. Contrary to all expectations, water saturation does not degrade the monotonic tensile strength of such a flax-epoxy composites and leads to an increase in the fatigue strength for a high number of cycles.

**Keywords:** A. Polymer-Matrix Composites, A. Natural fibres, B. Mechanical properties, C. Moisture

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