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Combined ultrasonic-mechanical characterization of orthotropic elastic properties of an unrefined bagasse fiber-polypropylene composite

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Abstract

Use of wood-fiber plastics for construction purposes calls for comprehensive understanding of their anisotropic mechanical properties. As a respective contribution, we here report the first-ever complete elasticity characterization of an orthotropic bagasse fiber polypropylene composite, requiring identification of nine independent constants. For this purpose, we carry out characterization in principal material directions. Six diagonal *stiffness* tensor components are quantified based on ultrasonic longitudinal and shear wave velocity measurements; and three diagonal *compliance* tensor components are identified as the inverses of three Young's moduli derived from unloading regimes of quasi-static uniaxial compression tests. Combination of all measurement data in the framework of orthotropic linear elasticity provides access to all off-diagonal stiffness and compliance tensor components, opening the door to quantifying six Poisson's ratios.

Keywords: A. Polymer-matrix composites (PMCs); B. Elasticity; B. Creep; D. Mechanical testing; D. Ultrasonics