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Hygroscopic expansion: a key point to describe natural fibre/polymer matrix interface bond strength

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Abstract :

The present article aims to investigate the contribution of hygroscopic expansion of flax fibres to interfacial radial stresses and Interfacial Shear Strength (IFSS) of Maleic Anhydride grafted PolyPropylene (MAPP)/Flax biocomposites.

During manufacturing of thermoplastic biocomposites and storage at 50% RH, a weight variation is observed, attributed to water content evolution within plant cell-walls. The hygroscopic radial expansion coefficient βr_{flax} of single flax fibres estimated by Environmental Scanning Electron Microscopy (ESEM) observation is many orders of magnitude higher ($\beta_{f,R}$ = 1.14 ε/Δm) than thermal expansion ($\alpha_{f,R}$ = 78 10^{-6} ε/°C) . Thus, its contribution to the development of residual stresses σ_{rad} during processing should be prevalent. A multiscale analysis of interfacial stress state and hygroscopic contribution is performed with the use of a cylindrical concentric model at microscopic scale and

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