

# MODELLING OF HYGROEXPANSION IN BIRCH PULP - PLA COMPOSITES - A NUMERICAL APPROACH BASED ON X-RAY MICRO-TOMOGRAPHY

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Sustainable wood fiber based materials as wood plastic composites (WPCs) are promising alternatives to engineering plastics and/or glass fiber reinforced materials in the construction and automotive sectors. However, due to the poor bonds of hydrophilic wood fibers with the hydrophobic matrix, moisture content (MC) variations cause hygroexpansion and strength reduction in WPCs as well as moisture-induced creep in the final products. In this context, a better understanding of the microscale phenomena in WPCs is needed for the assessment of their material properties and image-based modelling represents a promising approach [1].

This work presents a FEM modelling based on X-ray computed micro-tomography for the evaluation of hygroexpansion in polylactic acid (PLA) composites reinforced by birch pulp fibers. Water absorption tests were conducted on dog bone tensile test specimens containing 40% fibers to measure the levels of water uptake reached after 1 day, 7 days and 28 days immersion. Micro-tomographic images were acquired from a cylindrical sample of approximately 2 mm diameter cut from the middle web of the dry composite specimen [2]. Two-dimensional FEM meshes were created by using the oof2 open source software (<https://www.ctcms.nist.gov/oof/oof2/>) and FEM analyses of representative volume elements (RVEs) were carried out by using Abaqus code. The elastic moduli of fibers was assumed to be a parabolic function of MC starting from the reference in dry state. The hygroexpansion was simulated by assigning moisture changes to the RVE and hygroexpansion coefficients to the matrix and in the directions of fibers. The results in terms of elastic moduli and hygroexpansion were found in agreement with the measurements at different levels of water uptake.

## REFERENCES

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