A compact model for the micro- to macro-scopic deformation behavior of natural short-fibre reinforced semi-crystalline polymer composites

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Abstract

Despite the popularity of biopolymers nowadays, ranging from their applications in the aerospace and automotive industry to food packaging, the research and modeling of their mechanical resistance have been considerably limited to date. In this research, a micromechanically based constitutive model is proposed to investigate the elastic-viscoplastic micro- to macro-scopic deformation resistance of the biocomposites consisting of a semi-crystalline polymer matrix and short biofibers. The uniaxial tension of the high-strength Polylactic acid (PLA) polymer-hemp fiber composite was taken as a case study. Due to sufficiently high fiber content and strong bonding between the fibers and the two
phases of the polymer, that is, amorphous and crystalline, influence of the lattice crystalline structure was suppressed. This enabled a compact model to be developed and the predictions of the elastic-viscoplastic macroscopic deformation behavior.

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