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Epoxy coupling agent for PLA and PHB copolymer-based cotton fabric bio-composites

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Abstract

Epoxy coupling agent was deposited on cotton fabric used for the manufacture of film stacked composites based on poly(lactic acid) (PLA) or poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) (PHB copolymer) matrices. The additive confined on the fabric surface allowed it to be reactive in the heating stage of the composite production right at the interface between fibres and matrix. The resulting composites were tensile tested comparing the data with the neat matrices and the composites with untreated fabric. A discussion to explain the mechanical results taking in consideration the density, porosity and crystallinity as well as exploiting some micro-mechanical models is presented. The ability of the additive to increase the adhesion between cotton and both matrices is verified and is essential to lighten the structures and to reach application requirements.

Keywords: A. Fabrics/textiles; A. Polymer-matrix composites (PMCs); B. Mechanical properties; E. Recycling

1. Introduction

Composite materials are used in a wide range of industrial applications, such as air, land and sea transport, building and structural applications. Most of the commercial traditional composites are fossil fuel based synthetic materials such as epoxy, unsaturated polyester, or phenolics being reinforced with synthetic fibres like glass, carbon or aramid [1]. Such thermoset polymers with synthetic fibres have serious drawbacks in terms of their recyclability, notwithstanding the energy consumption, costs and health hazards for their production [2]. The recent discussion about the preservation of natural resources