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Wetting Analysis and Surface Characterization of Flax Fibers Modified with Zirconia by Sol-Gel Method

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Abstract

Natural fibers, which can be generated from agricultural wastes, are a renewable resource abundantly available in nature. Their low cost, low density, good mechanical properties, and good thermal/sound insulation characteristics make their use in composites an emerging area in material science. However, their high capacity in absorbing water, their low dimensional stability, and their incompatibility with most hydrophobic matrices lead to some restrictions of their use. In order to overcome this issue and improve their performance as composite reinforcement, chemical treatment is needed. This research focuses on the chemical modification of the surface of the flax fibers with a thin film of zirconium dioxide (ZrO_2) and the impregnation of the lumen with ZrO_2 particles. Small Angle X-ray Scattering (SAXS) analysis provides evidence of the effective ZrO_2-treatment of flax fibers. The coating of the surface was characterized by Scanning Electron Microscopy (SEM) and X-ray Photoelectron Spectroscopy (XPS). The impregnation of the lumen was characterized with Transmission Electron Microscopy (TEM). Water absorption and Dynamic Contact Angle (DCA) measurements were carried out in order to study the hydrophilic nature of the modified fibers. Results show significant effect of ZrO_2-treatment on the decrease of the hydrophilicity of flax fibers.

Keywords: Flax fiber; Zirconia; Sol-Gel; Coating; Impregnation; Water uptake.

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