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Enhancing Glass Transition Temperature and Mechanical Properties of Poly (propylene carbonate) by Intermacromolecular Complexation with Poly (vinyl alcohol)

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Abstract

Poly (propylene carbonate) (PPC), a promising biodegradable polymer used in medical materials and packaging, is amorphous with low glass transition temperature (T_g), which limits its application. In order to restrain the segment motion of PPC and improve its T_g, based on the supramolecular science theory, polyvinyl alcohol (PVA) with multi-hydroxyl groups was selected to melt blend with PPC to build a unique physical cross-linked network structure by hydrogen bonding between hydroxyl groups of PVA and carbonyl groups or/and terminal hydroxyl groups of PPC. The interactions between PPC and PVA, and the effects of PVA on T_g, thermal behavior, morphology as well as mechanical properties of PPC/PVA composites were investigated. The shift of ν_{O-H} and $\nu_{C=O}$ in FTIR confirmed the formation of intermolecular hydrogen bonding between PPC and PVA, which guaranteed the good compatibility between PPC and PVA, and significantly improved T_g from 34.1 ^oC of neat PPC to 44.0 ^oC of 70PPC/30PVA. This interaction also improved low-temperature thermal stability of the composite, which did favor to the thermal

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