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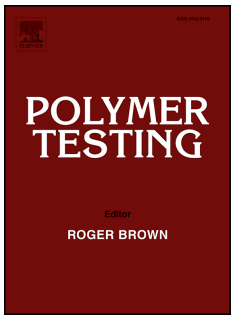

Simultaneously toughening and reinforcing poly(lactic acid)/thermoplastic polyurethane blend via enhancing interfacial adhesion by hydrophobic silica nanoparticles

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Material Properties

Simultaneously toughening and reinforcing poly(lactic acid)/thermoplastic polyurethane blend via enhancing interfacial adhesion by hydrophobic silica nanoparticles

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ABSTRACT

This work focuses on satisfactorily toughening and reinforcing poly(lactic acid)/thermoplastic polyurethane (PLA/TPU) blend with low TPU content (10 wt%) using appropriate amounts of hydrophobic silica nanoparticles (SiO_2) via simple melt mixing. Both thermodynamic prediction and transmission electron microscopy micrographs demonstrate that most SiO_2 nanoparticles distribute at interfaces between the PLA and TPU phases. This improves interfacial adhesion between the phases, which is attributed to good bonding strength between the PLA and SiO_2 via hydrophobic interaction and formation of hydrogen bonds between the TPU and SiO_2. The PLA/TPU (90/10) ternary blend nanocomposite with 2 wt% SiO_2 exhibits obviously high impact strength (about 5.0 and 12.6 times that of the corresponding blend and PLA, respectively) and higher tensile strength than the blend and even the PLA. Crazing is the main reason for improved impact toughnesses of the blend nanocomposites. This work provides a simple and effective strategy to endow PLA/elastomer blends with optimum strength–toughness balance by adding appropriate amounts of nanoparticles.

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