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Preparation and characterization of poly(propylene carbonate)/exfoliated graphite nanocomposite films with improved thermal stability, mechanical properties and barrier properties

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Abstract

Relatively high aspect ratio exfoliated graphite (EFG) particles with an average size of 7.4 μm and a nanometer sized thickness of 30-50 nm were successfully prepared by thermal treatment at 1050 degrees C and subsequent ultrasonication for application as a filler to improve the physical properties of eco-friendly poly(propylene carbonate) (PPC). A series of poly(propylenecarbonate)/exfoliated graphite (PPC/EFG) nanocomposite films with different EFG contents were prepared via a solution blending method. The physical properties were strongly dependent upon the chemical and morphological structures originating from the differences in EFG composition. The morphological structures, thermal properties, mechanical properties and barrier properties of the nanocomposite films were investigated as a function of the EFG content. While all of the PPC/EFG nanocomposite films exhibited good dispersion of EFG to some extent, Fourier transform infrared and SEM results revealed that solution blending did not lead to strong interactions between PPC and EFG. As a result, poor dispersion occurred in composite films with a high EFG content. By loading EFG particles, the oxygen permeabilities, moisture permeabilities and water uptake at equilibrium decreased as the EFG content increased. Compared with pure PPC, PPC/EFG nanocomposite films have enhanced molecular ordering. Specifically, the 2% PPC/EFG composite film shows greater molecular ordering than the other composite films, which results in the highest mechanical strength. In future work, the compatibility and dispersion of the PPC matrix polymer and EFG filler particles should be increased by modifying the EFG surface or introducing additives. (C) 2013 Society of Chemical Industry

Keywords

Author Keywords: poly(propylene carbonate) (PPC); exfoliated graphite (EFG); nanocomposite films; barrier properties

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