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Incorporation of hybrid pre-dispersed organo-montmorillonite/ destabilized bentonite nanofillers for improving tensile strength of peva copolymer with 40% vinyl acetate composition

Abstract

In this work, soft and flexible poly (ethylene-co-vinyl acetate) (PEVA) with 40% vinyl acetate (VA) composition was used as matrix material to form nanocomposites with single nanofiller (organo-montmorillonite (OMMT) or Bentonite (Bent)) and hybrid nanofillers (OMMT+Bent in the ratios of 4:1, 3:2, 2:3 and 1:4). In order to achieve greater exfoliation and dispersion of the hybrid nanofillers in the PEVA matrix, the pre-dispersing and destabilization technique was applied to the O-MMT and Bent, respectively. The procedures were done prior to the melt compounding process of the nanocomposite. A tensile test was done to evaluate the mechanical properties of the resultant nanocomposites and to allow the selection of the best OMMT/Bent ratio for the production of the hybrid nanocomposite. The structure and fractured surfaces of the neat PEVA and nanocomposite were analyzed using Fourier Transform Infrared (FTIR) and Scanning Electron Microscopy (SEM), respectively. Results indicated that the addition of hybrid pre-dispersed OMMT/destabilized bentonite nanofillers into the PEVA matrix resulted in greater mechanical performance as compared to the single OMMT or single Bent nanofiller. The best achievement in the tensile strength and elongation at break of the PEVA hybrid nanocomposite was obtained when the hybrid nanofillers was added in the ratio of 4:1 (OMMT: Bent). The SEM analysis showed that the PEVA hybrid nanocomposite with 4OMMT: 1Bent had greater matrix deformation than the neat PEVA when subjected to tensile load. This mechanical deformation could be related to the increased flexibility of the PEVA chains which facilitated more energy absorption during the stretching of the material. Apparently, this mechanism acted as a matrix toughening process which allowed the increment of both tensile strength and elongation at break values of the PEVA upon the addition of the hybrid nanofillers.

Keywords

Bentonite; Hybrid nanofillers; Organo-montmorillonite; Poly(ethylene-co-vinyl acetate)