Characterization of Polystyrene Nanocomposites Containing Nanoparticles of Pseudoboehmite Obtained by Sol-Gel Process

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Polymer nanocomposites are hybrid materials in which inorganic substances of nanometric dimensions are dispersed in a polymeric matrix. These substances have high surface area allowing a better interaction with the polymeric matrix and consequently promote changes in the physical properties of the final composite with small additions of the same. The preparation of nanocomposites with polymer matrix allows in many cases to find a relationship between a low cost due to the use of lower amount of charge, reaching high level of performance. In this work, were obtained polystyrene nanocomposites with pseudoboehmite synthesized by the sol-gel process with different concentrations of pseudoboehmite using octadecylamine as a coupling agent. The nanocomposites were prepared by the melt intercalation technique and characterized by differential thermal analysis, thermogravimetric analysis, heat deflection temperature, Vicat softening point, mechanical and rheological tests. The results showed an increase in the thermal properties, hardness and tensile strength values and decrease in the melt index, impact resistance and tensile elongation, showing the interaction of the filler with the polymer matrix.

Keywords: Nanocomposite. Pseudoboehmite. Polyestyrene. Characterization of nanostructured polymer composites.

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Use of Gamma-Alumina Nanoparticles for Drug Delivery System for Releasing Acyclovir

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The sol-gel process is a method for preparing porous ceramics, vitreous and crystalline materials from molecular precursors. In this process, a lattice of oxide compounds is made through reaction of inorganic materials in aqueous solution. The sol-gel process may be used to produce nanoparticles of pseudoboehmite, which are employed in drug delivery systems, production of nanocomposites and in the synthesis of gamma-alumina [1,2,3]. The firing of pseudoboehmite produces pure gamma-alumina [4,5]. The use of nanoparticles in drug delivery systems is advantageous because it prevents repeated doses and also decreases the amount of drug intake, which not only enhance the therapeutic effect, but also reduces the risks of plasma concentration reaching toxic levels. The use of synthetic nanoparticles have attracted great interest for applications in drug delivery systems. Pure gamma-alumina obtained from

pseudoboehmite is a synthetic aluminum compound with excellent adsorbent properties. In this work, gamma-alumina was obtained through pseudoboehmite firing to be used for in vitro release of acyclovir. The gamma-alumina was characterized by X-ray diffraction (XRD), Differential Thermal Analysis (DTA), Thermogravimetry Analysis (TG), Scanning Electron Microscopy (SEM) using secondary electron detector and EDS detector. The release profile was obtained by UV/Vis spectroscopy for in vitro analysis. The results indicate gamma-alumina is appropriate for release of acyclovir.

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Spark Plasma Sintering of Ti1-xAlxN Nano-powders Synthesized by High-Energy Ball Milling

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The present study focused on the fabrication of bulk materials from nano-powders using a spark plasma sintering (SPS) apparatus. Super-saturated solid solutions with various AlN fractions (10, 20, 30 and 50mole%) were synthesized by high-energy ball milling (HEBM) of pure nitrides. The complete dissolution of AlN in TiN was achieved after 100 h of milling. The milled powders were characterized by X-ray diffraction, SEM, energy-filtered transmission electron microscopy spectra imaging and energy dispersive x-ray spectroscopy. The crystalline size of the mechanically alloyed powders after 100 hours of milling was about 12-14 nm. powders of various compositions were sintered by SPS under 63MPa pressure at 1673K. The maximal values of hardness and bending strength (610MPa and 18.6GPa) were obtained for the composites with 20% mol%AlN and this powder was consolidated in the 1273-1423K temperature range by high pressure (500MPa) spark plasma sintering (HPSPS). Fully dense nanostructured HPSPS-processed at 1423K specimens displayed Young modulus 420GPa, hardness 20.5 GPa, bending strength 670MPa and fracture toughness 7.1 MPa·m0.5.