World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:10, No:04, 2016

Thermal and Mechanical Properties of Polycaprolactone-Soy Lecithin Modified Bentonite Nanocomposites

Authors : Danila Merino, Leandro N. Ludueña, Vera A. Alvarez

Abstract : Clays are commonly used to reinforce polymeric materials. In order to modify them, long-chain quaternary-alkylammonium salts have been widely employed. However, the application of these clays in biological fields is limited by the toxicity and poor biocompatibility presented by these modifiers. Meanwhile, soy lecithin, acts as a natural biosurfactant and environment-friendly biomodifier. In this report, we analyse the effect of content of soy lecithin-modified bentonite on the properties of polycaprolactone (PCL) nanocomposites. Commercial grade PCL (CAPA FB 100) was supplied by Perstorp, with Mw = 100000 g/mol. Minarmco S.A. and Melar S.A supplied bentonite and soy lecithin, respectively. Clays with 18, 30 and 45 wt% of organic content were prepared by exchanging 4 g of Na-Bent with 1, 2 and 4 g of soy lecithin aqueous and acid solution (pH=1, with HCl) at 75ºC for 2 h. Then, they were washed and lyophilized for 72 h. Samples were labeled A, B and C. Nanocomposites with 1 and 2 wt.% of each clay were prepared by melt-intercalation followed by compression-moulding. An intensive Brabender type mixer with two counter-rotating roller rotors was used. Mixing temperature was 100 ºC; speed of rotation was 100 rpm. and mixing time was 10 min. Compression moulding was carried out in a hydraulic press under 75 Kg/mm2 for 10 minutes at 100 ºC. The thickness of the samples was about 1 mm. Thermal and mechanical properties were analysed. PCL nanocomposites with 1 and 2% of B presented the best mechanical properties. It was observed that an excessive organic content produced an increment on the rigidity of PCL, but caused a detrimental effect on the tensile strength and elongation at break of the nanocomposites. Thermogravimetrical analyses suggest that all reinforced samples have higher resistance to degradation than neat PCL.

Keywords : chemical modification, clay, nanocomposite, characterization
Conference Title : ICMET 2016 : International Conference on Materials and Engineering Technology
Conference Location : Lisbon, Portugal
Conference Dates : April 14-15, 2016