World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:17, No:12, 2023

Direct In-Situ Ring Opening Polymerization of E-caprolactone to Produce Biodegradable PCL/Montmorillonite Nanocomposites

Authors : Amine Harrane, Mahmoud Belalia

Abstract : During the last decade, polymer layered silicate nanocomposites have received increasing attention from scientists and industrial researchers because they generally exhibit greatly improved mechanical, thermal, barrier and flame-retardant properties at low clay content in comparison with unfilled polymers or more conventional micro composites. Poly(ε-caprolactone) (PCL)-layered silicate nanocomposites have the advantage of adding biocompatibility and biodegradability to the traditional properties of nanocomposites. They can be prepared by in situ ring-opening polymerization of ε-caprolactone using a conventional initiator to induce polymerization in the presence of an organophilic clay, such as organomodified montmorillonite. Messersmith and Giannelis used montmorillonite exchanged with protonated 12-amino dodecanoic acid and Cr3+ exchanged fluorohectorite, a synthetic mica type of silicate. Sn-based catalysts such as tin (II) octoate and dibutyltin (IV) dimethoxide have been reported to efficiently promote the polymerization of ε-caprolactone in the presence of organomodified clays. In this work, we have used an alternative method to prepare PCL/montmorillonite nanocomposites. The cationic polymerization of ε-caprolactone was initiated directly by Maghnite-TOA, organomodified montmorillonite clay, to produce nanocomposites (Scheme 1). Resulted from nanocomposites were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), force atomic microscopy (AFM) and thermogravimetry.

Keywords : polycaprolactone, polycaprolactone/clay nanocomposites, biodegradables nanocomposites, Maghnite, Insitu polymeriation

Conference Title : ICEAPMC 2023 : International Conference on Engineering Applications of Polymer Matrix Composites

Conference Location : Istanbul, Türkiye

Conference Dates : December 18-19, 2023