Journal of Nanoscience and Nanotechnology, Volume 11, Number 10

A Review on Melt-State Viscoelastic Properties of Polymer Nanocomposites

Authors: Choi, Hyoung Jin; Ray, Suprakas Sinha

Source: Journal of Nanoscience and Nanotechnology, Volume 11, Number 10, October 2011 , pp. 8421-8449(29)

Publisher: American Scientific Publisher

Abstract:

The mixing of polymer matrices with nanoparticles to form composite materials has been an area of great research interest. The mechanical and rheological properties of such composite materials are directly related to the properties of the matrix polymer, the properties of the nano-filler, the strength and nature of the interfacial interactions between the polymer matrix and the filler, and finally, the surface area of the interfacial bonds. In the case of nano-filled composite materials, the area of interfacial bond is determined by the aspect ratio of the dispersed particles and the loading level. As the nanoparticles are more nicely dispersed in the polymer matrix, the thickness of the dispersed particles decreases, and as a result the aspect ratio and the affect of the filler on the matrix mechanical and other properties increases. One such nanoparticle is clay or layered silicate. Understanding the rheological properties of polymer layered silicate nanocomposites (PLSNs) under molten state is crucial to gain fundamental knowledge for the processability and the structure-property relationship of these materials. In the case of PLSNs, the melt rheological behaviors are strongly influenced by their nanostructure. In this article, we aim to critically review, from the available literatures, the recent progress in the melt-state rheological properties of various types of PLSNs and the relationship with structure. Both the linear and non-linear rheological properties have been reviewed with a particular focus on the effect of applied shear, both steady and dynamic, on the orientation of silicate platelets inside the polymer melts. To begin this, a brief description of the structure and properties of layered silicates have been summarized.

Keywords: LAYERED SILICATES; POLYMER NANOCOMPOSITES; MELT RHEOLOGY

http://www.ingentaconnect.com/content/asp/jnn/2011/00000011/00000010/art00001?token=004f1d7e65420c9d296e339412f415d7670257070492b457b7338422530329486189f21a940258