Comparison of the effect of carbon, halloysite and titania nanotubes on the mechanical and thermal properties of LDPE based nanocomposite films

Khaliq Majeed, Mariam Al Ali AlMaadeed, Moustafa Mohamed Zagho

PII: S1004-9541(17)30579-7
DOI: doi:10.1016/j.cjche.2017.09.017
Reference: CJCHE 934

To appear in:

Received date: 12 May 2017
Revised date: 19 September 2017
Accepted date: 21 September 2017

Please cite this article as: Khaliq Majeed, Mariam Al Ali AlMaadeed, Moustafa Mohamed Zagho, Comparison of the effect of carbon, halloysite and titania nanotubes on the mechanical and thermal properties of LDPE based nanocomposite films, (2017), doi:10.1016/j.cjche.2017.09.017

Materials and Product Engineering

Comparison of the effect of carbon, halloysite and titania nanotubes on the mechanical and thermal properties of LDPE based nanocomposite films

Khaliq Majeed [1,2,*], Mariam Al Ali AlMaadeed [1,3,*], Moustafa Mohamed Zagho [1,3]

[1] Center for Advanced Materials, Qatar University, PO Box 2713, Doha, Qatar.

[2] Department of Chemical Engineering, COMSATS Institute of Information Technology, Lahore, Pakistan.

[3] Materials Science and Technology Program, Qatar University, PO Box 2713, Doha, Qatar.

*Correspondence to:

M. A. Almaadeed (m.alali@qu.edu.qa) and K. Majeed (khaliqmajeed@ciitlahore.edu.pk)

Abstract

In this study, Titania nanotubes (TNTs) were prepared by hydrothermal method with the aim to compare the properties of these one-dimensional tubular nanostructures' reinforced nanocomposites with the carbon and halloysite nanotubes (CNTs and HNTs, respectively) reinforced nanocomposites. Low density polyethylene (LDPE) was used as the matrix material. The prepared nanocomposites were characterized and compared by means of their morphological, mechanical and thermal properties. SEM results showed enhanced interfacial interaction and better dispersion of TNTs and HNTs into LDPE with the incorporation of MAPE compatibilizer, however, these interactions seem to be absent between CNTs and LDPE, and the CNTs remained agglomerated. Contact angle measurements revealed that CNTs filled nanocomposites are more hydrophilic than HNTs composites, and less than TNTs composites. CNTs provided better tensile strength and Young's modulus than HNTs and TNTs nanocomposites, 42% increase in tensile strength and Young's modulus is achieved compared to LDPE. Tear strength improvement was noticed in the TNT composites with a value of 35.4 $N \cdot mm^{-1}$, compared to CNT composites with a value of 25.5 $N \cdot mm^{-1} \cdot s^{-1}$ All the prepared nanocomposite are more thermally stable than neat LDPE and the best improvement in thermal