Progress in Polymer Science 39 (2014) 1498–1525

Contents lists available at ScienceDirect

Progress in Polymer Science

journal homepage: www.elsevier.com/locate/ppolysci

Recent advance in research on halloysite nanotubes-polymer nanocomposite

Mingxian Liu [a,*], Zhixin Jia [b], Demin Jia [b], Changren Zhou [a]

[a] Department of Materials Science and Engineering, Jinan University, Guangzhou 510632, PR China
[b] College of Materials Science and Engineering, South China University of Technology, Guangzhou 510640, PR China

ARTICLE INFO

Article history:
Available online 24 April 2014

Keywords:
Interfacial interaction
Dispersion
Reinforcing
Flame retardance
Crystallization
Biocompatibility

ABSTRACT

Halloysite nanotubes (HNTs) are novel 1D natural nanomaterials with predominantly hollow tubular nanostructures and high aspect ratios. Due to their high mechanical strength, thermal stability, biocompatibility, and abundance, HNTs have a number of exciting potential applications in polymer nanocomposites. In this article, we review the recent progress toward the development of HNTs-polymer nanocomposites, while paying particular attention to interfacial interactions of the nanocomposites. The characteristics of the HNTs relative to the formation of the polymer nanocomposites are summarized first. The covalent or non-covalent functionalization methods for HNTs and various fabrication approaches for HNTs-polymer nanocomposites are introduced afterward. Polymer nanocomposites reinforced with HNTs possess highly increased tensile and flexural strength, elastic moduli, and improved toughness. HNTs-polymer nanocomposites also exhibit elevated thermal resistance, flame retardance and unique crystallization behavior. Due to the tubular microstructure and the biocompatibility of HNTs, HNTs-polymer nanocomposites have demonstrated good drug encapsulation and sustained release abilities, gaining them extensive use as tissue engineering scaffolds and drug carriers. Finally, we summarize the characteristics of HNTs-polymer nanocomposites and predict for the development of the potential applications in high-performance composites for aircraft/automobile industries, environmental protection, and biomaterials.

Contents

* Corresponding author. Tel.: +86 20 85223279; fax: +86 20 85223271.
E-mail addresses: liumx@jnu.edu.cn (M. Liu), tcrz9@jnu.edu.cn (C. Zhou).

http://dx.doi.org/10.1016/j.progpolymsci.2014.04.004
0079-6700/

Nomenclature

AEAPS	[3-2-aminoethylamino) propyl]trimethoxysilane
AIBN	azo-bis-isobutryonitrile
APS	3-aminopropyltrimethoxysilane
APTES	(3-aminopropyl)triethoxysilane
ATRP	atom transfer radical polymerization
BBT	2,5-bis(2-benzoxazolyl) thiophene)
BDP	bis(diphenyl phosphate)
BNNTs	boron nitride nanotubes
C.O.F	coefficient of friction
CBS	N-cyclohexyl-2-benzothiazole sulfonamide
CNTs	carbon nanotubes
CTE	coefficient of thermal expansion
DCM	dichloromethane
DDS	drug delivery systems
DMF	dimethyl formamide
DPG	diphenyl guanidine
DRIFTS	diffuse reflectance infrared Fourier transform spectroscopy