Accepted Manuscript

Mechanical and electrical properties of ethylene-1-octene and polypropylene composites filled with carbon nanotubes

I. Burmistrov, N. Gorshkov, I. Ilinykh, D. Muratov, E. Kolesnikov, E. Yakovlev, I. Mazov, J.-P. Issi, D. Kusnezov

PII: S0266-3538(16)30977-0

DOI: 10.1016/j.compscitech.2017.05.005

Reference: CSTE 6772

To appear in: *Composites Science and Technology*

Received Date: 16 August 2016

Revised Date: 3 May 2017

Accepted Date: 5 May 2017

Please cite this article as: Burmistrov I, Gorshkov N, Ilinykh I, Muratov D, Kolesnikov E, Yakovlev E, Mazov I, Issi J-P, Kusnezov D, Mechanical and electrical properties of ethylene-1-octene and polypropylene composites filled with carbon nanotubes, *Composites Science and Technology* (2017), doi: 10.1016/j.compscitech.2017.05.005.

MECHANICAL AND ELECTRICAL PROPERTIES OF ETHYLENE-1-OCTENE AND POLYPROPYLENE COMPOSITES FILLED WITH CARBON NANOTUBES

Burmistrov I.[1,2] , Gorshkov N.[1], Ilinykh I.[2], Muratov D.[2], Kolesnikov E.[2], Yakovlev E.[1], Mazov I.[2]., Issi J.-P.[2,3], Kusnezov D.[2].

[1] Yuri Gagarin State Technical University of Saratov
[2] National University of Science and Technology MISiS
[3] Université Catholique de Louvain

ABSTRACT

In the present work, the effect of carbon nanotubes (CNTs) addition on the electrical conductivity and mechanical properties of thermoplastic polymers was investigated. CNTs were incorporated into the polymer matrix either in high concentrations (masterbatch) or as an additive in small quantity (dilution source of masterbatches in a polymeric binder). Masterbatches containing a 5-20 % by weight of CNTs and composites obtained through their addition in polypropylene - the actual content of CNTs in polymer 0.1 and 0.01 wt. % - were synthesized and characterized by mechanical tests and scanning electron microscopy. Also, the frequency dependence of the AC electrical conductivity of masterbatches and dilute composites were measured. It has been shown that the introduction of masterbatches containing 10 wt. % of CNT provides a more efficient reinforcement of the composite than those using masterbatches with 5 and 20 wt. % of CNTs. It is also found that the alternating current (AC) conductivities display two or three regions: regions of constant conductivity and regions where the conductivity increases with increasing frequency (following the percolation scaling law). It was also observed that the conductivity increases drastically with increasing CNT content in the investigated concentration range (from 0 to 20 wt. %).

Key words: carbon nanotubes, carbon black, electrical conductivity, hopping conductivity, polymer composite

1. Introduction

Carbon nanotubes (CNTs) have been studied extensively since the seminal paper of Iijima in 1991 [1]. The exceptional mechanical, thermal and electrical properties combined with the high aspect ratio and large specific surface areas have made CNTs a promising materials for a wide range of applications. Single walled carbon nanotubes (SWCNTs) exhibit semiconducting