Accepted Manuscript

Enhanced conductive polymer nanocomposite by foam structure and polyelectrolyte encapsulated on carbon nanotubes

Weixia Yang, Wei Zou, Zhongjie Du, Hangquan Li, Chen Zhang

PII: S0266-3538(15)30162-7

DOI: 10.1016/j.compscitech.2015.12.009

Reference: CSTE 6275

To appear in: *Composites Science and Technology*

Received Date: 6 September 2015

Revised Date: 9 December 2015

Accepted Date: 15 December 2015

Enhanced Conductive Polymer Nanocomposite by Foam Structure and Polyelectrolyte Encapsulated on Carbon Nanotubes

Weixia Yang, Wei Zou, Zhongjie Du, Hangquan Li, Chen Zhang*

Key Laboratory of Carbon Fibre and Functional Polymers (Beijing University of Chemical Technology), Ministry of Education; College of Materials Science and Engineering, Beijing University of Chemical Technology, Beijing 100029, China

Abstract: Improved conductive polystyrene (PS)-based nanocomposite filled with ultralow addition of multi-walled carbon nanotubes (MWCNTs) were fabricated by concentrated emulsion polymerization. First, the foam structure was constructed to compress MWCNTs into a thin polymer skeleton and enhance the electrical conductivity of the nanocomposite. Second, a polyelectrolyte poly (3,4-ethylene dioxythiophene):poly(styrene sulfonate) (PEDOT:PSS) was introduced onto MWCNTs to reduce the noncontact resistivity within the inter-tube junctions. The effect of porous morphology, the loading phase and content of MWCNTs, and the synergetic effect of MWCNTs and PEDOT:PSS on the electrical conductivity of the nanocomposites were investigated. It was found that the foam structure of nanocomposite with a specific location of conductive fillers can strongly reduce the percolation threshold. In addition, the conductivities of the nanocomposites could be controlled by the porous structure. As a result, the percolation threshold of 0.3 wt% PEDOT:PSS/MWCNTs to PS matrix was achieved, and the highest conductivity was obtained from the foam structure with the thinnest pore wall and the appropriate ratio of PEDOT:PSS/MWCNTs.

KEYWORDS: A. Carbon nanotubes; A. Nano composites; B. Porosity/Voids; B. Electrical properties; B. Synergism

1. Introduction

Conductive polymer composites consisting single or hybrid conductive fillers in a polymer matrix[1] are interesting for a wide range of applications, such as antistatic materials[2], sensors[3-4], electrocatalysts[5], electromagnetic interference shielding [6-7], electrostatic discharge protection[8], and electrostatic painting[9]. Two major concerns in this field are reduction of the percolation threshold and achievement of high conductivity. Recently, the spotlight has been shifting to the introduction of conduction fillers including carbon black, carbon nanotubes, and graphene into porous polymers[10-12]. The existence of the pores in polymer

*Corresponding author, Email: zhangch@mail.buct.edu.cn, Tel/Fax: 86-10-64428804.