World Journal of Engineering 7(1) (2010) 30-33

World Journal of
Engineering

Optimized dispersion and orientation studies of CNTs in polymer matrixes: a new perspective for advanced nanocomposite textiles

G.A. Voyiatzis,[1,2,*] A.S. Beobide,[1,2] A. Manikas,[1,2] S.F. Nitodas,[3] T.K. Karachalios,[3] P.A. Kakavas,[4] C. Boutris,[5] and S. Pavlidou[5]

1 Foundation for Research & Technology-Hellas (FORTH), Institute of Chemical Engineering and High Temperature Chemical Processes (ICE-HT), P.O. Box 1414, GR-26504 Rio-Patras, Greece. kakavasp@otenet.gr +30 2610-965 253;

2 Interdepartmental Program of Graduate Studies on 'Polymer Science and Technology', University of Patras, GR-26500 Rio-Patras, Greece.

3 Nanothinx SA, Stadiou Str, GR-26504 Rio-Patras, Greece.

4 Technological Educational Institute of Patras, Department of Renovation and Rehabilitation of Buildings, GR-26334 Koukouli-Patras, Greece.

5 Clothing Textile & Fibre Technology Development Company (CLOTEFI), GR-17676 Athens, Greece.

(Received 22 May 2009; accepted 29 December 2009)

Abstract

Multi-wall carbon nanotubes, MWCNT, have been separately incorporated into the polymeric matrixes of an amorphous [poly(methyl methacrylate), PMMA] and a semicrystalline [poly(vinyl chloride), PVC] polymer. Uniform nanocomposites were obtained by applying sonication and film casting in a combination of solvents. Samples containing 2 and 5 wt% MWCNT have been uniaxially stretched above their glass transition temperature, Tg. The molecular orientation of the polymeric matrix in the uniaxially drawn nanocomposite samples has been estimated via polarized micro-Raman spectroscopy. Dynamic mechanical properties of both the isotropic and anisotropic specimen were investigated using dynamic mechanical analysis (DMA). Scanning electron microscopy (SEM) images indicated the dispersion and distribution of nanotubes within the PMMA/MWCNT and PVC/MWCNT films before and after uniaxial stretching.

Key words: *CNT dispersion, Molecular orientation, Polymer nanocomposites, MWCNT alignment*

The energy absorption capability of a composite material is crucial in developing improved human safety in an automotive crash. Energy absorption is dependent on parameters like fiber and matrix type, fiber orientation and volume fraction, specimen architecture and processing conditions (Jacob *et al*., 2002). The challenge is the

ISSN:1708-5284