J Material Sci Eng 2012, 1:3
http://dx.doi.org/10.4172/2169-0022.S1.008

OMICS Group Conferences
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International Conference and Expo on
Materials Science & Engineering

October 22-24, 2012 DoubleTree by Hilton Chicago-North Shore, USA

Influence of single walled carbon nanotubes and their functionality on the properties of polyamide 6/Poly (Methyl methacrylate) blends

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A series of polyamide 6 (PA6)/poly(methyl methacrylate) (PMMA) nanocomposites with different compositions were prepared by melt-mixing method by incorporating non-functionalized and functionalized (carboxylic acid (COOH) and hydroxyl (OH)) single wall carbon nanotubes (SWCNTs). Influence of these SWCNTs on structural, thermal, crystalline, morphology and mechanical properties were investigated. The FT-IR analyses of nanocomposites show the formation of hydrogen-bond interactions among PA6, PMMA and functionalized SWCNTs. Thermal studies of these nanocomposites exhibited higher thermal stability and increased crystallinity of PA6 with respect to the blends. The X-ray diffraction analyses of nanocomposites indicate that the α_{II} phase of PA6 was shifted towards γ phase. The melt flow index values of the nanocomposites were decreased by the addition of SWCNTs compared to the blends. Among nanocomposites, PA6/PMMA/COOH- or OH-SWCNTs 49.5/49.5/1 wt% were exhibited higher viscosity compare to that of PA6/PMMA/SWCNTs 49.5/49.5/1 wt%. This indicates due to the structural interactions among PA6, PMMA and functionalized SWCNTs. Nanocomposites exhibited an improved tensile modulus compare to the blends. The scanning electron microscope (SEM) images of nanocomposites showed improved compatibility compare to the blends. The significant improvements in thermal, morphological and crystalline properties of nanocomposites are considered resulting from achieving better compatibility between PA6 and PMMA by functionalized SWCNTs. We observed through these studies that the functionalized SWCNTs are acting as compatibilizers in PA6/PMMA blend system.

Biography

K. Madhukar received his Ph.D., from Osmania University, Hyderabad, India in 1989. Presently he is the Head and Chairman, Board of Studies, Department of Physics, Nizam College, Osmania University, Hyderabad. His research group interests include the design, development and applications of novel materials, such as blends and nanocomposites of thermoplastics and biopolymers. He has published 25 papers in reputed journals.

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Computational modeling of nanocomposites mechanical behavior at different environments parameters (moisture and loading)

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Discovering of carbon nanotubes (CNTs) by S. Iijima, [1] put the beginning of a revolution in nanoscience (nanomaterials). CNTs could be used as a very useful reinforcement for relatively novel materials, so called nanocomposites (a matrix-epoxy, resin, polymer, ceramics, reinforced by carbon nanotubes). Nanocomposites, have better mechanical properties - elasticity modulus, stiffness strength, due to CNTs. They find applications in engineering, nanotechnology, industry, techniques and so on, [2]. Recently has been proved that CNTs are very good tool in molecular and cellular biology, [3] and for biomedical applications, [4]. The investigations on these nanostructures increase. The aim of the paper, presented could be formulated as follows: to develop a modified theoretical (computational) model for study of the effects of moisture and thermal loading on the stress state of nanocomposites at different types of reinforcements carbon nanotubes- (SWCNTs) and (MWCNTs). On the basis of classical mechanics theories, and experimental data, has been created a new computational model. Numerical algorithms and FORTRAN programs, designed by authors, have been given as well. By numerical simulations, have been obtained graphics, reflecting effects of moisture, temperature, etc. on the mechanical behavior of nanocomposites. Comparison of the results, obtained and experiments in literature, shows a good agreement.

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