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Nisha Bagotia, Veena Choudhary, D.K. Sharma

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Synergistic effect of graphene/multiwalled carbon nanotube hybrid fillers on mechanical, electrical and EMI shielding properties of polycarbonate/ethylene methyl acrylate nanocomposites

Nisha Bagotia[a], Veena Choudhary[b*], D.K. Sharma[a]

[a]Centre for Energy Studies, Indian Institute of Technology Delhi, New Delhi-110016.

[b] Department of Material Science of Technology, Indian Institute of Technology Delhi, New Delhi-110016.

[*]***Corresponding author:*** *veenach@hotmail.com, veenac@polymers.iitd.ac.in; Tel: +91-11-26591423*

Abstract

This paper describes the preparation of polycarbonate/ethylene methyl acrylate (95/5 w/w) nanocomposites using graphene: MWCNT hybrid filler in varying ratios (1:1, 1:3 and 3:1) by melt blending process. The effect of graphene/MWCNT hybrid filler on electrical, mechanical, thermal and electromagnetic interference shielding properties of nanocomposites was investigated. Morphology of these composites was characterized by scanning and transmission electron microscopy. Composites with 10 phr loading of hybrid filler (graphene: MWCNT ratio of 1:3) show the highest tensile strength and tensile modulus as compared to the composites based on graphene or MWCNT at the same loading. The maximum electrical conductivity (1.91×10^{-1} S/cm) was also achieved at a loading of 10 phr of hybrid filler (graphene: MWCNT in the ratio of 1:3), which is higher as compared to the composite prepared using either of the filler alone at the same loading. This significant enhancement in electrical conductivity is responsible to attain up to -34 dB EMI shielding effectiveness in frequency range of 8.2-12.4 GHz (X-band). An increase in mechanical properties, electrical conductivity and EMI shielding for composites having hybrid filler (graphene: MWCNT in ratio 1:3) shows the synergistic effects when such fillers are used in combination.