Polymeric nanocomposites /nanomaterials for electromagnetic radiation shielding: A major challenge of environment pollution to health protection

Narayan Ch. Das

Rubber Technology Centre, Indian Institute of Technology Kharagpur-721302, India.
E-mail: ncdas@rtc.iitkgp.ac.in

Abstract: The growth in the application of electronic devices across a broad spectrum of military, industrial, commercial and consumer sectors has created a new form of pollution known as radio frequency interference (RFI) or electromagnetic (EM) radiation or EM interference (EMI) that can cause interference or malfunctioning of equipment. Those EM radiation consisting many unwanted radiated signals which not only degrade system or equipment performance, those EM radiationare doing serious effect on human health especially, on nervous system and brain. The possible or suggested effects of EMF on the body are Parkinson's disease, Alzheimer's disease, Cancer, tumors, Headache, fatigue, neurological disorder, etc. One of the simplest methods is to reduce electromagnetic signal by shielding (Fig. 1). Electrical conductive polymeric nanocomposites filled with carbon based conductive filler are becoming popular for microwave radiation absorbing materials because of their light weight, high flexibility, anti-corrosive, easy fabrication into intricate shape by common processing techniques and cost effectiveness. Currently, carbon materials, including carbon fibers, carbon nanotubes (CNTs) and graphene have played a leading role in the investigation and application of microwave absorbing materials due to their low specific mass and high aspect rations, which results in high electromagnetic losses at low filler content along with a reduction of thickness and weight (Fig.2a-b). In addition, electrical, thermal conductivity as well as microwave absorbing efficiency or shielding effectiveness are strongly depends on type of polymer, filler and its concentration, filler dispersion, polymer blends, processing parameter etc.

In fact, polymer nanocomposites can be fabricated by different techniques like melt mixing, solution mixing, dry mixing, powder mixing, and aqueous mixing as well as in-situ polymerization. Depending on types of polymer, their initial form and the nature of conductive fillers and ingredients. In this work, I would like to emphasize the effect of different filler types of carbon-based based fillers, its doses and dispersion of filler in polymer matrix on electrical conductivity, mechanical properties, thermal stability, thermal conductivity and EMI shielding effectiveness

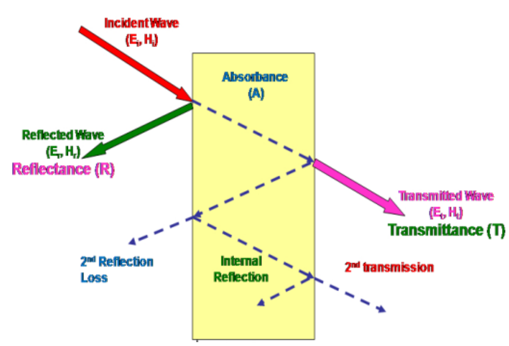

Figure 1: Schematic representation of shielding mechanisms.

5th International Conference on Nanotechnology for Better Living (NBL-2019), Jointly organized by National Institute of Technology (NIT) Srinagar and Indian Institute of Technology (IIT) Kharagpur; April 7 – 11, 2019 at SKUAST, Shalimar Srinagar, Jammu and Kashmir, India; Editor: Dr. M. A. Shah and Prof. P. Banerji, ISBN: 978-81-939516-0-6; Published by Applied Science Innovations Pvt. Ltd., Pune, Maharashtra, India.

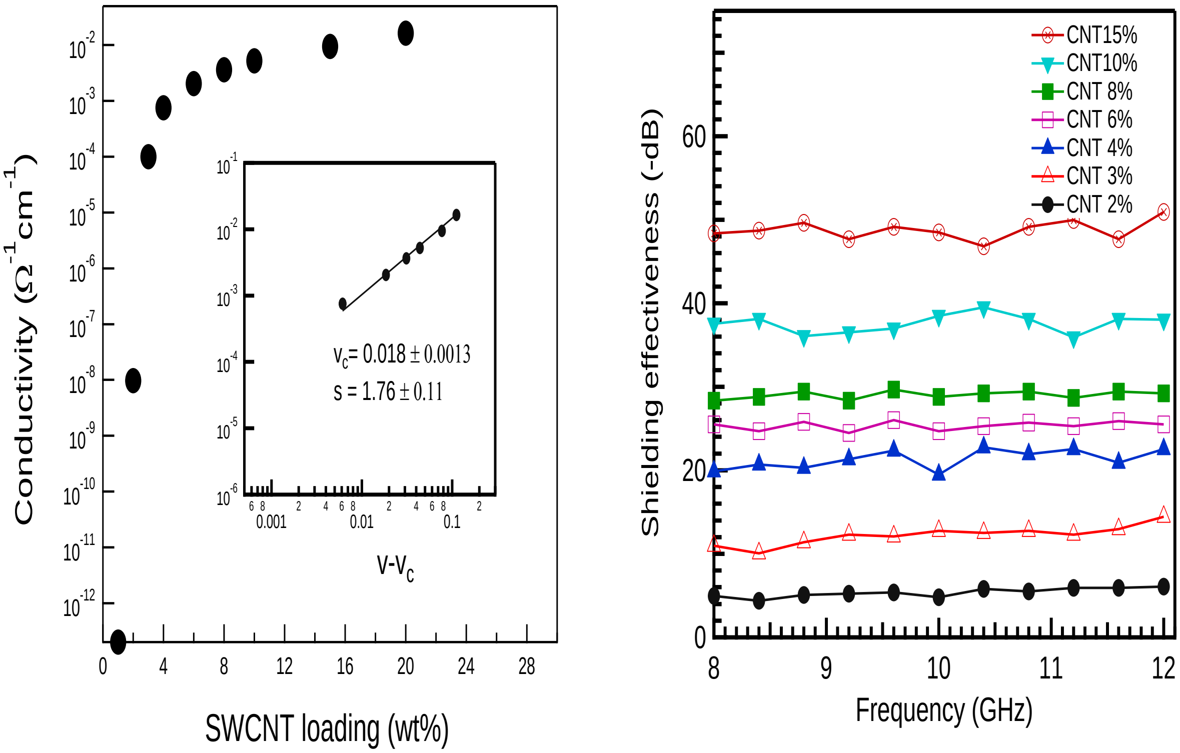

Figure 2: (a) shows conductivity vs filler loading and (b) indicate EMI shielding effectiveness vs frequency at different filler loading.

Biography: Dr. Narayan Ch. Das received his B.Sc. in Chemistry, B. Tech. degree in Polymer Science and Technology from Calcutta University (1996). He completed his M. Tech. degree (1998) and Ph.D. (2002) in Polymer Science from IIT, Kharagpur. He worked as a Research Associate at Hiroshima University, Japan Michigan Technological University, SUNY Binghamton, USA. He also worked as a Research Professor at Indiana University, USA. Currently, he is an Associate Professor at Rubber Technology Centre of IIT Kharagpur. His research interests include nanomaterials, polymer nanocomposites, rheology and processing of rubber, biomaterials, carbon dots, membrane for water purification, food packaging, SAXS and SANS.

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