ABSTRACT

In recent years, the rapid growth in compact electronics, wireless technology, and telecommunication has stimulated a significant attention towards functioning materials that shields against high-energy electromagnetic (EM) radiation generated by devices. Therefore, the need of developing electromagnetic interference (EMI) shielding materials to restrict both incoming and outgoing electrical and magnetic fields and hence, the preparation of good EMI shielding materials has become a great challenge till date.

To overcome these limitations, present work focuses towards construction of polydimethylsiloxane (PDMS) based EMI shielding materials with enhanced absorption performance. Furthermore, PDMS as an encapsulating layer opens up new type of hydride materials due its hydrophobic nature and corrosion resistance property. The present research proposed various effective ways to enhanced absorption performance via creating the inhomogeneity in the polymer composites to facilitate the internal multiple reflection of microwave. Our study on hollow Prussian blue (HPB) nanoparticles anchored reduced graphene oxide (rGO) sheets (HPBR) plays as active filler for the PDMS composites. Electromagnetic waves (EMWs) absorption performances can be altered via microstructural changing and by varying the mass ratio of the precursors of active filler. For improving absorption performance, hybrid sandwich-type composite structure made of a composite (PRC) matrix, rGO and PDMS where cigarette wrapper is impregnated which is easily available and cheap source of aluminium instead of a commercially available aluminium sheet. The development of hydrogel-based materials, now have a fresh choice on EMI shielding application as water can produce polarization loss and dissipates EMWs. One drawback of these hydrogel materials is its stability. Sustainability of hydrogel by using PDMS pocket has turned the EMI SE performances and durability in new directions. In the case of PDMS encapsulation, polyacrylamide and polyacrylamide-alginate hydrogel were utilized as the matrix, and silver nanowire, ionic liquid, lithium chloride, polypyrrole, and polydopamine-decorated polypyrrole were used as the filler materials. Pressure induced compressibility and water dependency allowed the composites to have tunable EMI SE. The morphological, thermal, magnetic, mechanical and shielding properties of the prepared polymer composites have been discussed in detail in the thesis. As a result, it can be said that the PDMS based composite with different architectures are effective and efficient candidates for shielding applications in contemporary electronics due to their ease of fabrication, light weight, excellent flexibility, good mechanical properties, and ultrahigh EMI shielding performance.

KEYWORDS: Microstructure, Hydrogel-elastomer, Dehydration tolerance, Permittivity, Electromagnetic interference.