Probing the Multi-Functional Performance of Magnetic Nanoparticles/Epoxy Resin Hybrid Nanocomposites

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Polymer matrix nanocomposites is an important class of engineering materials for various technological applications. Multifunctional performance is achieved by integrating various desirable and supplementary properties/responses in a materials’ system [1-3]. The latter should be able to respond under various loading conditions. Mechanical/thermal properties, tunable electric conductivity, variable electric polarization/dielectric permittivity, adjustable magnetic response, thermally induced phase changes contribute to the overall multifunctional performance. In the present study, magnetic nanoparticles (Fe$_3$O$_4$, or ZnFe$_2$O$_4$ or SrFe$_{12}$O$_{19}$) with ferroelectric (BaTiO$_3$) particles or carbon nanotubes (CNTs) are used as fillers in a polymer matrix. BaTiO$_3$ particles provide functionality to the systems, via their thermally induced ferroelectric-to-paraelectric transition [4], while CNTs enhance mechanical endurance and electrical conductivity. Hybrid nanocomposites underwent structural, morphological characterization, and their thermo-mechanical, magneto-electric properties were investigated. The magnetic behaviour varying the employed magnetic filler type as well as the energy storing/retrieving ability of the studied systems is examined and discussed, aiming to determine the system exhibiting optimum performance.

References


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