$ZnTiO_3/BaTiO_3$/EPOXY RESIN HYBRID NANOCOMPOSITES: DEVELOPMENT DIELECTRIC RESPONSE AND FUNCTIONAL PERFORMANCE

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ABSTRACT

The scientific and technological impact of polymer matrix nanocomposites (PNCs) is globally recognized and appreciated[1,2]. Polymer matrix composites became an important class of engineering materials, because of their mechanical properties, lightweight, thermal stability, and the adaptation of complex shapes and forms[1,2]. The era of nanostructured materials gave an additional impetus to polymer matrix composites. By employing a nano-scaled reinforcing phase, such as nanoparticles, nanofibers, or nanoflakes, interfacial area enhances significantly and the PNCs' response is governed not only by the properties of the constituents, but also by the occurring interactions at the interface[3,4]. Nowadays, besides the mechanical properties, electrical and magnetic responses are attracting attention and acquire significance[4-6]. Multifunctional performance can be defined as the combination of various desirable properties or behaviours in a single materials' system. Hybrid PNCs have the advantage of modulating complementary properties/responses and interactions of the reinforcing phases and the matrix material[5,6]. Polar oxides increase the dielectric permittivity and electrical energy storage of PNCs, while piezo/ferro-electric crystal particles exhibit a high level of adjustable polarization via their thermally induced structural changes providing thus an additional side of multitasking performance[5-7]. In this study, hybrid PNCs of epoxy resin and ceramic nanoparticles of $ZnTiO_3$ and $BaTiO_3$, were prepared at various concentrations of the reinforcing phases. The structure and the morphology of the fabricated hybrid nanocomposites were assessed via X-Ray Diffraction (XRD) patterns and Scanning Electron Microscopy (SEM) images. Prepared specimens were characterized by means of Differential Scanning Calorimetry (DSC) and Broad Band Dielectric Spectroscopy (BDS), while the piezoelectric response of the hybrid PNCs and their ability to store and retrieve energy was also investigated.

KEYWORDS: Hybrid nanocomposites, Electrical properties, Energy storing/retrieving, Piezo/ferro-electric response

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