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Enhanced dielectric properties and energy storage performance of PVDF nanocomposites containing ferromagnetic metals doped ZnO nanoflowers

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Advanced high k-polymer nanocomposites designed by integrating high dielectric fillers within different polymers have considerable potential in energy storage applications due to their flexibility and ease of fabrication. Dielectric properties and the energy storage performance for various nanocomposites based on polyvinylidene fluoride (PVDF) are demonstrated here in this study. Semiconducting nanoflowers of ZnO were synthesized following hydrothermal fabrication, and the nanoarchitectures were modified by doping with ferromagnetic metals-Iron (Fe), Nickel (Ni) and Cobalt (Co). While doping with Ni, changed the flower like architecture of ZnO in to spherical shape, Co-doping developed nanorods with hexagonal cross sections with no significant change in the structure for Fe-doped ZnO. Different strategies of fabrication methods such as solution casting, sandwiching and electrospinning were practiced for the nanocomposite fabrication. In all cases, the concentration of the nanoparticles was varied between 0.5 wt.% to 2 wt.% and a regular increase in dielectric constant was observed with increase in concentration. At 2 wt.%, the solution casted films of Fe-doped ZnO filled PVDF composite showed a three times increase in dielectric constant. Whereas for the Ni-doped ZnO containing nanocomposite, the increase was about 4.8 times. In the case of Co-doped ZnO, a similar increase in dielectric constant was noticed for electrospun fibers. The significance of fabrication methods as well as the nanoparticle size effects are correlated with the energy storage performances.

Biography

Hemalatha has received PhD in Materials science from Madurai Kamaraj University, India. Currently, she is working as a Research Assistant at Qatar University, in the field of energy harvesting. Her research areas of interest include polymer nanocomposites and nanomaterials.

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