World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:19, No:12, 2025

Enhancing Piezoelectric Properties of PVDF-HFP/PLA/PZT Nanocomposite for Energy Harvesting Application

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Abstract : Using flexible piezoelectric nanocomposite films in autonomous nano-systems, sensors, and portable electronics has garnered significant attention within the scientific community. This paper investigates the impact of Lead zirconate titanate (PZT) nanoparticles on the crystal structure of polyvinylidene fluoride hexafluoro propylene (PVDF-HFP)/polylactic acid (PLA), its distinctive crystallization behavior, mechanical properties, and the ensuing enhancement in piezoelectricity. In this study, PVDF-HFP/PLA/PZT nanocomposite films were fabricated utilizing the solvent casting technique, incorporating varying concentrations of PZT. Subsequent characterization of the films involved comprehensive analyses employing polarized optical microscopy (POM), Fourier-transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD). POM observations revealed a homogeneous dispersion of PZT nanofillers within the PVDF-HFP/PLA matrix. FTIR and XRD analyses confirmed the presence of the β-phase in the nanocomposites, signifying improvements in their piezoelectric properties. The substantial augmentation in piezoelectricity witnessed emphasizes the potential of electroactive nanocomposites for energy harvesting applications. This research contributes to advancing sustainable energy technologies by elucidating the efficacy of PZT-enhanced PVDFHFP-PLA nanocomposites as proficient materials for piezoelectric energy conversion.

Keywords : piezoelectric films, energy harvesting, dielectric polymers, nanocomposite
Conference Title : ICNNE 2025 : International Conference on Nanomaterials and Nanotechnology in Energy
Conference Location : New York, United States
Conference Dates : December 09-10, 2025