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Enhancement of β-phase in PVDF films embedded with ferromagnetic Gd_5Si_4 nanoparticles for piezoelectric energy harvesting SHANE HARSTAD, NOEL D'SOUZA, Department of Mechanical and Nuclear Engineering, Virginia Commonwealth University, Richmond, VA, NAVNEET SOIN, Institute of Renewable Energy and Environment Technology, University of Bolton, Bolton, UK, AHMED EL-GENDY, Department of Mechanical and Nuclear Engineering, Virginia Commonwealth University, Richmond, VA, SHALABH GUPTA, VITALIJ PECHARSKY, Division of Materials Science and Engineering, Ames Laboratory, US Dept. of Energy, Ames, IA, TAHIR SHAH, ELIAS SIORES, Institute of Renewable Energy and Environment Technology, University of Bolton, Bolton, UK, RAVI HADIMANI, Department of Mechanical and Nuclear Engineering, Virginia Commonwealth University, Richmond, VA — Self-polarized Gd5Si4-polyvinylidene fluoride (PVDF) nanocomposite films have been synthesized via a facile phase-inversion technique. For a 5 wt% Gd5Si4-PVDF film, the enhancement of the piezoelectric β-phase from 49% for pristine PVDF to 81% for nanocomposite is confirmed using FTIR spectroscopy. The Gd5Si4 particles prepared using high-energy ball milling have a particle size of ˜470 nm with a high magnetization of 11 emu/g. The analysis of the Gd5Si4-PVDF films revealed a change from diamagnetic behavior to enhanced ferromagnetism when pristine PVDF films are loaded with 2.5 wt% and 5 wt% Gd5Si4 nanoparticles. The increased β-phase fraction resulting from the addition of magnetic Gd5Si4 nanoparticles to membranes of PVDF paves the way for future efficient energy harvesting applications using a combination of magnetic and piezoelectric effects.

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