PVDF-HFP based free standing hybrid composite films for piezoelectric energy harvesting to power IoT sensors

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Abstract

With increasing demand for piezoelectric energy harvesting and the advantages offered by ferroelectric polymer-based composite materials, this work investigates piezoelectric energy harvesting from free-standing poly(vinylidene fluoride)-co-hexafluoropropylene/0.67($BiFeO_3$)-(0.33$BaTiO_3$)/Molybdenum Disulfide (PVDF-HFP/BF-BT/MoS_2) hybrid composite films synthesized via solution casting and subsequent hot-pressing method. Structural properties were analysed using XRD. FTIR spectroscopy was used to determine the fraction of β-phase of the synthesized hybrid composite films. FESEM micrographs confirmed the presence of pores in the synthesized samples, which provided an additional advantage in enhancing their piezoelectric performance. The dielectric and ferroelectric properties were studied, in which the dielectric constant increased up to around 70% than that of pure polymer at a frequency of 1kHz. A PUND analysis was performed to validate the data obtained from the static hysteresis loop. Piezoelectric charge and voltage coefficients were also measured, which indicates potential of the synthesized films for being used in energy harvesting applications. The harvested energy can further be utilized for powering low-power devices, like IoT sensors, showing the real-time applicability of the synthesized free-standing hybrid composite films.

References

[1] T. K. Siponkoski, H. M. Jantunen, J. A. Juuti, Appl. Phys. Lett. 120(2022), 052903. https://doi.org/10.1063/5.0075853
[2] R. Li, J. Wang, A. Li, Q. Ma, S. Feng, B. Ran, L. Zhang. Sensors. 25(2025),2085. https://doi.org/10.3390/s25072085
[3] S. Ghosh, P. Chopraac, S. Wategaonkar. Phys. Chem. Chem. Phys. 22(2020), 17482-17493. https://doi.org/10.1039/D0CP01508C

Figures

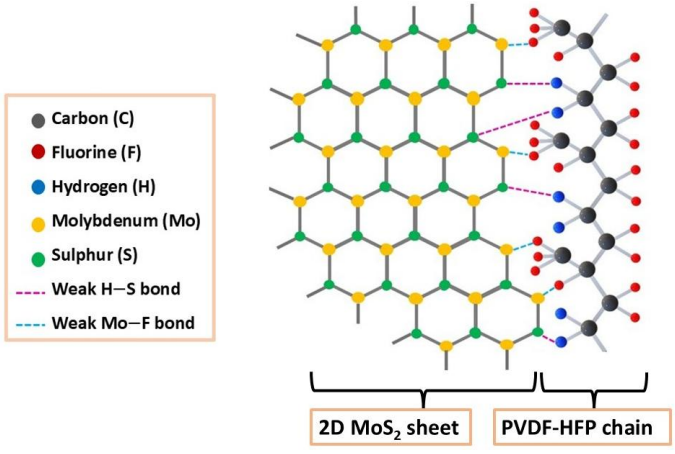

Figure 1: Schematic diagram of possible interaction between 2D-MoS_2 sheets and PVDF-HFP chain