Fabrication and Characterization of Flexible Piezoelectric Composite Film of KNN-LiSb /PVDF for Energy Harvesting Application

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**ABSTRACT**

Piezoelectric energy harvesting has attracted a lot of interest for tackling the environmental issue brought on by the usage of non-renewable resources. Over the last few decades, self-powered, portable, lightweight technologies and smart materials have become more prevalent. Piezoelectric materials are the most widely used among these smart materials. Piezoelectric materials can be used to convert mechanical energy into electrical energy. Past studies have shown that lead-based ceramics, such as lead zirconate titanate (PZT), have excellent piezoelectric properties like high piezoelectric coefficient(d33), and high dielectric constant. But because PZT contains a significant amount of lead (around 60%), it is detrimental to the environment. Lead-free ceramics, such as potassium sodium niobate (KNN), barium titanate (BaTiO3), bismuth potassium titanate (BKT), etc, are preferred to resolve this matter. Due to their environmental friendliness, good electrical properties, and high curie temperature, KNN-based ceramics have gained a lot of attention.

In this work, we have fabricated [0.95(K0.48Na0.52) NbO3 – 0.05LiSbO3] / PVDF piezoelectric generator (PEG), where PVDF is used as a polymer matrix and KNN-LiSb as a filler piezoelectric material. The stated objectives of adding Lithium and Antimony to KNN powder are to improve the thermal stability, and piezoelectric properties. According to literature, PVDF has been investigated as a potential piezoelectric polymer due to its structural flexibility and greater piezoelectric coefficient than other polymeric materials such as nylon11, polypropylene, poly dimethyl siloxane, and so forth. The KNN-LiSb / PVDF composite films have been prepared with various concentration (0%,5%,10%,15%, and 20% on the weight of PVDF) by using drop casting method. The phase and structural analysis of piezoelectric composite film was investigated by XRD and FTIR (Fourier Transform Infrared spectroscopy). The morphology of composite films was investigated by SEM (Scanning Electron Microscopy) which showed that the ceramic particles were distributed uniformly throughout the PVDF matrix. Furthermore, the prepared generator's efficiency in harvesting energy was assessed by tapping it with a finger to apply pressure, followed by a measurement of the output voltage and short-circuit current. The current work showed that lead-free piezoelectric ceramics can be modified with suitable dopants to provide high-performance PEG.

*Keywords:* Piezoelectricity, PVDF, XRD

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