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10 - Fluoropolymer nanocomposites for piezoelectric energy harvesting applications

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Abstract

Energy harvesting from the ambient sources present in our surrounding has gained the attention of scientific community over the past few decades in order to reduce the humanity's reliance on the conventional energy sources. In this direction, flexible piezoelectric nanogenerator which can harvest a diverse range of ubiquitously available mechanical energy and convert it into useful form of electricity is a promising energy source having widespread application in the field of wearable electronics, e-skin, patchable and implantable sensors. These types of nanogenerators can also be used for harnessing kinetic energy from the vehicle traffic, water, and wind for further reducing the greenhouse emission by reducing the load on the existing power grid. For this, poly(vinylidene fluoride) (PVDF) and its copolymers are the most promising candidates for fabricating piezoelectric nanogenerator owing to their high flexibility, unique electroactive characteristics, biocompatibility, low cost, and good stability. However, the piezoresponse of PVDF-based nanogenerator is still low to drive electronic devices directly from the generated power. Therefore, the present chapter focuses on the factors affecting piezoelectricity in the fluoropolymer and ways to enhance the output performance by maximizing energy conversion efficiency of piezoelectric nanogenerator. The chapter will start with a brief introduction of theory and principle involved in the piezoelectric energy harvesting, and then, the properties of the various piezoelectric fluoropolymers will be discussed. Further, the effect of synthesis routes, inclusion of copolymers, and addition of different types of nanofillers have been covered for optimized electricity generation in the fabricated nanogenerator. Finally, recent advancements in the development of flexible piezoelectric nanogenerator based on fluoropolymer nanocomposites are discussed in light of innovative applications.

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Keywords

Fluoropolymer nanocomposites; energy harvesting; flexible device; piezoelectricity; self-powered system

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