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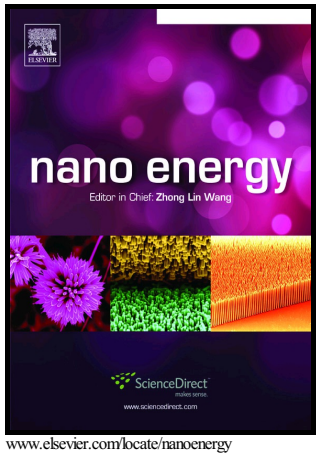

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Ferroelectret nanogenerator with large transverse piezoelectric activity

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Abstract

Energy harvesting from vibrations enables power delivery to low-energy electronics for autonomous devices, wearables, as well as wireless and remote sensing. Here we present a piezoelectric energy harvester consisting of specially designed ferroelectrets based on fluorocarbon polymers that have very large low-frequency *transverse* piezoelectric coefficients g_{31} = 3.0 Vm/N. This is much larger than corresponding values for lead zirconate titanate (PZT) or for polyvinylidene fluoride (PVDF) which are presently standard materials for harvester devices. We use these ferroelectrets in miniature energy harvesters that can be classified as Ferroelectret Nanogenerators (FENG's). Their performance is characterized by a power output of approximately 50 µW for an acceleration of 9.81 m/s^2 and a seismic mass of 0.09 g. This compares favorably with the best PZT or PVDF systems, but is accomplished with a soft material that is small, lightweight, and flexible. This permits uses of such harvesters for powering miniature devices, such as small mobile sensing equipment, nano- and microelectronic circuits, body-worn electronics, or medical implants.

Keywords: ferroelectret nanogenerator; FENG; transverse piezoelectric activity; parallel tunnel structure; fluorinated ethylene propylene; vibrational energy