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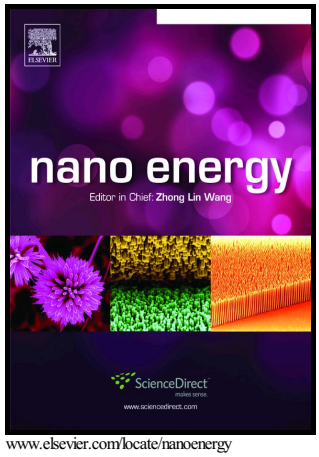

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A Durable and Stable Piezoelectric Nanogenerator with Nanocomposite Nanofibers Embedded in an Elastomer under High Loading for a Self-Powered Sensor System

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ABSTRACT

Practical usage of piezoelectric nanogenerators (PENGs) under heavy loading environments for high power generation, such as smart shoes, has been limited due to the low mechanical endurance of many piezoelectric materials. Durability and performance under harsh environments are a stumbling block for the practical application of PENGs. Synthesis of piezoelectrically enhanced nanofibers electrospun from nanocomposite of barium titanate nanoparticles (BT NPs) dispersed in poly(vinylidene fluoride-trifluoroethylene) (P(VDF-TrFE)) enables successful fabrication of a robust, efficient, flexible and lead-free PENG. A nanofiber PENG (nf-PENG) fabricated by embedding nanocomposite nanofibers in an elastomer film is demonstrated for biomechanical energy harvesting and storage during walking. When placed inside of a shoe, a nf-PENG loaded with 15 wt% BT NPs can generate an output of 25 V at a walking frequency of 0.6 Hz with high mechanical durability under very high loads (600 N). This can charge a 4.7 μF capacitor after approximately 72 steps. The stored charge can operate a

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