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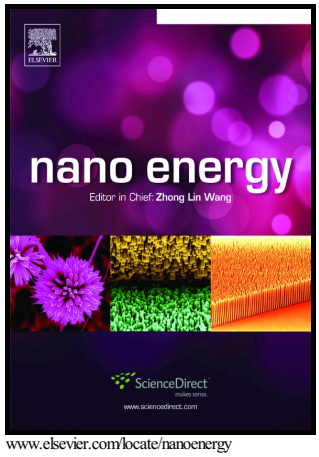

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Polymer Tubes as Carrier Boats of Thermosetting and Powder Materials Based on 3D printing for Triboelectric Nanogenerator with Microstructure

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Abstract

Traditional 3D printing craft's limit in fabricating micro/nanostructures and thermosetting materials makes it hard to be directly applied to the fabrication of triboelectric nanogenerator (TENG), whose performance strongly relies on structures and properties of the used materials. To meet these challenges, polymer tubes (tubular polyethylene (PE) and nylon (PA)) are used as carrier boats of directly printing polydimethylsiloxane (PDMS) and polyethylene glycol (PEG) without templates for the purpose of gaining a device with the highest output performance, which in turn can be obtained by adding a more electronegative material and removing PEG out of the film after printing to fabricate a sponge-like structure. Under these conditions, a best performance of 306 V output voltage, 6.14 mA instantaneous current, 74.4% energy conversion efficiency and 236.67 W/m^3 power density could be achieved, which are higher than the values with traditional 3D printing method. Most importantly, this device can be applied to light a processed LED bulb (85 V, 3 W) directly. This innovative method based on fused deposition modeling (FDM) exhibits outstanding properties of short fabrication cycle, low cost, possibility of large-area modeling and wider selection of materials, which can stimulate the industrialization of TENG and make it more accessible to practical applications.

Graphical abstract