Double-layer structured PVDF nanocomposite film designed for flexible nanogenerator exhibiting enhanced piezoelectric output and mechanical property

Penghao Hu\*,#, Lili Yan\*, Chaoxian Zhao\*, Yangyang Zhang\*, Jin Niu\*

**\*** Institute for Advanced Materials & Technology, University of Science & Technology Beijing, Beijing 100083, China (penghaohu@gmail.com)

**#** Institute of Flexible Electronics Technology of Tsinghua University Zhejiang, Jiaxing 314006, China

Abstract

PVDF-based nanocomposite films are promising in fabrication flexible piezoelectric nanogenerators for self-powered portable devices. In this work, a double-layered heterostructure was designed and the PVDF nanocomposite films contained with barium titanate nanoparticles were prepared by solution spin coating. The nanofillers were concentrated distributed in one layer of half the film, and the remaining half was neat PVDF layer. The double-layered BT/PVDF films were characterized comparatively with their counterpart of single-layer films. Although containing with less content of BT nanoparticles and lower proportion of β-phase in polymer, the piezoelectric nanogenerator (PENG) devices fabricated by double-layered films represent higher piezoelectric outputs in mechanical-to-electric conversion measurement. The charges accumulated at the additional interlayer interface between BT/PVDF layer and PVDF layer contributes much to enhancing electric capacity of the film. Benefited from good interfacial adhesion and better flexibility, the mechanical property and cyclic endurance are also improved. The double-layer film contained with 20 volume fractions (vol%) BTNPs represent excellent comprehensive performance of 6.7 V in output voltage, 2.4 μA in output current, and good stability changed within 3% in more than one thousand circles. The double-layer constructure is promising in nanocomposite films to develop PENGs for self-powered devices.

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