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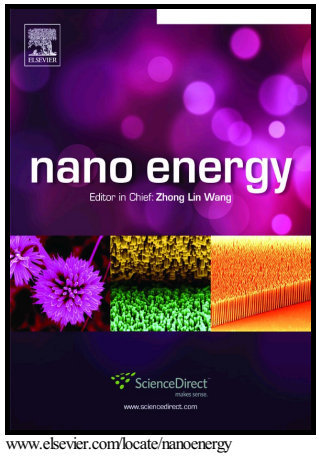

www.elsevier.com/locate/nanoenergy

PII: S2211-2855(17)30501-3
DOI: http://dx.doi.org/10.1016/j.nanoen.2017.08.025
Reference: NANOEN2139

To appear in: *Nano Energy*

Received date: 21 July 2017
Revised date: 14 August 2017
Accepted date: 16 August 2017

Cite this article as: Yonghui Zhang, Zengxia Mei, Tao Wang, Wenxing Huo, Shujuan Cui, Huili Liang and Xiaolong Du, Flexible Transparent High-Voltage Diodes for Energy Management in Wearable Electronics, *Nano Energy,* http://dx.doi.org/10.1016/j.nanoen.2017.08.025

Flexible Transparent High-Voltage Diodes for Energy Management in Wearable Electronics

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Abstract:
This work reports flexible fully transparent high-voltage diodes that feature high rectification ratio (R_r ~ 10^8) and high breakdown voltage (V_b ~ 150 V) simultaneously, combined with their applications as building blocks of energy management systems in wearable electronics where triboelectric nanogenerators (TENGs) are used as power source. Both experimental results and technology computer aided design (TCAD) simulations suggest that R_r and V_b can be modulated by the offset length in an opposite tendency. The low reverse leakage current (~ 10^{-15} A/μm) guarantees an ultra-low power consumption in standby mode, which is a core issue in wearable device applications. Besides the unprecedented electrical performance, the diodes exhibit good mechanical robustness with minimal degradation throughout the strain and fatigue tests. By incorporating these high-voltage diodes into half-wave and full-wave rectifier circuits, the high alternating current (AC) output voltage of TENGs is successfully rectified into direct current (DC) voltage and charged into supercapacitors (SCs), indicating their high integration and compatibility with TENGs, and thus their promising applications in various wearable electronic systems.

Graphical abstract: