Supporting Information

Flexible Piezoelectric Nanogenerators Based on ZnO Nanorods Grown on Common Paper Substrates

Yu Qiu, Heqiu Zhang*, Lizhong Hu, Lina Wang, Dechao Yang, Bin Wang, Jiuyu Ji, Guoqiang Liu, Xin Liu, Jianfan Lin, Fei Li and Shijun Han

School of Physics and Optoelectronic Technology of Dalian University of Technology, Dalian 116024, People's Republic of China

*Corresponding Author. E-mail: hqzhang@dlut.edu.cn

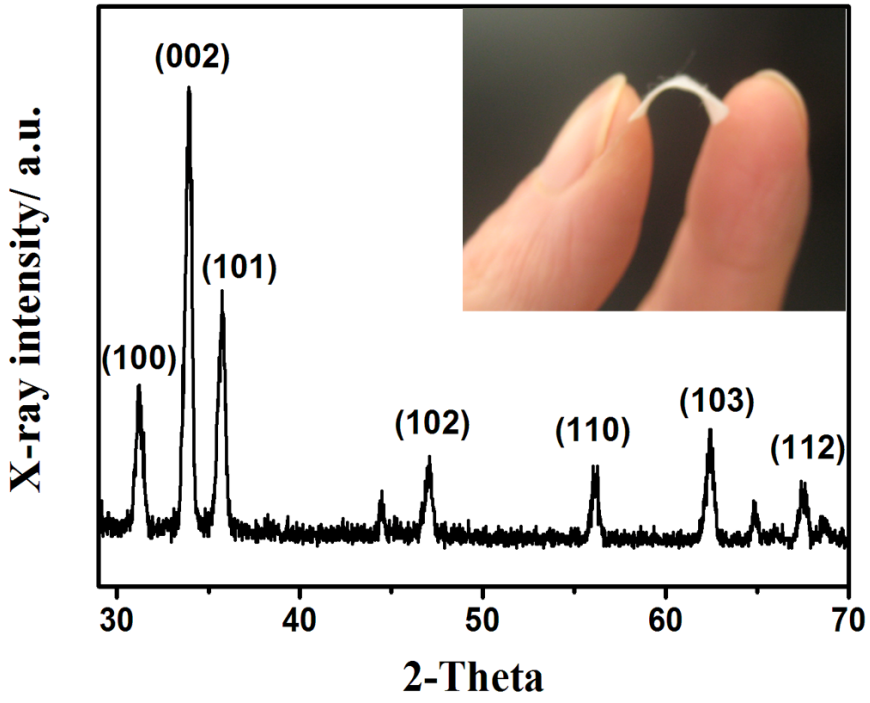

Figure S1. XRD spectra of a ZnO-paper piece confirming the crystalline structure. The inset is its digital camera photograph, indicating its high flexibility.

Calculation of the manually given strain

Assume the plastic board (PB) is bent into a circular arc with a radius of R, accordingly the bending radius of the ZPNG fixed on the PB is also R, as shown in Figure S2. Thus we can easily create the following formula and calculate R from it

$$h = 2R\sin^2(\theta/2) = 2R\sin^2(L/2R) \qquad (1)$$

where h and L are the height of the gasket and the length of the PB, respectively. Then the bending radius R of ~99.7 cm is estimated for an h of 2cm and a L of 20cm. The thickness of the PB is 0.2 cm. As a result, the maximum strain applied on the ZPNG is calculated to be ~0.25 % according to the formula $\varepsilon = h/2R$.

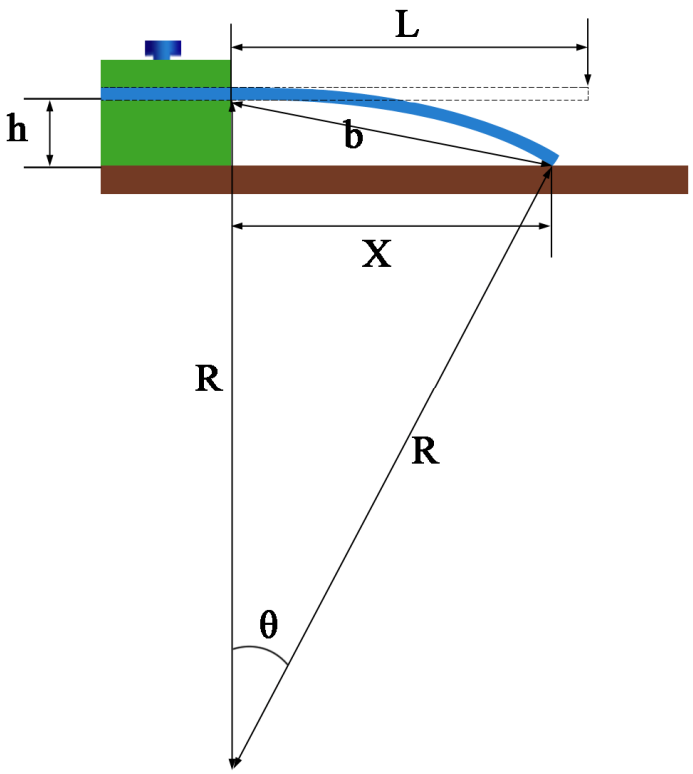

Figure S2. Schematic diagram of the bending of the PB applied an external force at its free end.

No voltage or current output generated from the common paper

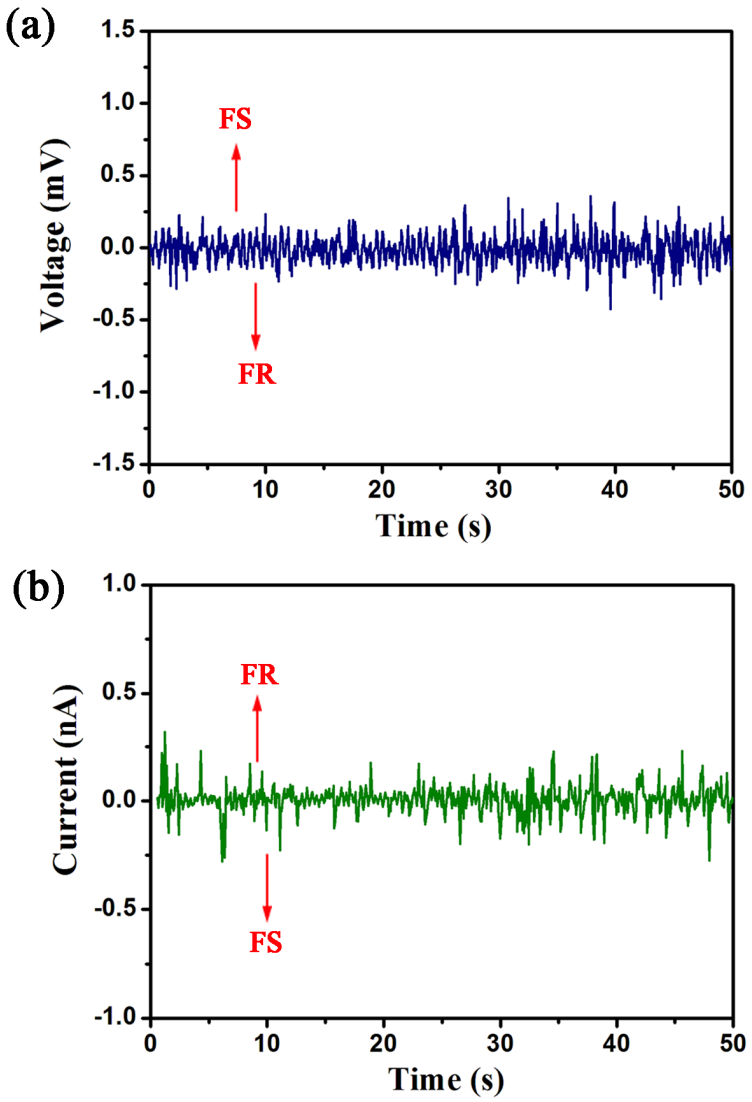

Figure S3. The electric outputs of a common paper under FS and FR, no voltage or current was observed except of noise, confirming that the electric outputs of a ZPNG generated from the piezoelectric ZnO NRs on the paper.

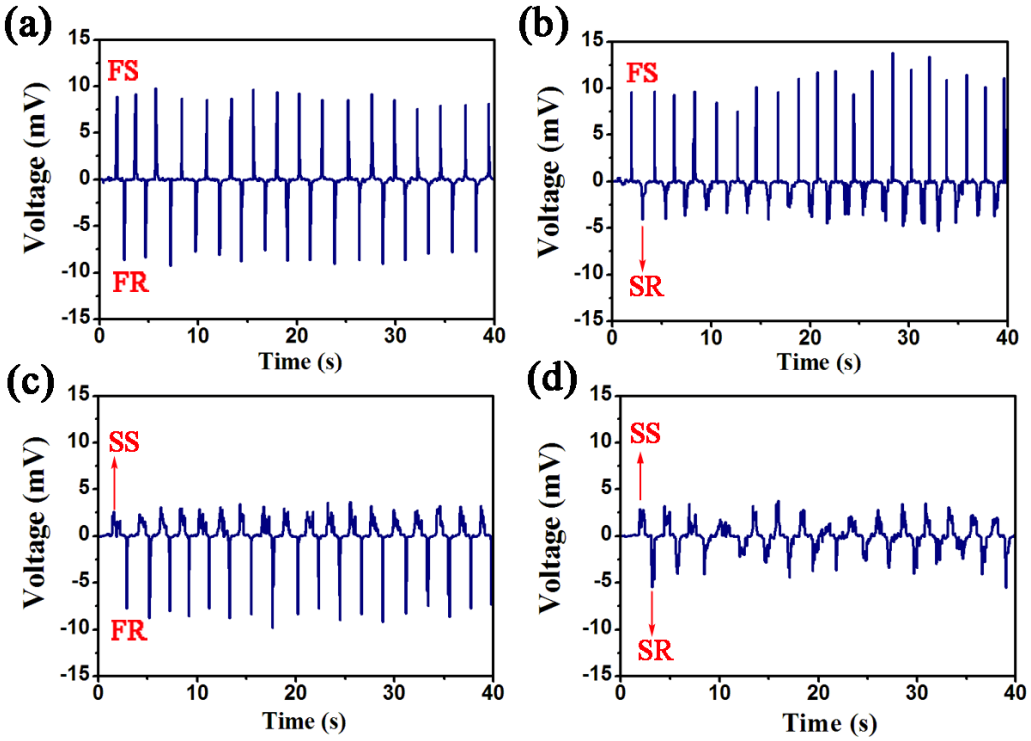

Figure S4. Voltage outputs of a ZnO-paper nanogenerator (ZPNG) at different strain rate under a constant applied strain (h=2 cm). (a) Voltage output generated under fast stretching (FS) and fast releasing (FR). (b) Voltage output generated under FS and SR. (c) Voltage output generated under slow stretching (SS) and FR. (d) Voltage output generated under SS and SR.

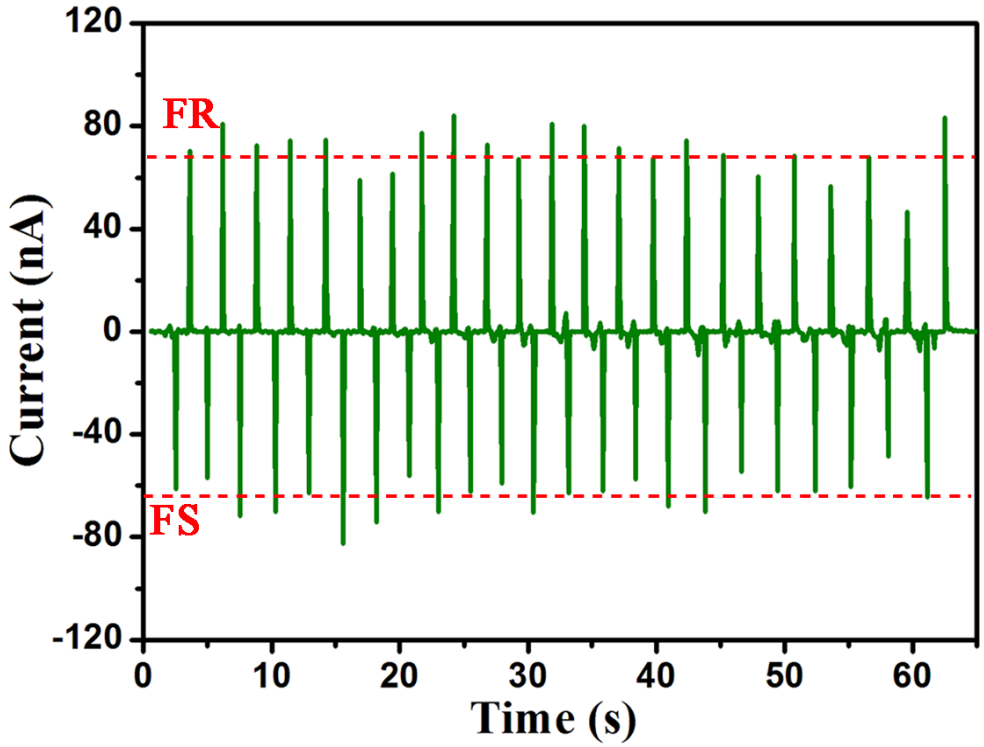

Figure S5. Current outputs of a large-size of ZnO-paper nanogenerator (ZPNG) subjected to repeated cycles of fast stretching (FS) and fast releasing (FR).