Self-Powered Piezotronic Strain Sensor Based on Single $ZnSnO_3$ Microbelts

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Supplementary information S1

The thermionic emission-diffusion phenomena were dominated in our strain sensor devices, as given by the equation 1 below.

$$\mathrm{I} = \mathrm{A} \cdot R \cdot T^2 \exp\left(\sqrt{\frac{q^3\left[\frac{2qD}{k_s}\left(V_{bi}+V-{}^{kT}/_{q}\right)\right]^{\frac{1}{2}}}{4\pi k_s}} - \frac{\varphi_s}{kT}\right) \qquad (1)$$

where A is the area of the source Schottky barrier, R is the effective Richardson constant, q is the electron charge, D is the donor impurity density, k is the Bolzman constant, k_s is the permittivity of $ZnSnO_3$, and V_{bi} is the potential at barrier. Figure S1 shows that the ln I-$V^{1/4}$ curve is almost linear. As subjected by varied tensile and compressive strains to $ZnSnO_3$ microbelt, the SBH for the metal-semiconductor-metal (MSM) structure in microbelt is a combination effect from both strain induced the change of piezoelectric polarization and band structure.[1]

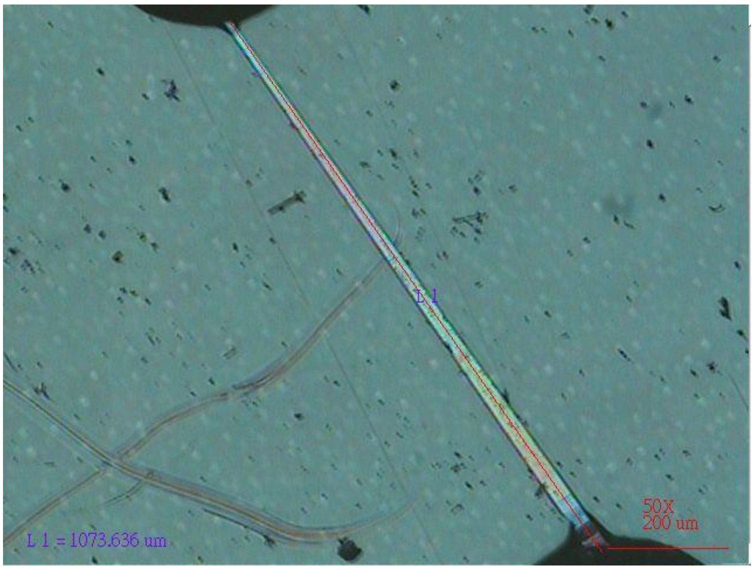


Figure S1 Digital micrograph image shows the length of the microbelts can up to 500-1000μm.

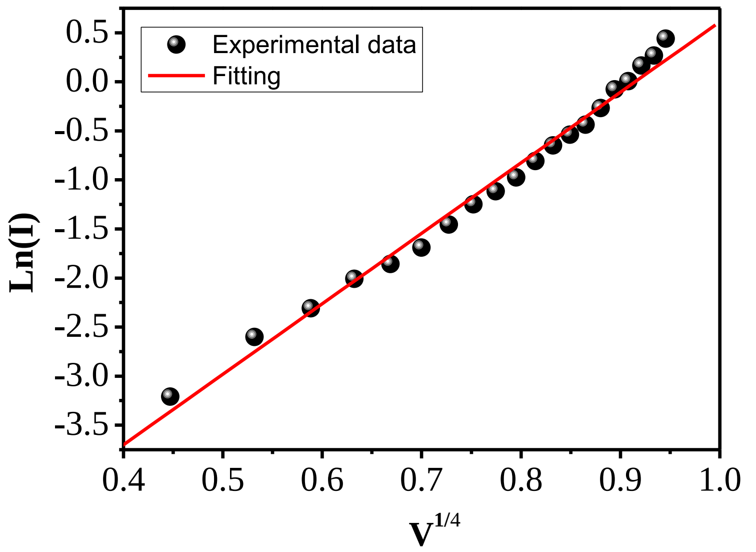
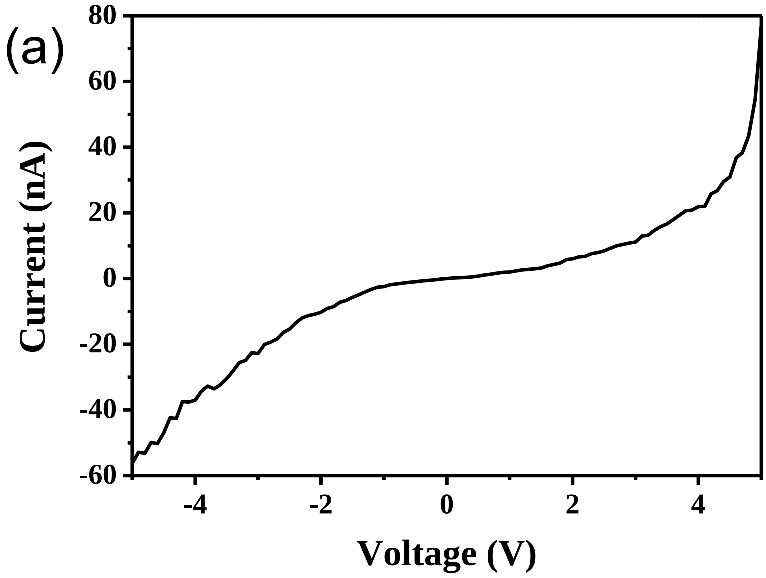


Figure S2 Plot of ln I as a function $V^{1/4}$ as data provide from Figure 2(a)



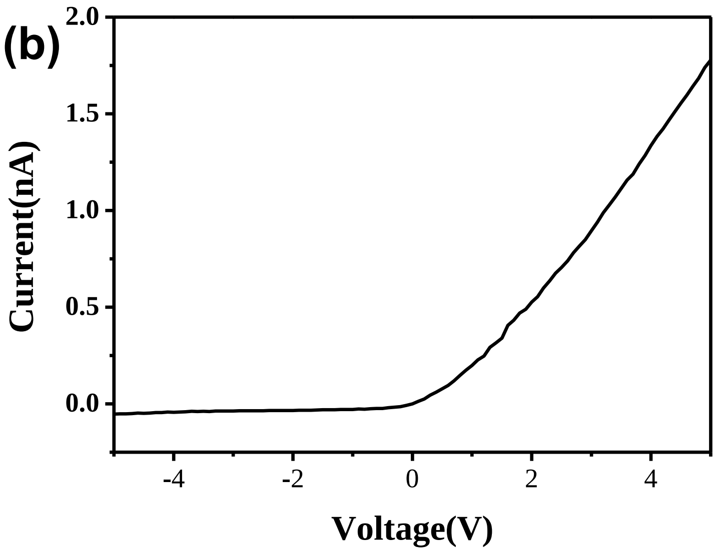


Figure S3. (a) I-V curve of strain sensor, the calculated inner resistance is ~$2.81\times10^{8}\Omega$;

(b) I-V curve of nanogenerator, the calculated inner resistance is ~$3.45\times10^{10}\Omega$.

Reference:

1. (a) Zhou, J.; Fei, P.; Gu, Y. D.; Mai, W. J.; Gao, Y. F.; Yang, R.; Bao, G.; Wang, Z. L., Piezoelectric-Potential-Controlled Polarity-Reversible Schottky Diodes and Switches of ZnO Wires. *Nano Lett.* **2008,** *8*, 3973-3977; (b) Zhou, J.; Gu, Y. D.; Fei, P.; Mai, W. J.; Gao, Y. F.; Yang, R. S.; Bao, G.; Wang, Z. L., Flexible Piezotronic Strain Sensor. *Nano Lett.* **2008,** *8*, 3035-3040.