Self-Powered Pendulum and Micro-force Active Sensors Based on ZnS Nanogenerator

Jyh Ming Wu[1*], Chi Chun Kao[2]

[1] Department of Material Science and Engineering, National Tsing Hua University, 101, Section 2 Kuang Fu Road, Hsinchu 300, Taiwan.

[*] Address correspondence to: wujm@mx.nthu.edu.tw

[2] Department of Materials Science and Engineering, Feng Chia University, 100 Wenhwa Road, Seatwen, Taichung 40724, Taiwan

Supplementary information S1

The definition of momentum (J) is given by the following equations.

$mgh = \frac{1}{2} \cdot m \cdot v^2 \ldots$ (1)

$v_f^2 = 2 \cdot g \cdot h \ \ldots$ (2)

$J = \Delta p = m \cdot \Delta v = m \cdot v_f = m(v_{f2} - v_{f1}) \ldots$ (3)

Where v_f is the final velocity on reaching the surface of the nanogenerator and h is the height from which the object is dropped. J is the momentum and m is the object's mass. On the basis of kinetic and potential energy as expressed by equation (1) and (2), respectively, the final velocity (v_f) of a falling object can be determined. Equation (3) further represents that the change in momentum (Δp, SI unit: kg m/s, or, N s) is the product of the object's mass and its change in velocity (Δv). It will be noted that the v_f is the velocity of the object before impact to the surface of the nanogenerator, and afterwards the v_f is v_{f2} and v_{f1}. Where v_{f2} and v_{f1} are the final velocity and initial velocity that act on the surface of the nanogenerator,

respectively. Assuming v_{f2} is zero, the momentum (J) can be therefore determined by the equation (3). Therefore, the momentum for the vary height of 3, 4, 5, 6, and 7 cm are 0.077N s, 0.089 N s, 0.099 N s, 0.108N s, and 0.117 N s, respectively.

Supplementary information S2

The control sample has been conducted by using PDMS without ZnS nanowires, which exhibited no output signal, as shown in Figure S2.

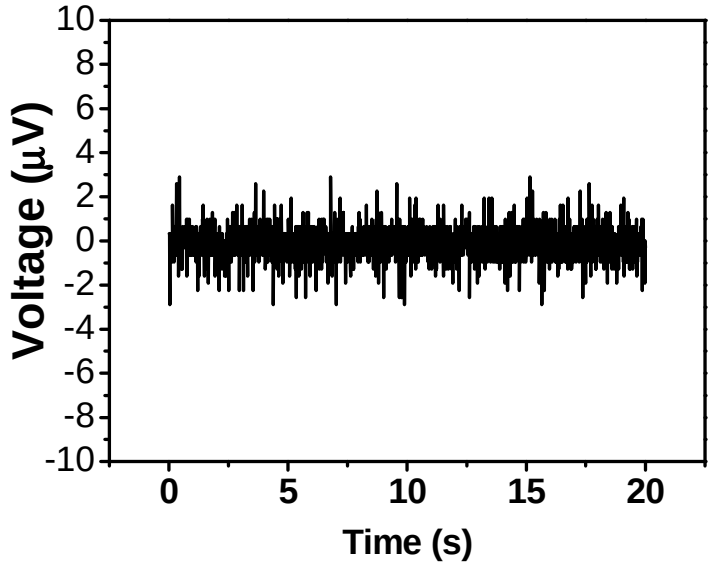

Figure S2 The control sample without ZnS nanowires: Si/PDMS/Si