Supplementary Information

Flexible Thermopower Generation in Broad Temperature range from PANI/nanorods Hybrids Based P-N Couples

Yao Wang [a,b]*, *Guifen Liu* [a], *Ming Sheng* [a], *Chao Yu* [a] *and Yuan Deng* [a,b]**

[a] School of Materials Science and Engineering, Beihang University, Beijing 100191, China

[b] *Beijing Advanced Innovation Center for Biomedical Engineering, Beihang University, Beijing 100083, China*

*Email: wang-yao@buaa.edu.cn
**Email: dengyuan@buaa.edu.cn

The test on thermal conductivity of the film is described as follow: The film is clamped between a pair of parallel conductive surfaces, one heated and one cooled, which imposes a measured heat-flow through the sample. The apparent thermal conductivity is defined as:

$$\kappa_{app} = \frac{d}{(R_t + R_{sample} + R_b) \times A} \qquad (1)$$

where d is the thickness of the sample, A is the area of the conductive surface, R_t, R_b are the contact resistances of the top surface and bottom surface, respectively, and R_{sample} is the thermal resistance of the sample. When measured a series of samples with varying thickness, the actual thermal conductivity of the sample could be calculated according to the following evolved equation

$$\kappa_{actual} = \frac{d}{R_{sample} \times A} = \frac{\Delta d}{\Delta(R_t + R_{sample} + R_b) \times A} \qquad (2)$$

Thus, the actual thermal conductivity of the film equals to the reciprocal of the slope of linear fitting of thermal impedance vs. sample thickness data.

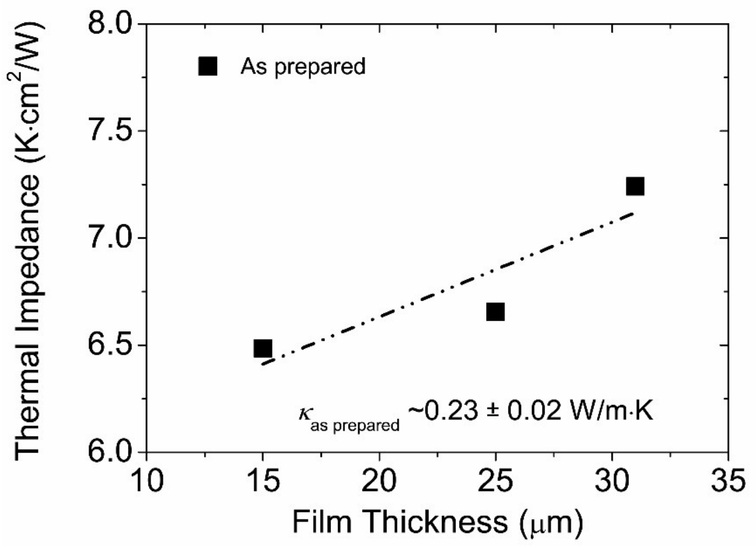

Fig. S1 Variation of thermal impedances of 60 wt% PANI/Bi_2S_3 hybrid films with different thicknesses.

For the films after heat treatment, they are hard to be separated from PI substrate, thus, the thermal impedances were measured containing the PI substrate. Then, the thermal conductivity of the hybrid film is estimated without considering the contact resistance between PI and PANI/Bi_2S_3 hybrid film as below:

$$R_{total} = R_{PI} + R_{PANI/Bi2S3} = \frac{d_{PI}}{\kappa_{PI} \times A} + \frac{d_{PANI/Bi2S3}}{\kappa_{PANI/Bi2S3} \times A} \qquad (3)$$

where R_{total} = 4.749 K·cm^2/W, R_{PI} = 4.089 K·cm^2/W, d_{PI} = 50 μm, $d_{\text{PANI/Bi2S3}}$ =20 μm, κ_{PI} = 0.122 W/m·K. Finally, $\kappa_{\text{PANI/Bi2S3}}$ = 0.32 ± 0.03 W/m·K.