Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting information

Enhancing thermoelectric properties by using surface polarization effect based on PEDOT:PSS thin film

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1. Measure the output power of PEDOT:PSS device

When the different temperature get the 8 K of Al(hot)/PEDOT:PSS/Au(cold) device, the open-circuit voltage can get 9μV, and the short-circuit current can get 1.24 μA, the output is change with the load resistance change, when the load resistance get the 81 Ω, the output power get the most maximum of 91μW, see the **Figure S**1.

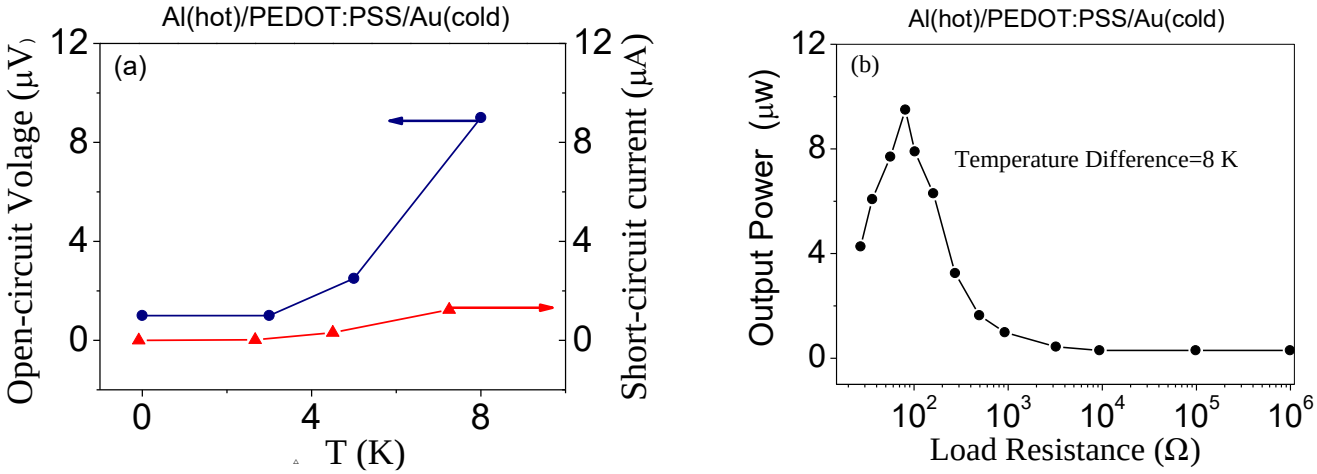

Figure S1 (a) Output voltage and short-circuit current of Al(hot)/PEDOT:PSS/Au(cold) device under various temperature difference, (b) measured useful output power of Al(hot)/PEDOT:PSS/Au(cold) device with various resistance loads with the different temperature is 8 K.

2. Measure the Stability properties

In the post-synthesis cases, EG was added after the final solution was prepared. Amounts of EG was normalized to the amount (mass) of polymer present, the amount of TDAE was little. In the post-synthesis case, the amount of PEDOT:PSS in the resulting dry hybrid material was also determined again by TGA where the amount of PEDOT:PSS was taken as the amount that decomposes at low temperature (100 ºC < T < 190 ºC) and the amount of EG was taken as the amount that decomposes at high temperatures (T > 190 ºC). See sample TGA in **Figure S2**. So for normalization, an equivalent amount of EG was used to match the pre-synthesis cases.

In addition, the PEDOT:PSS showed good stability. We tested stability of power with increasing time and observed that under ambient atmosphere, it did not degrade after 2800 min at high temperature of 150 ºC, as shown in **Figure S3**. Deduced half-lifetime is longer than 50 h.

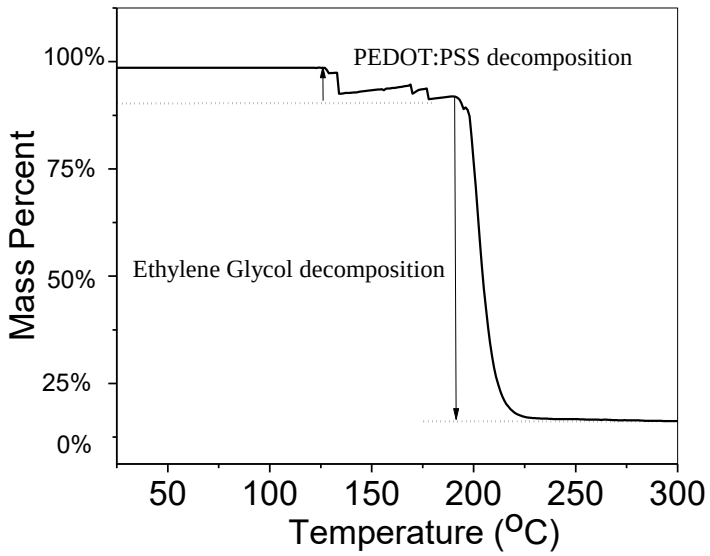

Figure S2. Example TGA of the EG hybrid material. The material was dried thoroughly before the TGA so there was no appreciable mass loss before 110 ºC. Boiling point of EG is 190 ºC which exceeds the temperature range of TGA. A slow temperature ramp rate (~1 degrees C/min) was used to facilitate evaporation of EG.

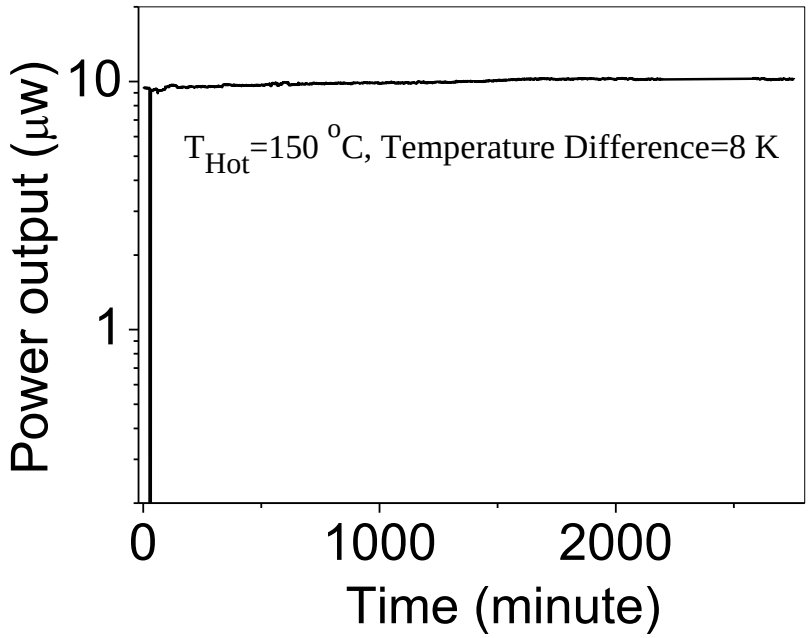

Figure S3. Output power stability of Al(hot)/PEDOT:PSS/Au(cold) device with hot-side temperature of 150 ºC K and temperature difference of 8 K.