Supporting Information

Synergistic Thermoelectric Power Factor Increase in Films Incorporating Tellurium and Thiophene-based Semiconductors

Jasmine Sinha#, Robert M. Ireland#, Stephen J. Lee, and Howard E. Katz

Department of Materials Science and Engineering, Johns Hopkins University, 206 Maryland Hall, 3400 North Charles Street, Baltimore, MD 21218, hekatz@jhu.edu. #contributed equally to this work

Measurement and experimental details: Conductance was measured by obtaining **I-V** curves on a semiconductor parameter analyzer (compliance is 10 mA, minimum current reading is <100 pA, typical applied voltage in this work is 1 V). The polymer film thickness was measured by using Keyence VK-X100 series Laser Microscope 3D. The Seebeck coefficient (**S**) was measured with the sample mounted between thermoelectric heater-cooler pair, with one electrode of the sample over each. The slopes of plots of **ΔV** versus **ΔT** gave values of Seebeck Coefficient (**S).** The Seebeck Coefficient measurement was calibrated by using Ni metal, for which the value (-21.4 ± 0.4μV/K) was in good agreement to the reported value (-19.5 and -20.5 μV/K), demonstrating the accuracy of the Seebeck Coefficient data.

The dried Te was weighed to varied amounts (0.4-4 mg) and added to 1 mg of the polymer in $CHCl_3$. The solution was drop cast and the film dried over 24 hours at room temperature. In case of F_4TCNQ as the dopant, the polymer was doped with different ratios of F_4TCNQ in chloroform and drop casted followed by drying in dessicator for 24 hr, whereas, in case of $NOPF_6$ as the dopant, 0.001 M solution of $NOPF_6$ in acetonitrile was freshly prepared to which thin film of polymer on glass slide was dipped for appropriate time intervals followed by rinsing in acetonitrile and drying. The thickness of the film varied from 1-3 μm in different regions.

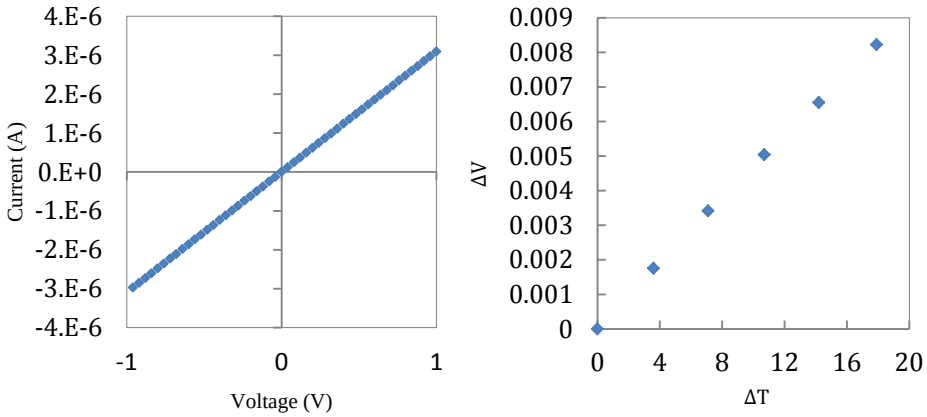

Figure S1. Plots used to calculate σ and S for typical Te on 6PTTP6 sample.

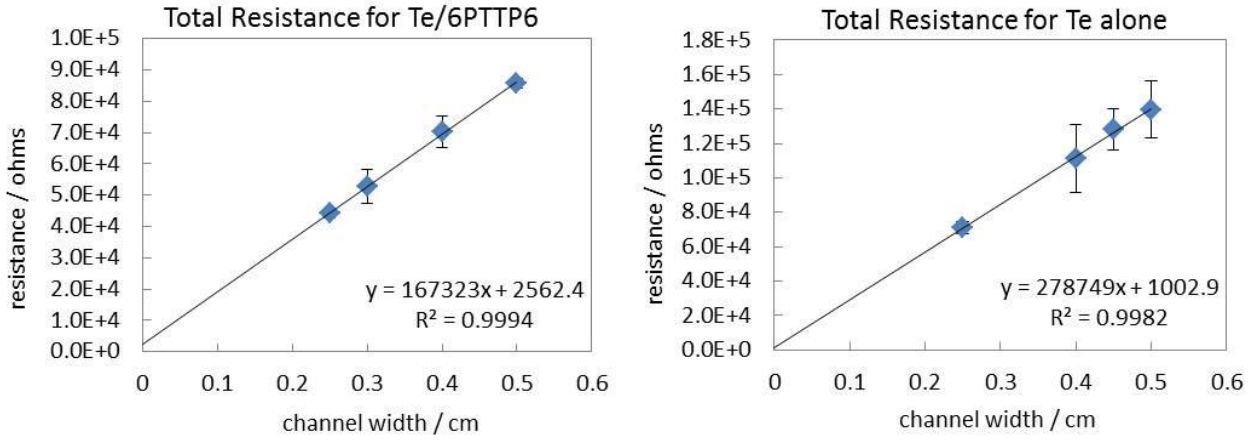

Figure S2. Plot showing total measured resistance for Te/6PTTP6 and Te vapor-deposited on Corning glass at room temperature, contact resistance is extrapolated as the resistance at zero channel length (y-intercept).

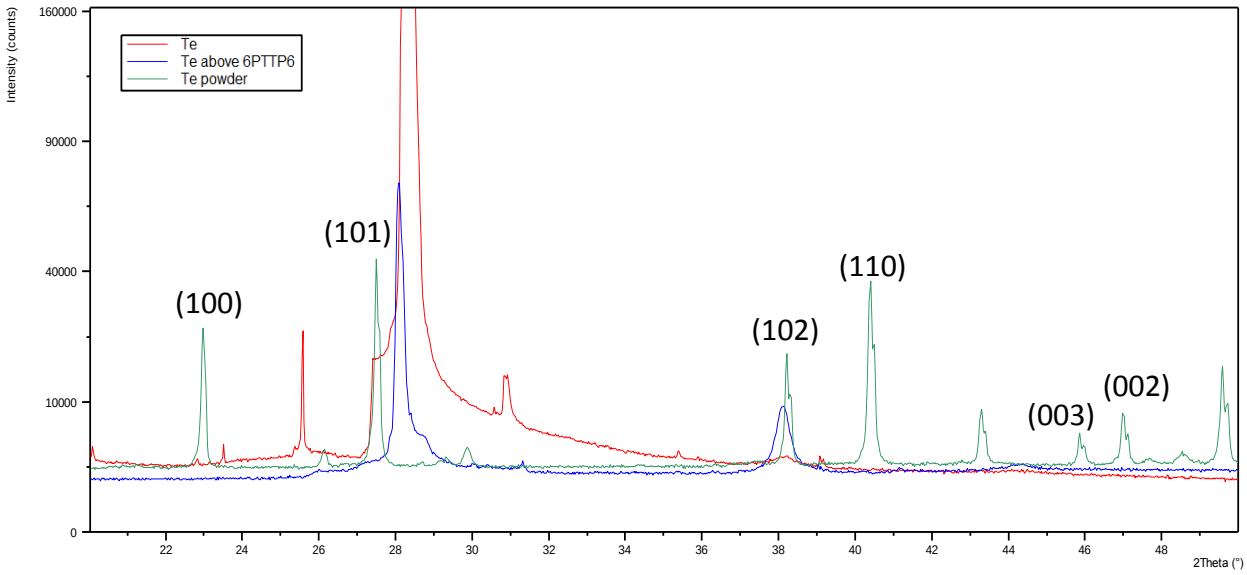

Figure S3. X-ray diffraction for 10 nm Te films on glass (including the off-scale peak) or 6PTTP6, including a scan of Te powder (including the leftmost and five rightmost peaks).

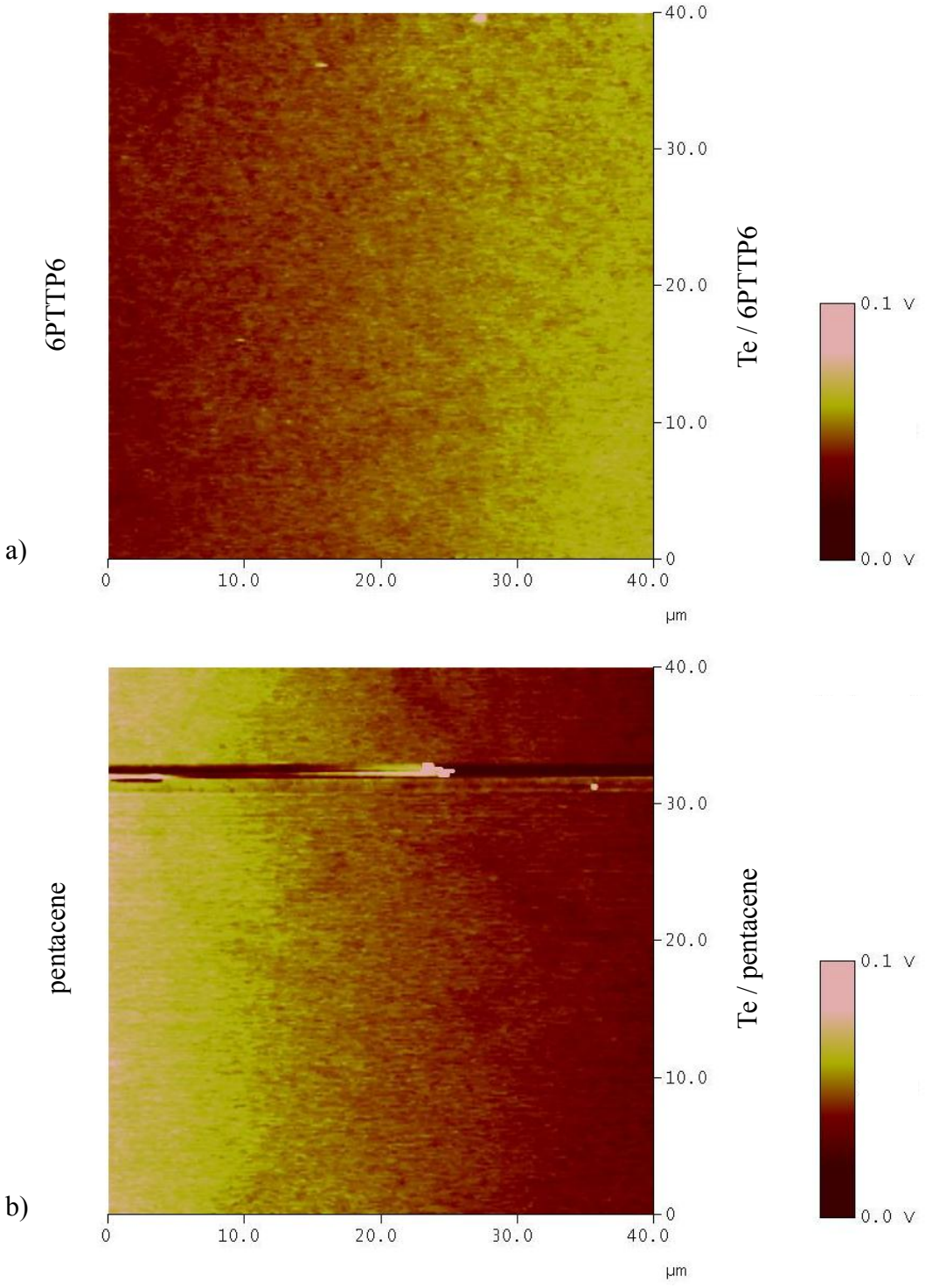

Figure S4. 2D surface potential scans of a) 6PTTP6 vs. Te/6PTTP6 from left to right and b) pentacene vs. Te/pentacene from left to right. Shows pentacene is more excepting of hole carriers from Te as-deposited on each OSC.

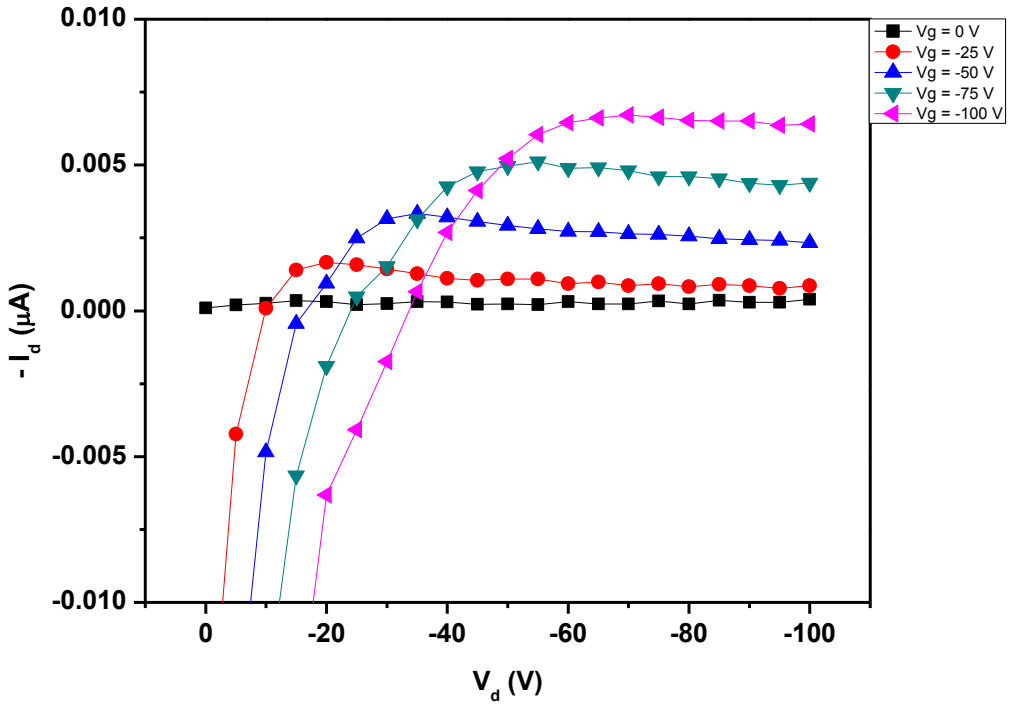

Figure S5. OFET output curves for the polymer measured under ambient condition.