

## Supporting Information

### **Field-Effect modulation of Seebeck Coefficient in Single PbSe Nanowires**

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#### **METHODS**

PbSe nanowires were synthesized using solution-phase methods. 0.76 g Pb acetate trihydrate and 2 mL oleic acid in 10 mL diphenyl ether were heated at 150°C for 30 min to dry the solution and form Pb oleate. After cooling the Pb oleate solution to 60°C, 4 mL of 0.16M trioctylphosphine (TOP) selenide in TOP were injected into the Pb oleate solution and then the combined solution was injected into 15 mL of diphenyl ether at 250°C. After heating for 2 min the reaction was quenched in a water bath. The entire procedure was performed under inert atmosphere. The product was washed with hexanes and centrifuged at 3000 rpm for 30 min and then stored in either hexanes or chloroform.

SEM images were obtained using a JEOL JSM-6240 field emission SEM. TEM and HRTEM images were collected at 200kV using a Phillips CM200/FEG (field-emission gun) microscope and a LaB<sub>6</sub> FEI Tecnai G2 20 HRTEM, equipped with a Super TWIN lens.

Nanowire devices were wire-bonded onto a chip package and electrical measurements were performed in a screened chamber. Four-point probe resistance measurements were performed using a MIO multifunction DAC card 6052E as a voltage source, and the current flowing through the nanowire (electrodes 2 and 5 in Figure 2a) and voltage drop on the nanowire (electrodes 3 and 4) were monitored using a DL Instruments 1211 current preamplifier and Scientific Instrument voltage amplifier, respectively. Thermoelectric power measurements were done using a Keithley 236 source-measurement unit as a current source to resistively heat the microfabricated metal line, while the generated thermal voltage on the PbSe nanowire was monitored using a Keithley 2182 nanovoltmeter. To determine the temperature difference along the nanowire, the resistance changes of the middle two electrodes (3 and 4 in Figure 2a) were measured using two SRS 810 lock-in amplifiers while current was applied to the heater line. The temperature-dependent resistance of the inner electrodes was determined in order to calibrate the temperature measurement on each end of the nanowire. The change in resistance of the metal lines was monitored as the temperature of the entire substrate was uniformly and slowly increased using a Lakeshore temperature controller in a Lakeshore ST-500 cryostat. The resulting curves were used to measure the

temperature on each end of the nanowires during thermoelectric power measurements.

Al<sub>2</sub>O<sub>3</sub> coating was achieved by atomic layer deposition (ALD). PbSe nanowire devices were loaded into a custom-made ALD chamber and pumped to 300 mTorr. ALD deposition was carried out at 50°C. Trimethylaluminum (TMA) and water were introduced into the ALD chamber alternatively, with purging times of 30 sec and 3 min, respectively. 70 cycles of atomic layer deposition were typically performed.