Supporting Information

Wide spectral photoresponse of layered platinum diselenide based photodiodes

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Hall-effect Measurements

Hall-effect measurements were performed in a van der Pauw configuration at room temperature. The measured Hall voltage, V_H, is defined by the following equation

$$V_H = I \times B \times R_{H\text{-sheet}}$$

where I is the applied excitation current, B is the applied DC or AC magnetic field, $R_{H\text{-sheet}}$ is the extracted sheet Hall coefficient. It can also be expressed as

$$V_H = (I \times B \times h_f) / (n_s \times e) = I \times B \times \mu_H \times \rho_s$$

where n_s is the extracted sheet carrier concentration, h_f is the applied Hall factor (equal to unity for this work), μ_H is the extracted Hall mobility, ρ_s is the measured sheet resistivity by 4-point measurement.

ρ_s can be extracted using the following equation

$$\rho_s = (\pi \times F_{AB} \times (R_A + R_B) / (2 \times \ln(2)))$$

where F_{AB} is the solution to the van der Pauw equation, R_A and R_B are the measured 4-point orthogonal resistances. F_{AB} is proportional to the ratio of the perpendicular 4-point orthogonal resistances between the equivalent geometrical contacts (i.e., R_A and R_B).

The 2-point linear I-V measurement of the $PtSe_2$ sample with starting Pt thickness of 1 nm is shown in Figure S1 indicating good ohmic contacts. Note that for all resistance and Hall measurements of the sample, the 2-point ohmic correlation factor is accurate to at least 0.99995, and the solution to the 4-point van der Pauw equation gives an F_{AB} accurate to 0.99. A photograph of the sample mounted on the Hall measurement card is shown in the inset of Figure

S1. The sample has almost square area of ~0.95 × 1 cm^2. The electrical properties of the $PtSe_2$ film at room temperature are summarized in Table S1.

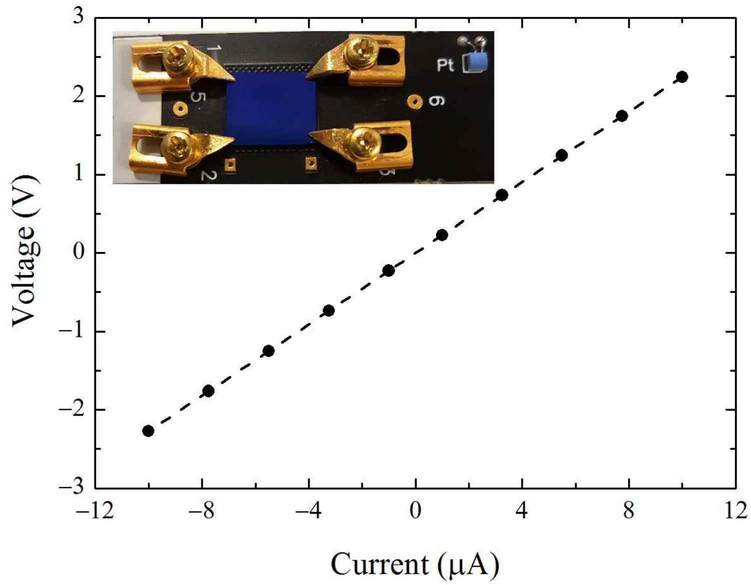

Figure S1. 2-point I-V measurement output as an illustration of the linear behavior of the sample. Van der Pauw configuration illustrating the sample mounted on the Hall measurement card is shown in the inset.

Table S1. Summary electrical characteristics of the $PtSe_2$ film obtained by Hall measurements at room temperature.

Number of $PtSe_2$ layers	5 – 6
% of measurement accuracy	100%
Carrier type	p-type
Mobility ($cm^2V^{-1}s$)	3.5
Carrier concentration (cm^{-3})	1.89×10^{20}
Resistivity (Ωcm)	9.53×10^{-3}

Photoresponse Measurements

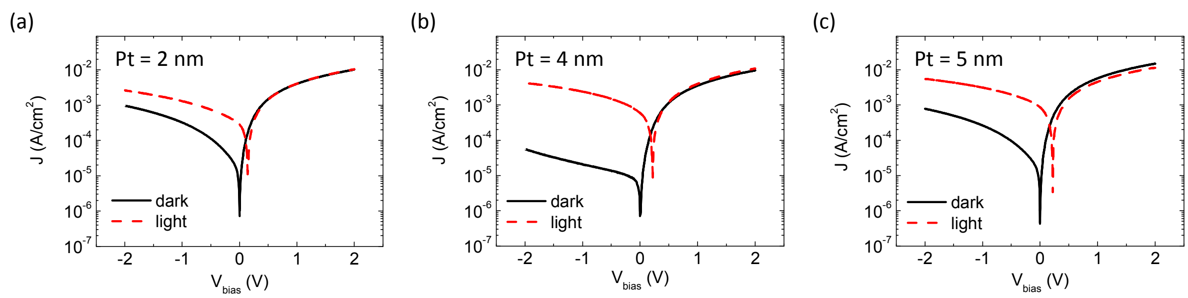

Figure S2. Plots of $J - V$ data measured in the dark and under illuminated conditions for the $PtSe_2$/n-Si SBDs with $PtSe_2$ films synthesized from (a) 2, (b) 4 and (c) 5 nm thick initial Pt layers.

Spectral Response Measurements

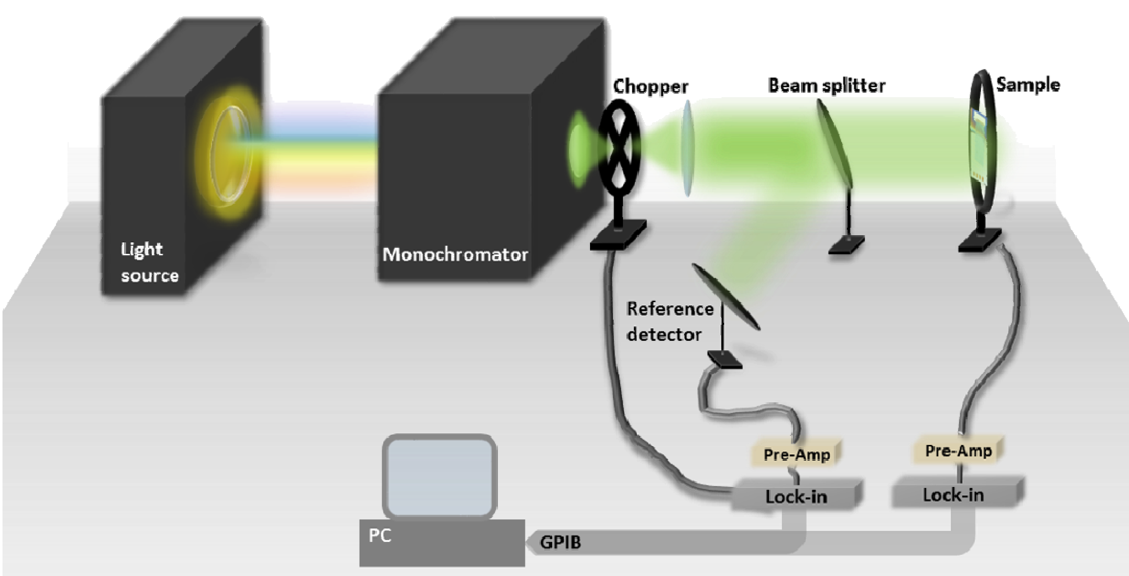

Figure S3. Schematic diagram of the spectral response measurement system.

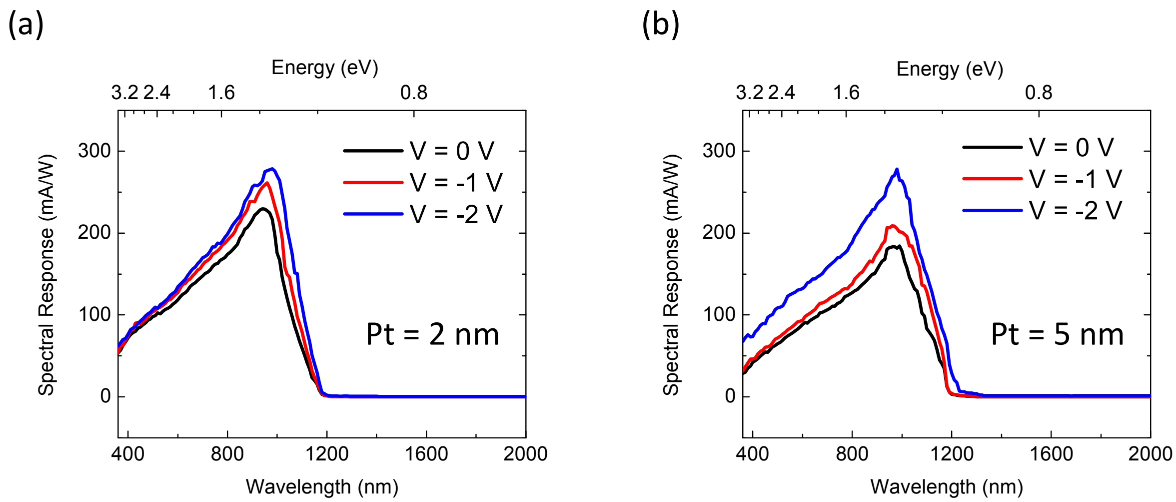

Figure S4. Absolute SR plots of the $PtSe_2$/n-Si SBDs with $PtSe_2$ films grown from (a) 2 nm and (b) 5 nm thick Pt layers under various reverse dc biases.