Supporting Information

High-performance near-infrared light photovoltaic detector based on multilayered $PtSe_2$/Ge heterojunction

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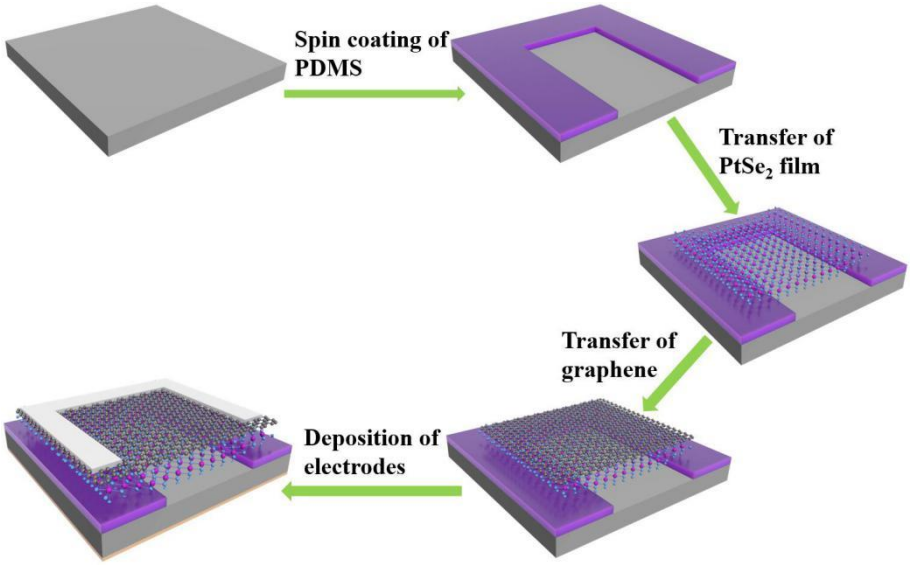

Figure S1. Schematic illustration of the procedures for fabrication of $PtSe_2$/Ge heterojunction photodetector.

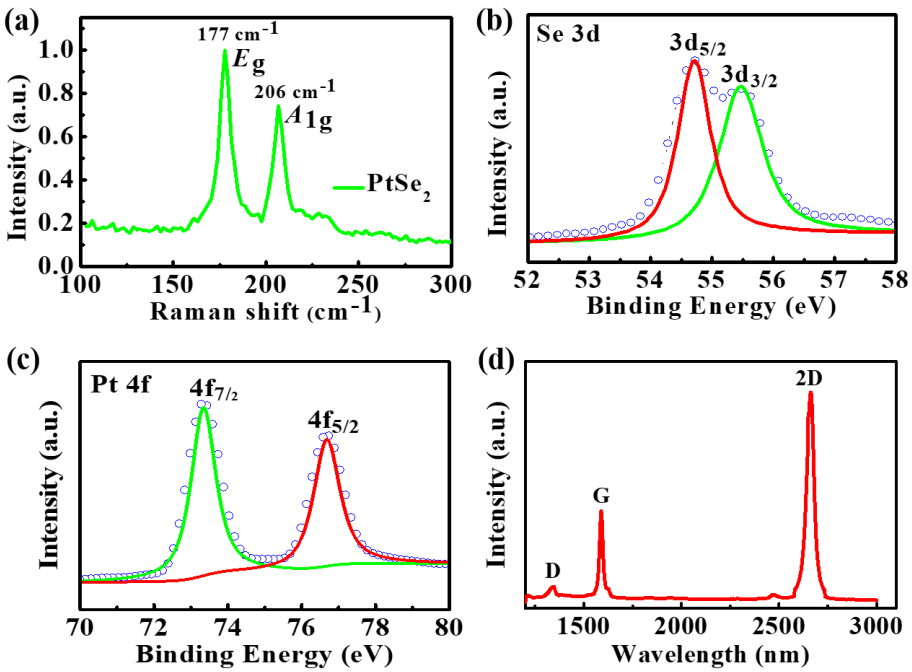

Figure S2. (a) Raman spectrum of the $PtSe_2$ film. The high resolution XPS spectra of (b) Se 3d and (c) Pt 4f. (d) Raman spectrum of the graphene film. The intensity ratio of I_{2D}:I_G≈2.3, along with the weak D-band scattering, signifies the high-quality single-layer characteristic of the graphene film.

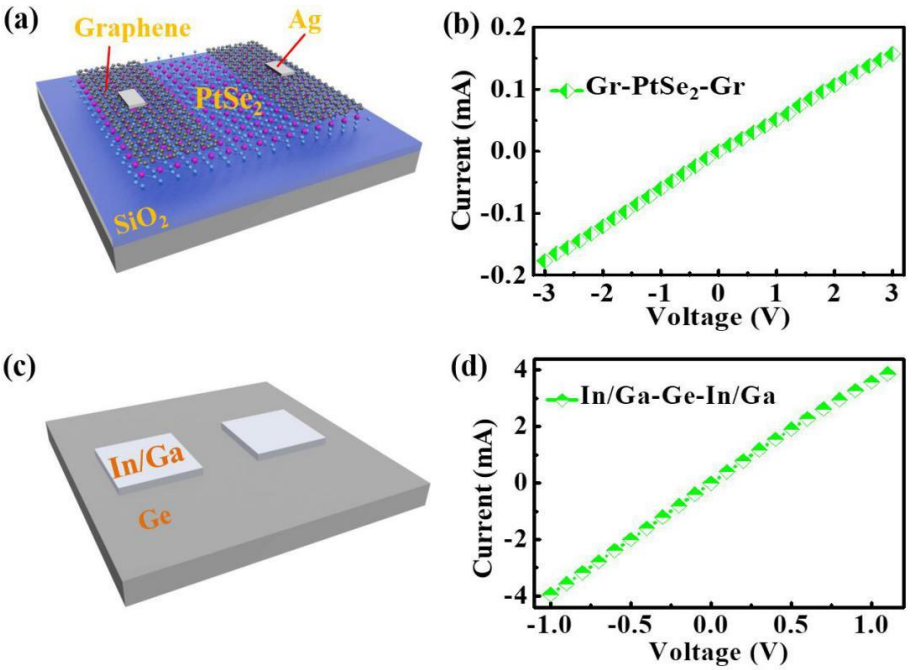

Figure S3. (a) Schematic illustration of the *I-V* characteristics measurement for (a)

graphene/$PtSe_2$/graphene hybrid, and (c) In/Ga-Ge-In/Ga hybrid. *I-V* curves of (b) graphene/$PtSe_2$/graphene hybrid and (d) In/Ga-Ge-In/Ga hybrid, indicating the formation of good Ohmic contacts.

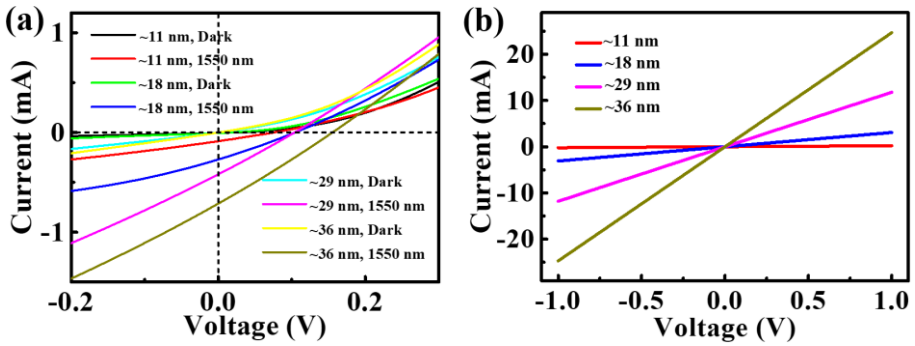

Figure S4. (a) *I-V* curves of $PtSe_2$/Ge heterojunction with different $PtSe_2$ thicknesses in dark and under 1550 nm NIR illumination. (b) *I-V* curves of Au/$PtSe_2$/Au structures with different $PtSe_2$ thicknesses, indicating that the sheet resistance of $PtSe_2$ layers decreases with increase in their thickness.

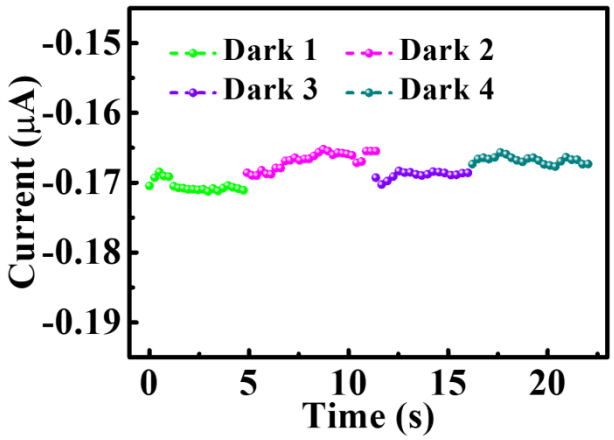

Figure S5. Dark currents of the PtSe2/Ge heterojunction photodetector under different NIR illuminations: Dark 1, 2, 3, 4 denote dark current under 1300, 1550, 1650 and 2200 nm illuminations, respectively.

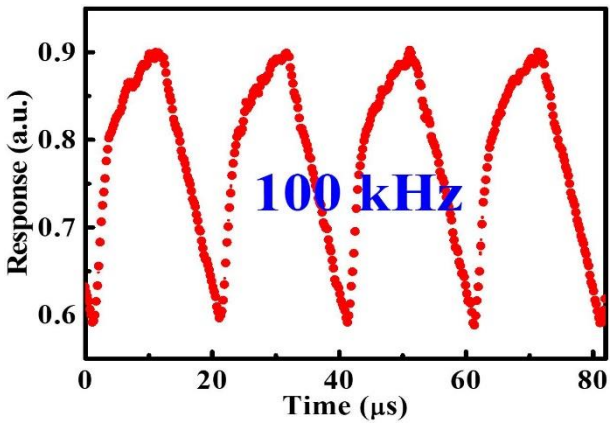

Figure S6. Photoresponse of the NIR detector under pulsed 1550 nm illumination with a frequency of 100 KHz.