Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Broadening Spectral Response and Achieving Environmental Stability in SnS_2/Ag-NPs/HfO_2 Flexible Phototransistor

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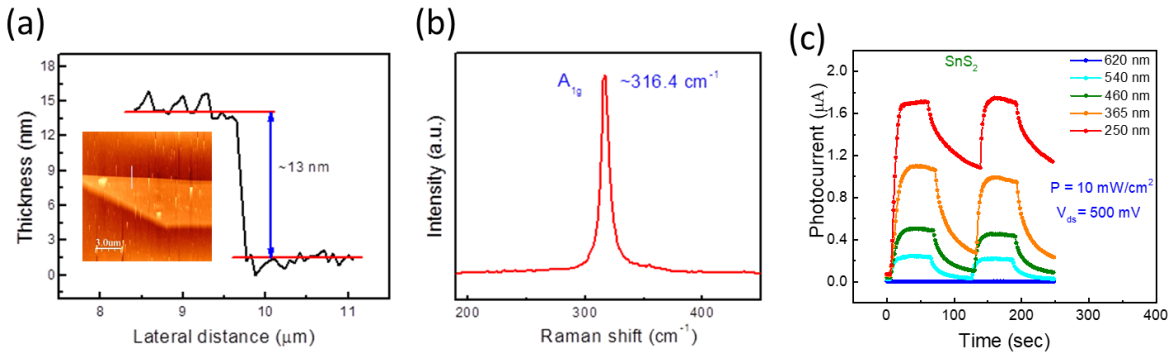

Figure S1: Characterizatoin of SnS_2 device. (a) Thickness profile of SnS_2 device obtained by atomic force microscopy. Inset: topographic image of SnS_2 flake. **(b)** Room temperature Raman spectrum of SnS_2 flake depicting single A_{1g} peak. **(c)** Time-dependent photocurrent of SnS_2 device.

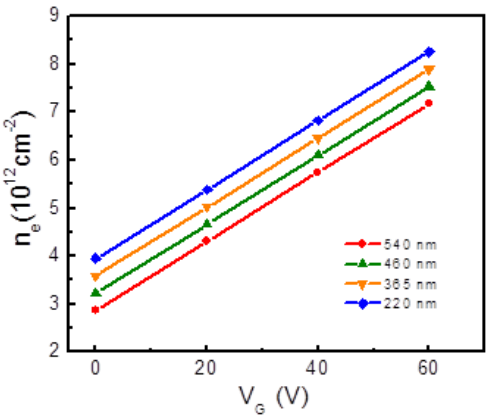

Figure S2: Carrier concentration at different gating conditions. The electron concentration [$n_e = C_{ox}(V_g - V_{th})$] at Vg values (0, 20, 40, and 60V) is calculated, and it shows an increasing trend as we irradiate the lower wavelength light. This demonstrates that the devices under light having lower (higher) wavelengths generate large (small) carriers, which can improve the charge density and field-effect mobility of the SnS_2 transistor.

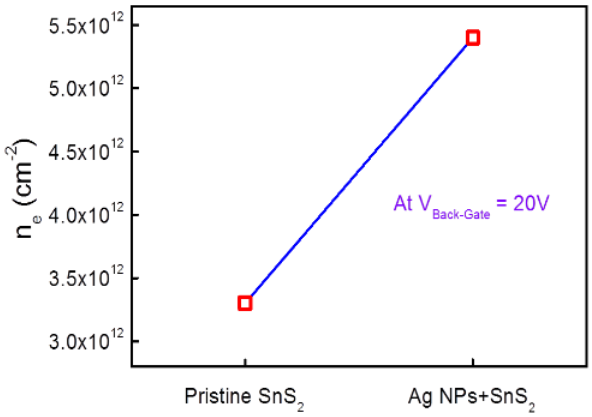

Figure S3: Comparison of carrier concentration. The electron carrier density of pristine SnS_2 and SnS_2+Ag(NPs) at $V_g = 20V$.

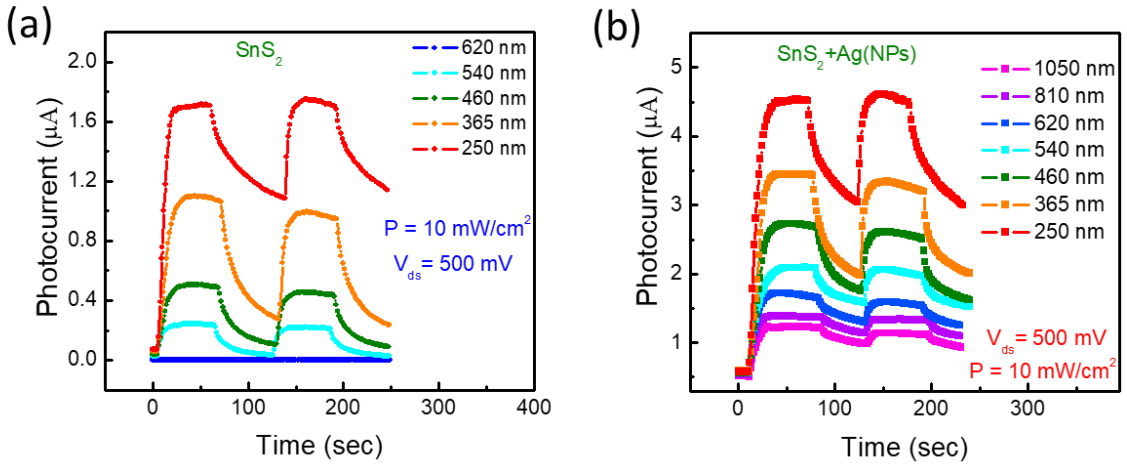

Figure S4: Comparison of temporal photocurrent. The time-dependent photocurrent of pristine SnS_2 and SnS_2/Ag-NPs at $V_g = 0V$ and $V_{ds} = 500$ mV. The light intensity was kept at 10 mW/cm^2 during all the wavelength irradiation.

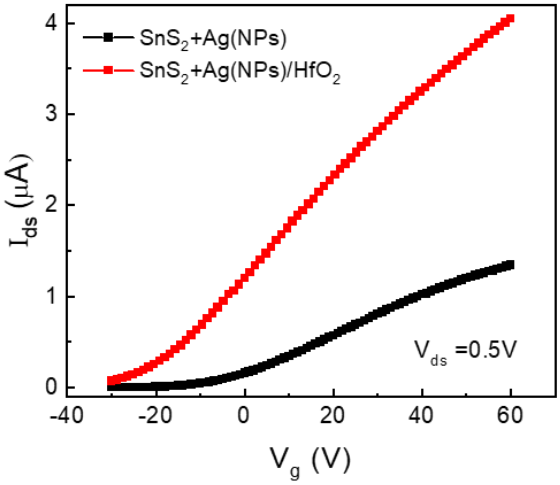

Figure S5: Transfer curve comparison. The transfer curves of SnS_2/Ag-NPs and SnS_2/Ag-NPs/HfO_2 transistors.

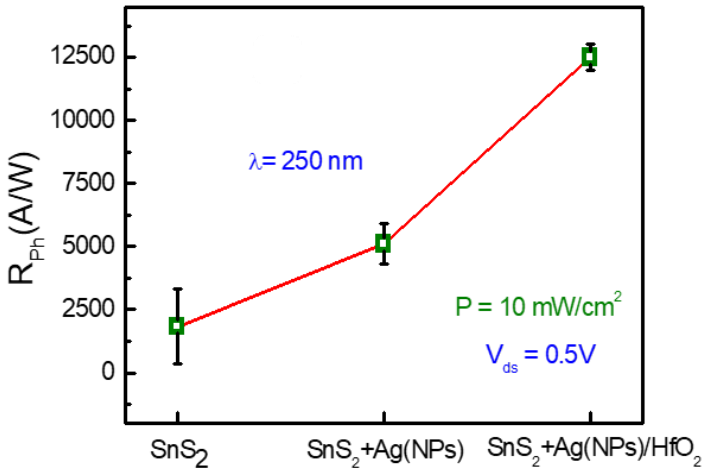

Figure S6: Enhacnement in photoresponsivity for different device configuration. The comparative photoresponsivity of SnS_2, SnS_2/Ag-NPs and SnS_2/Ag-NPs/HfO_2 photodetectors at V_g = 0V.

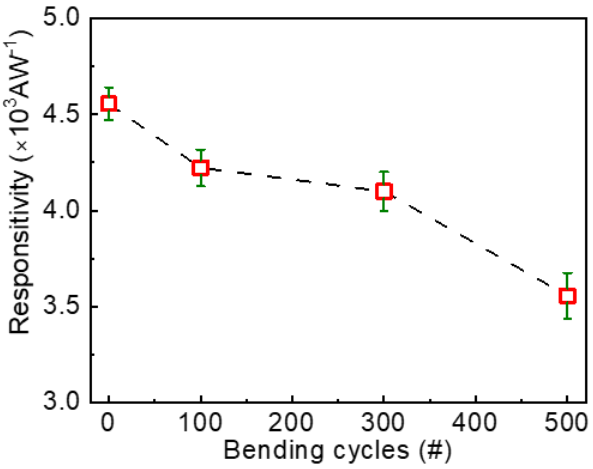

Figure S7: Effect of bending cycles on photoresponsitivty. The responsivity of flexible SnS_2/Ag-NPs photodetector for repeated bending cycles at λ = 250 nm, P= 10mW/cm^2.

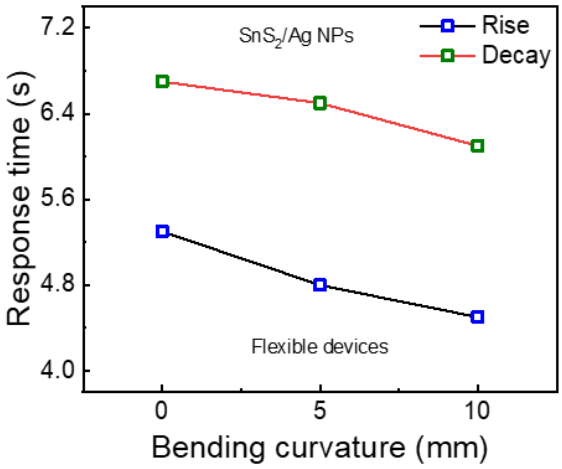

Figure S8. The rise (blue square) and decay (green square) times of SnS_2/Ag-NPs photodetectors under λ = 250 nm at various bending states.

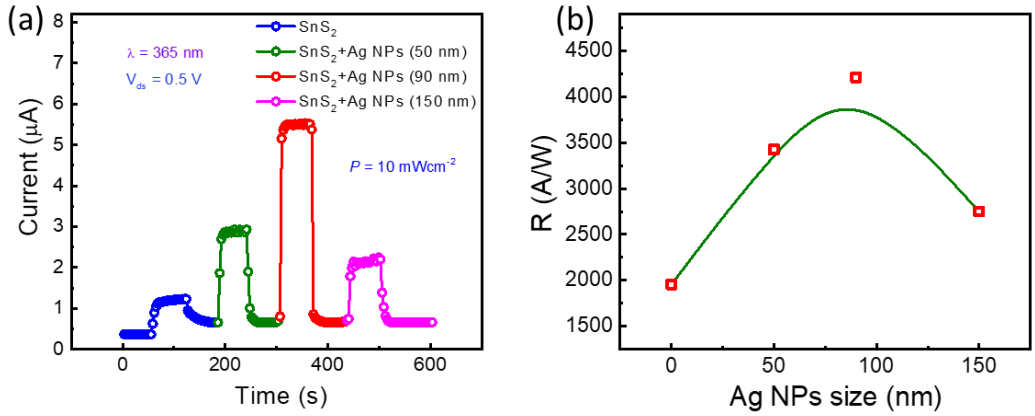

Figure S9. **(a)** The drain current of SnS2 photodetectors under light λ = 365 nm while decorating the different size of Ag NPs. **(b)** The photoresponsivity of SnS2 photodetectors at various sizes of Ag NPs.

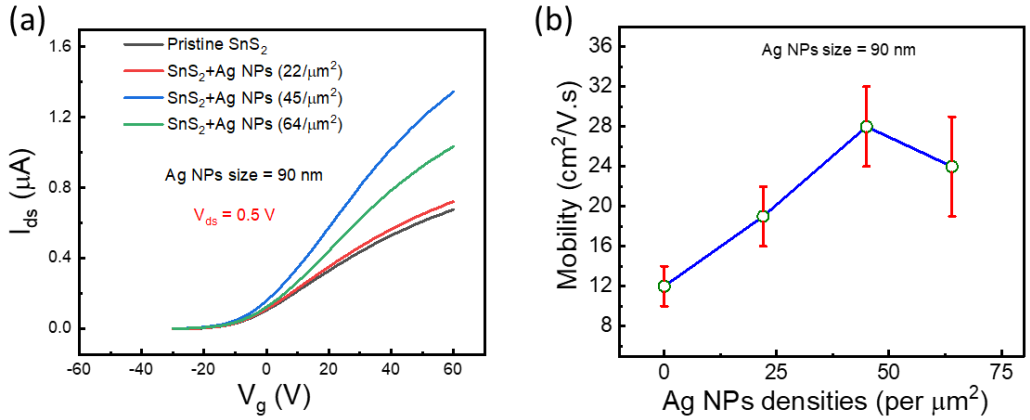

Figure S10. (a) The transfer curves of SnS_2 transistors with decoration of Ag NPs (90 nm) having different densities. **(b)** Field effect mobilities of SnS_2/Ag NPs (90 nm) transistors with various densities.