Electronic Supplementary Material (ESI) for Materials Advances.

Supporting Information

Pulsed laser deposition for conformal growth of MoS_2 on GaN nanorods for highly efficient self-powered photodetection

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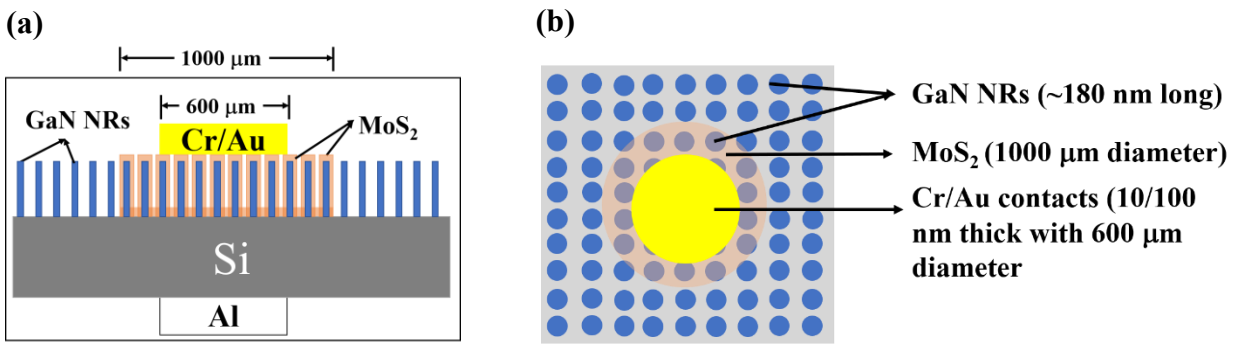

Fig. S1 Schematic of the photodetector (PD) showing (a) cross-sectional view and (b) top view. The dimensions of the images are not to scale.

$$Photosensitive\ area\ (A) = area\ of\ (MoS_2\ thin\ film - contact\ electode)$$
$$= 3.14 \times [(500\ \mu m)^2 - (300\ \mu m)^2]$$
$$= 0.502\ mm^2$$

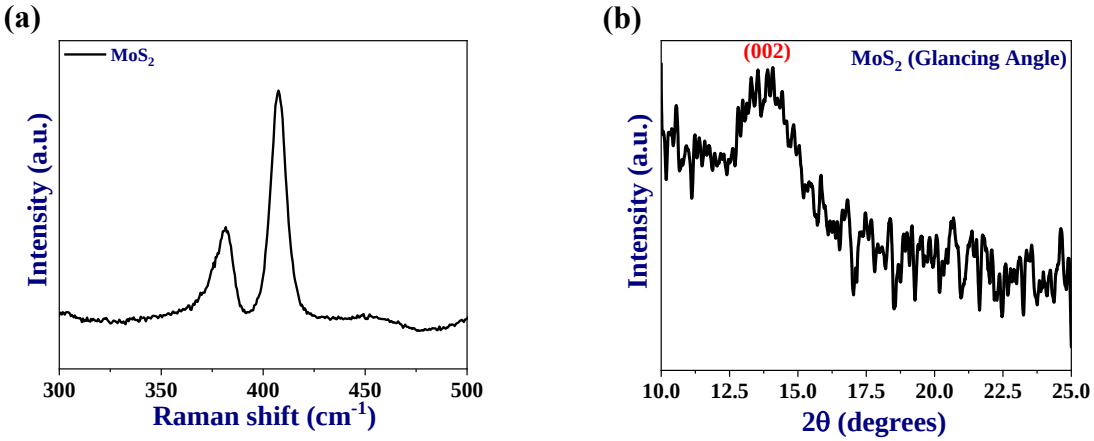

Fig. S2 (a) μ-Raman spectrum and (b) glancing angle X-ray diffraction pattern of 2H-MoS_2.

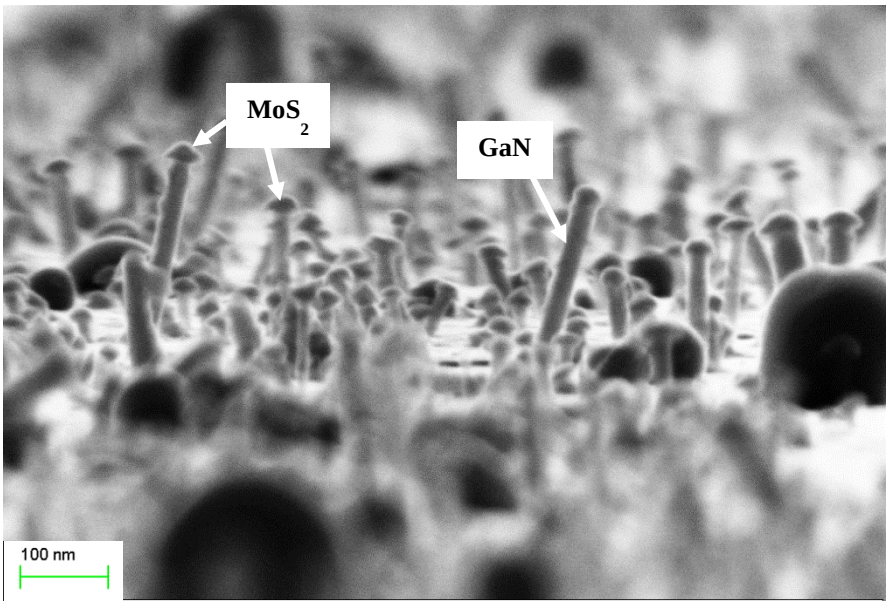

Fig. S3 Bird-eye view SEM image of the MoS_2/GaN NRs/Si heterostructure, depicting the growth morphology of MoS_2.

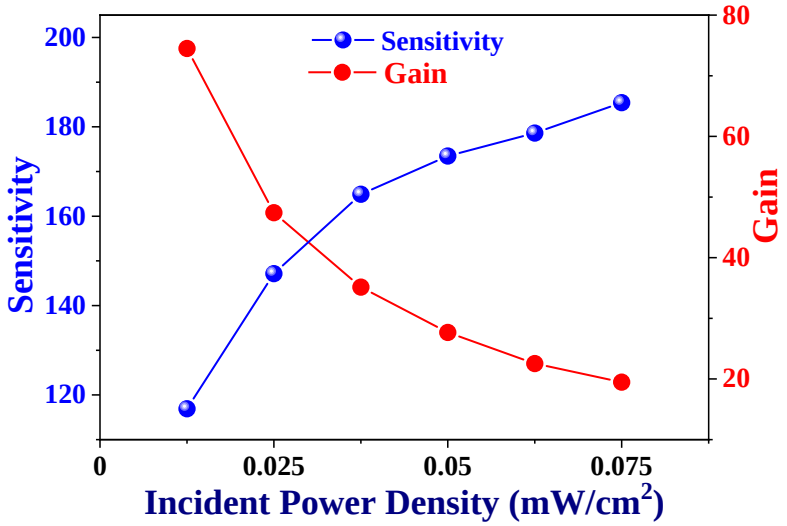

Fig. S4 Variation of sensitivity and gain with power density of the incident light for MoS_2/GaN NRs/Si based device.

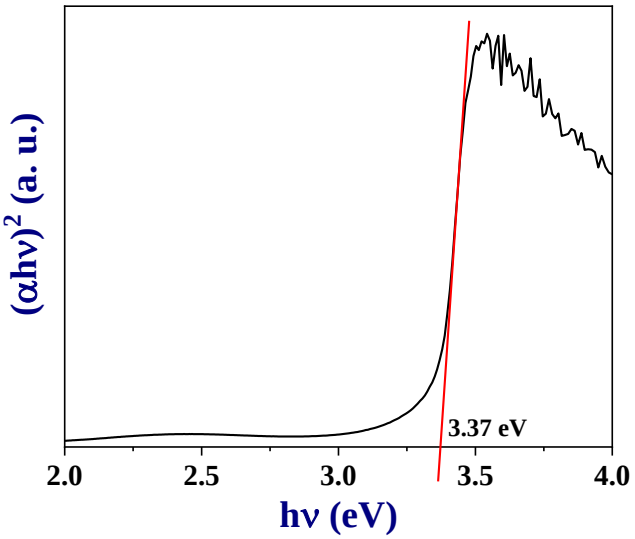

Fig. S5 Determination of band gap of GaN using Tauc plot.

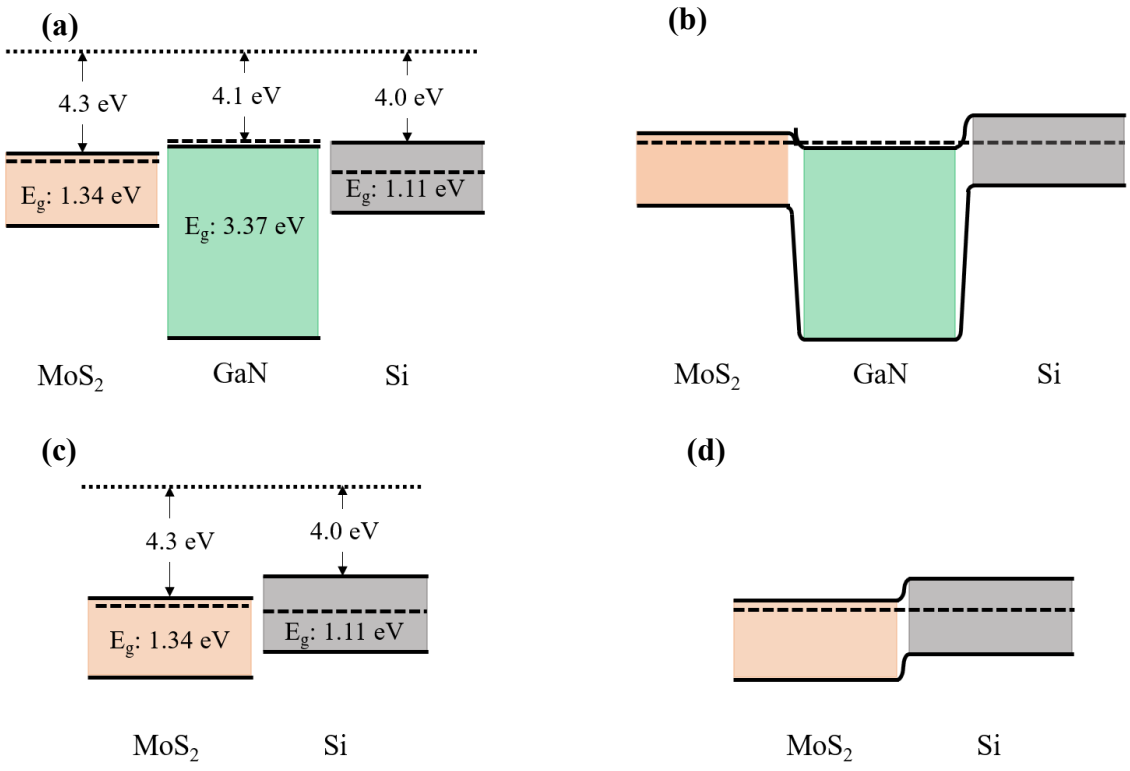

Fig. S6 Band diagrams of (a, b) MoS_2/GaN/Si and (c, d) MoS_2/Si before and after the formation of the heterojunctions.

The responsivity for the top-top contact configuration is shown in **Figure S7(a)** along with the top-bottom configuration for incident light of power density 0.075 mW/cm^2. The maximum responsivity in case of the top-top configuration is found to be ~1.83 A/W, which is much lower than the responsivity obtained for the top-bottom configuration (~14.22 A/W). Moreover, the maximum responsivity of the GaN NRs/Si-base device (**Figure S7(b)**) is found to be ~0.15 A/W, at a wavelength of 364 nm. Hence, it is evident that the performance of MoS_2/GaN NRs/Si heterojunction-based device is much superior.

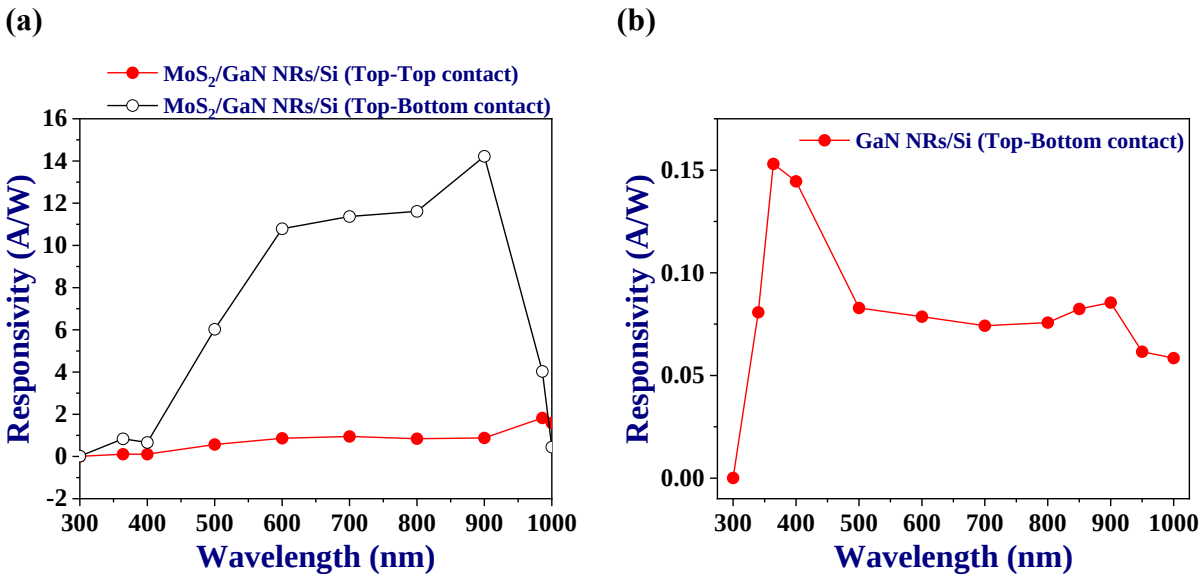

Fig. S7 Responsivity as a function of wavelength of (a) MoS_2/GaN NRs/Si-based device in two different configurations: top-top contact and top-bottom contact, and (b) GaN NRs/Si-based device.