

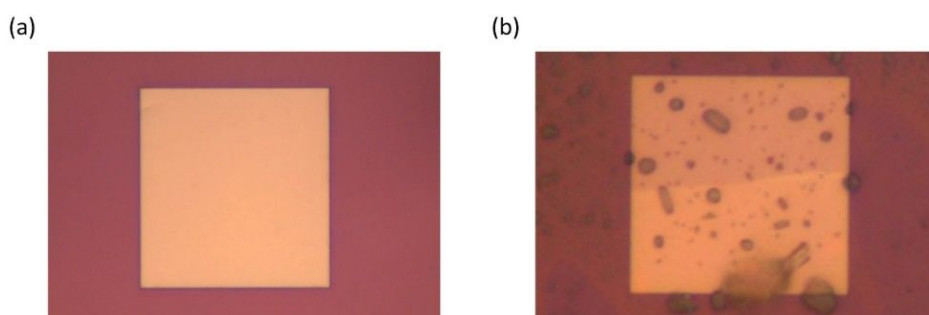
# Supporting Information

## Construction of $\text{Bi}_2\text{O}_2\text{Se}/\text{Bi}_2\text{Se}_3$ Van Der Waals Heterostructure for Self-powered and Broadband Photodetector

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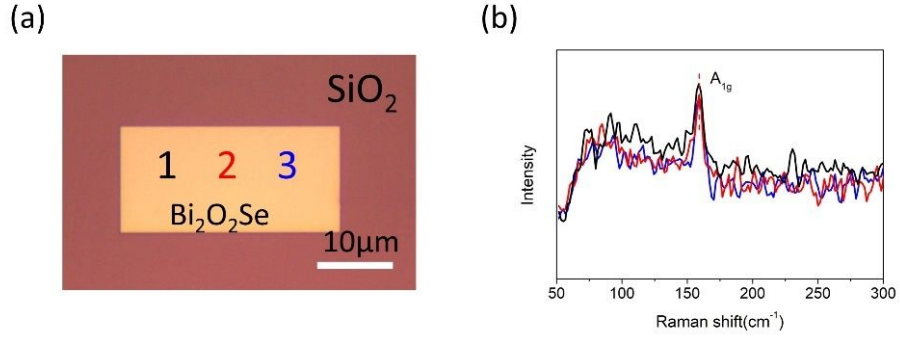
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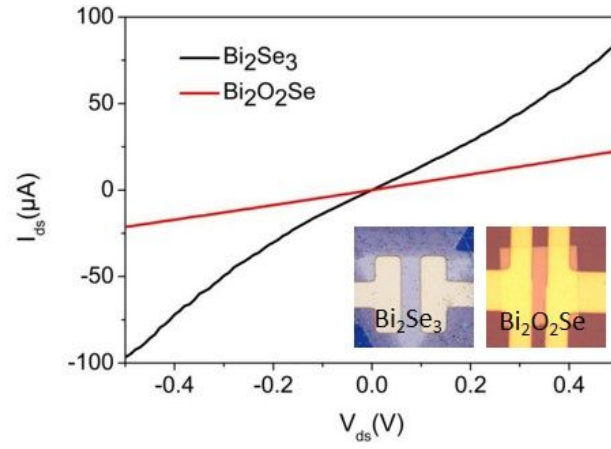
**Figure S-1.** The optical image of the transferred sample with (a) and without (b) small molecules naphthalene.

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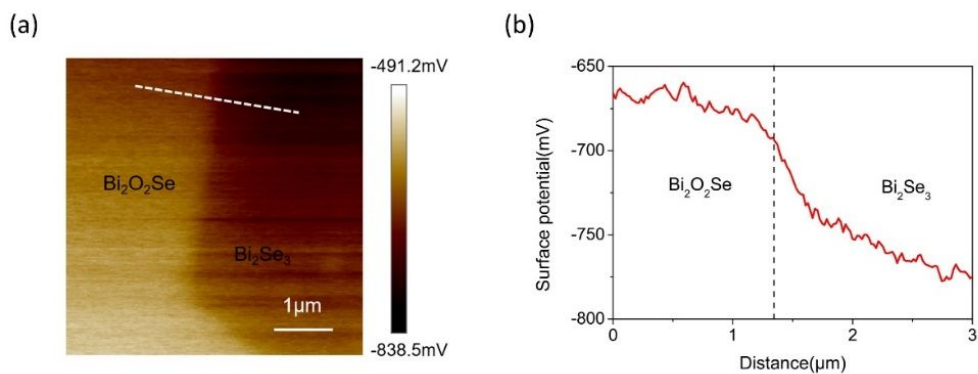
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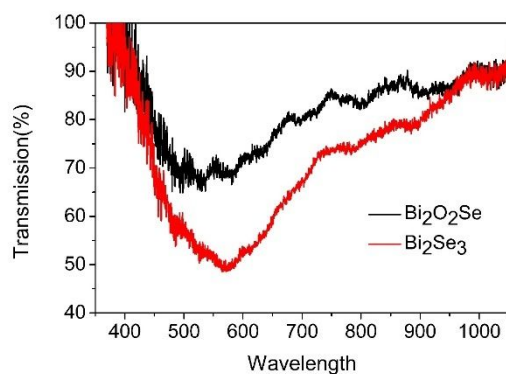
**Figure S-2.** (a) Optical image of samples transferred to a silicon substrate using the improved method. (b) The Raman characterization of different areas at the sample transferred to silicon substrate.



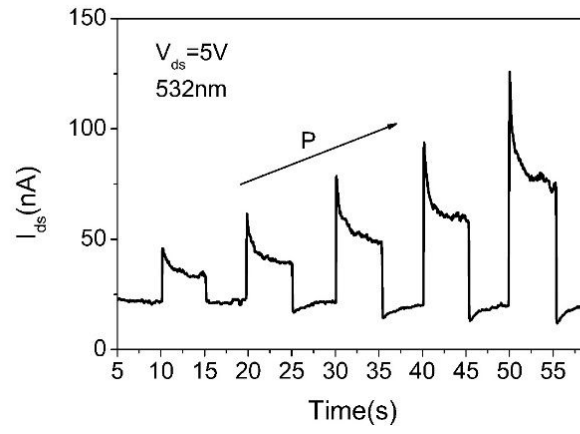
**Figure S-3.** The I-V characterizations of the individual  $\text{Bi}_2\text{O}_2\text{Se}$  and  $\text{Bi}_2\text{Se}_3$  nanosheets. Inset: Optical images of corresponding devices.



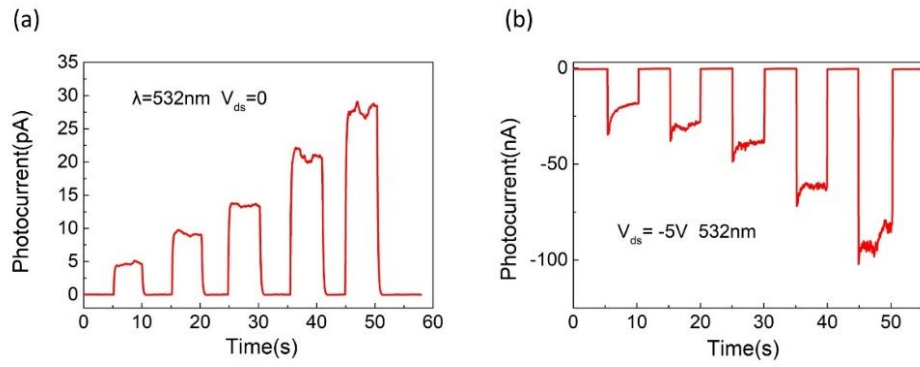
**Figure S-4.** (a) KPFM surface potential map of the heterostructure region (b) The surface potential profile across the sample corresponding to the dashed line in panel.



**Figure S-5.** The transmission characterization of the individual  $\text{Bi}_2\text{O}_2\text{Se}$  and  $\text{Bi}_2\text{Se}_3$  nanosheets.



**Figure S-6.** Photoresponse of the heterostructure under different laser power (532 nm) at  $V_{ds} = 5$  V.



**Figure S-7.** I-T response curves of the heterostructure device at 0V (a) and -5V (b).