Supporting Materials

Type-III Organic/Two-Dimensional multi-layer Phototransistors with Promoted Operation Speed at Communication Band

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1. The EDS of graphene/HAT-CN/Bi_2O_2Se on SiO_2 substrate.

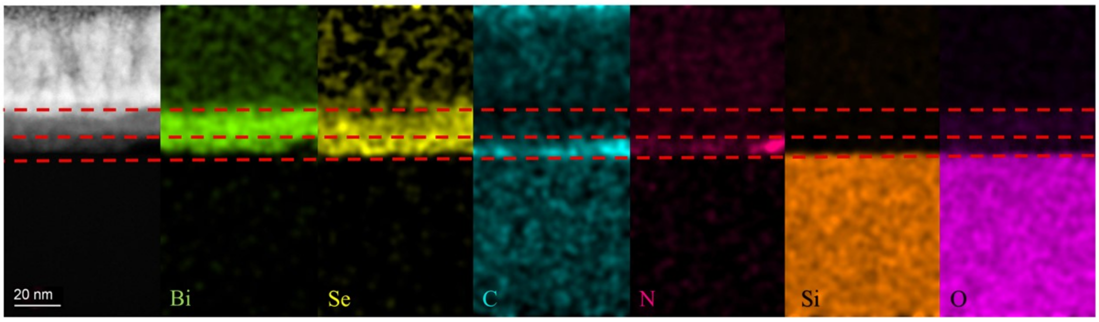

Fig. S1. The EDS of our device can distinguish Bi_2O_2Se and graphene/HAT-CN.

2. The Raman spectrum of HAT-CN on SiO_2 substrate.

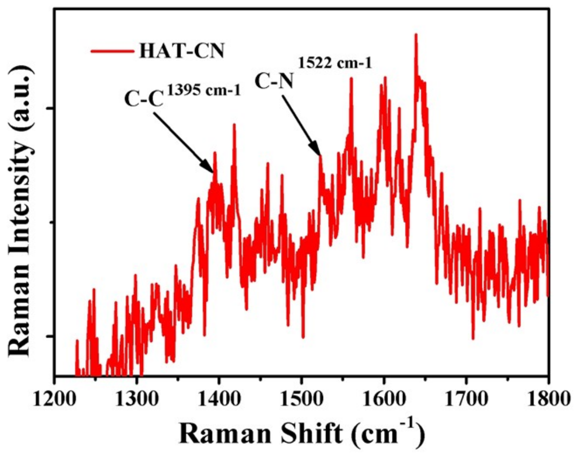

Fig. S2. The Raman spectrum of HAT-CN can distinguish C-C peak and C-N peak.

3. The V_g modulation on graphene/HAT-CN/Bi_2O_2Se phototransistor.

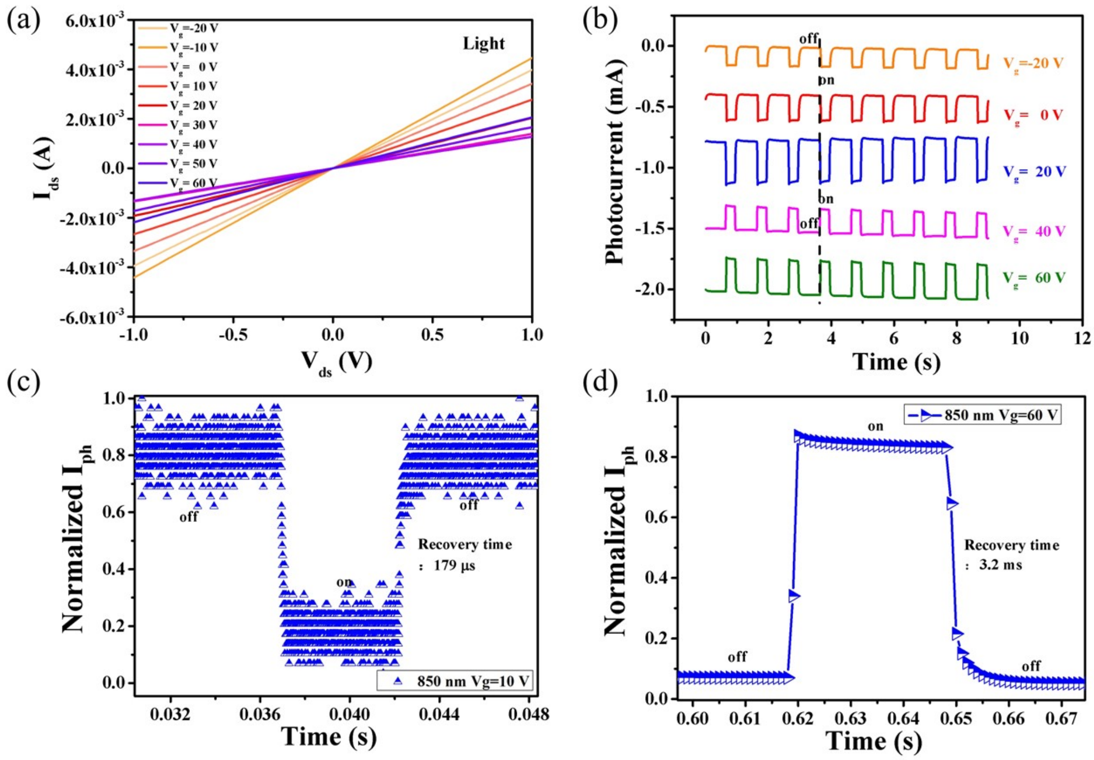

Fig. S3. The IV and photocurrent measurements at different gate voltages under the 850 nm with 60 mW/cm^2

4. The graphene/Bi_2O_2Se control phototransistor.

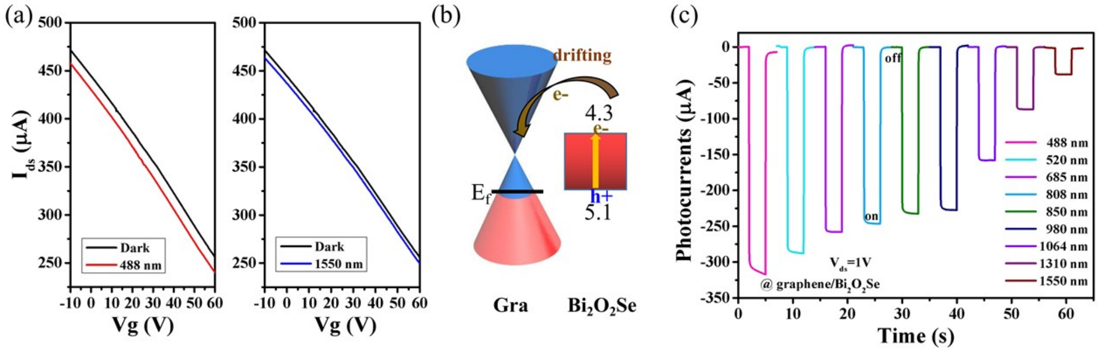

Fig. S4. Optoelectronic characterization and measurements of graphene/Bi_2O_2Se phototransistor. (a) The V_{ds} curve with varied Vg applying. (b) The energy band schematic of graphene/Bi_2O_2Se. (c) Transient response performance of graphene/Bi_2O_2Se.

5. Photocurrent measurements at increasing input power density.

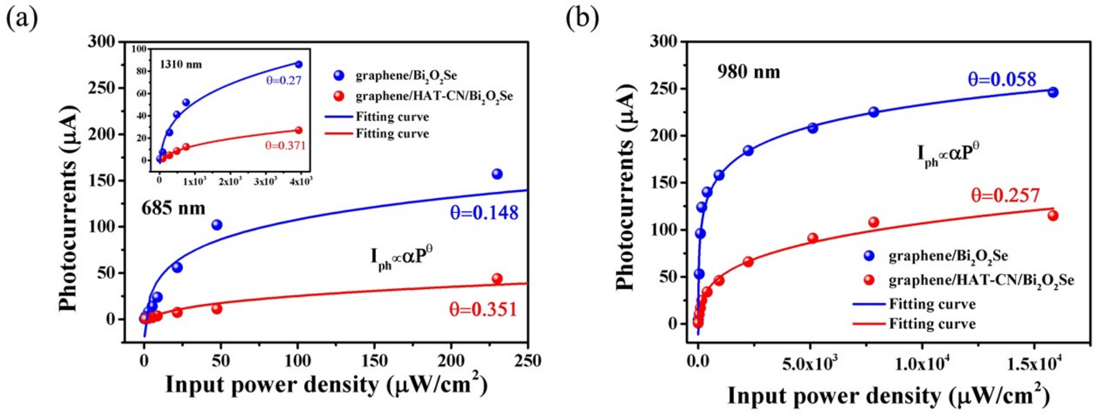

Fig. S5. Transient photocurrent measurements at increasing input power density of graphene/Bi_2O_2Se and graphene/HAT-CN/Bi_2O_2Se control devices.

6. The response time of graphene/HAT-CN/Bi_2O_2Se at communication band.

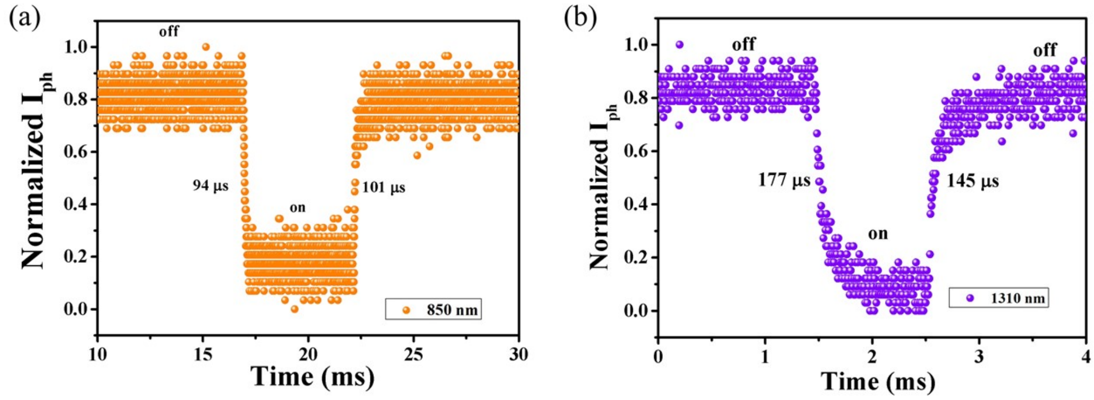

Fig. S6. (a,b) The dynamic response time of graphene/HAT-CN/Bi_2O_2Se with the irradiated light at 850 and 1310 nm.

7. The thickness dependent performance of graphene/HAT-CN/Bi_2O_2Se.

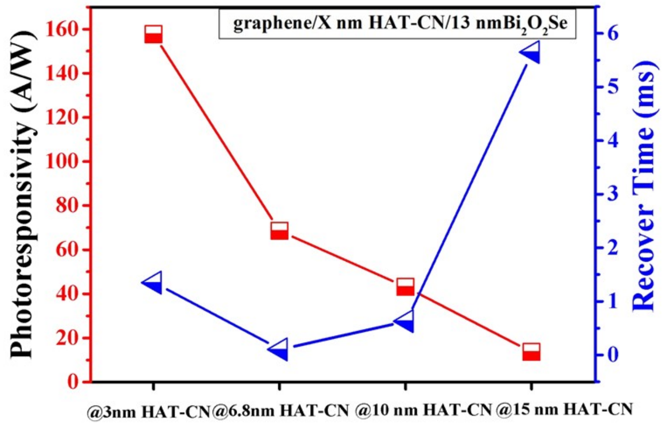

Fig. S7. The responsivity and recover time of thickness various HATCN devices at 1310 nm.

8. The noise spectrum of graphene/Bi_2O_2Se

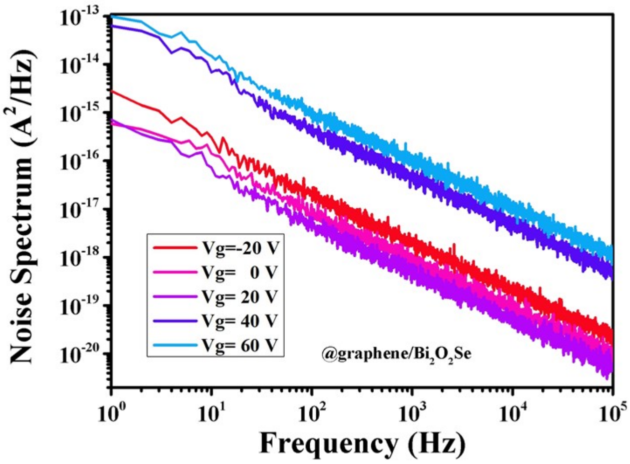

Fig. S8. The 1/f noise analysis of the device for different Vg values.

9. The stability of graphene/HAT-CN/Bi_2O_2Se

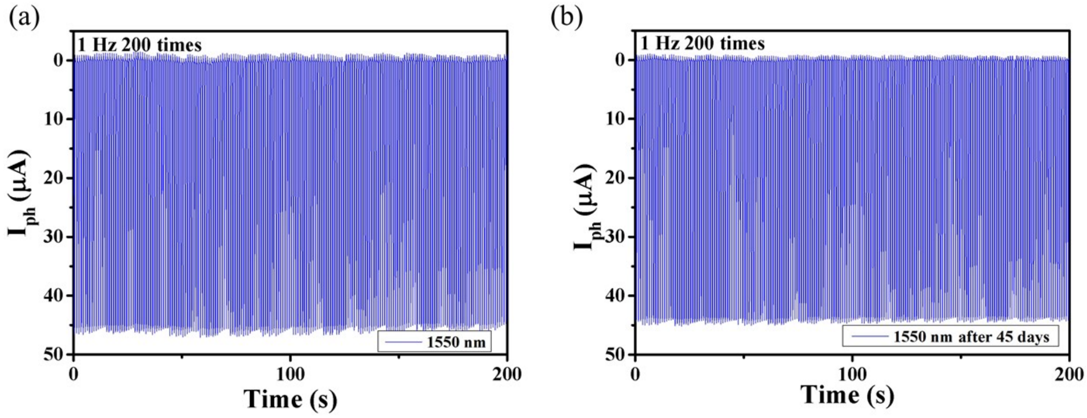

Fig. S9. (a) The detection stability of graphene/HAT-CN/Bi_2O_2Se at 1550 nm. (b) And after 45 days, the stability of graphene/HAT-CN/Bi_2O_2Se.