Supporting information

Synthesis of bulk GaSe

The gallium (99.999%) and selenium powder were put in quartz boats. The two boats were transferred into silica tube in the furnace and separated 20 cm between them (as shown in Figure 1S). The system was purged with 100 sccm Ar gas for 30 min. The boats with Ga and Se were heated to 1280 K and 850 K, respectively, and kept at these temperature for 10 min with 10 sccm Ar gas. Then the system was cooled to room temperature by nature.

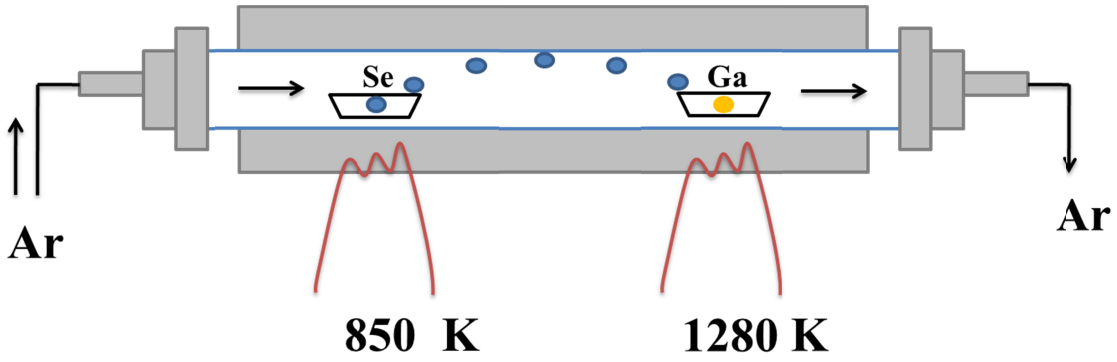


Figure 1S: The schematic of synthesized bulk GaSe crystals using CVD method.

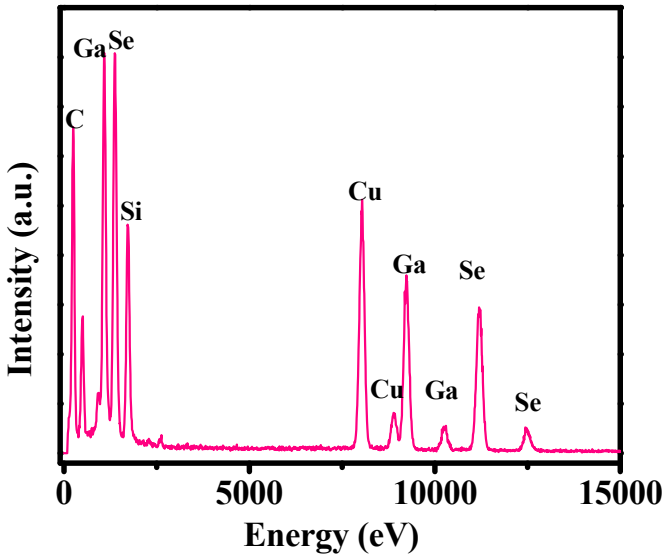


Figure 2S: The EDS spectrum of the synthesized GaSe crystal.

The chemical composition of the GaSe nanosheets is characterized by EDS. The result reveals that the ratio of composed of elements Ga and Se is close to 1:1.

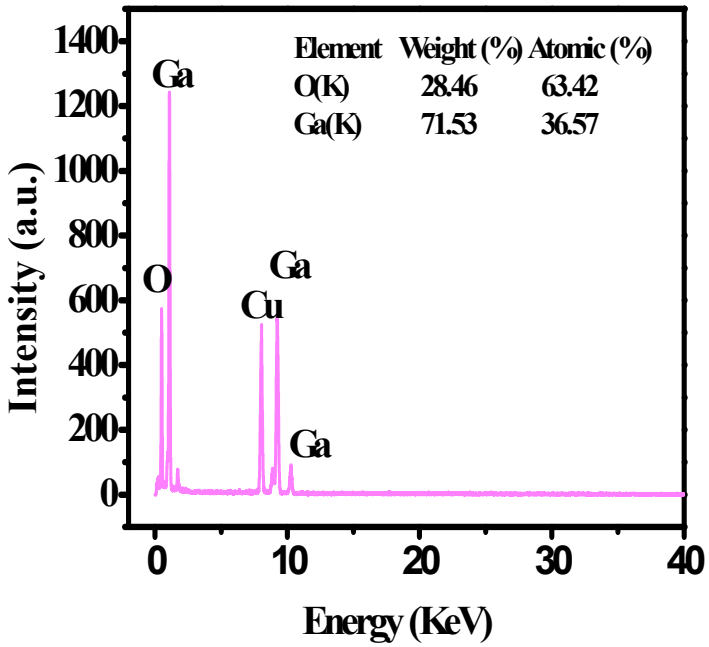
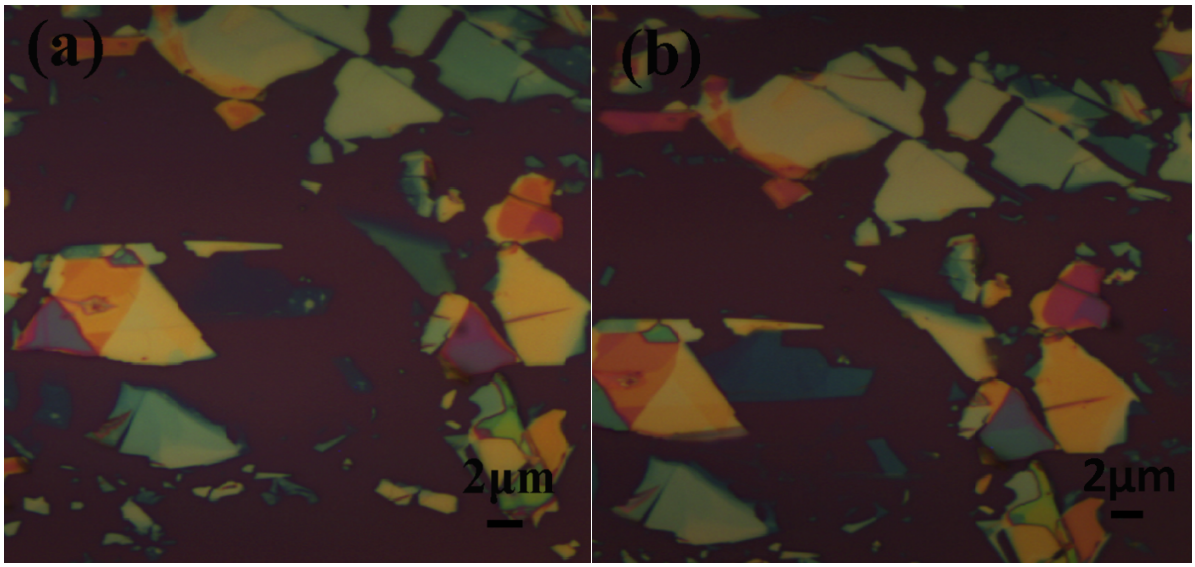


Figure 3S: The EDS spectra of 2D β-Ga_2O_3 nanosheets.



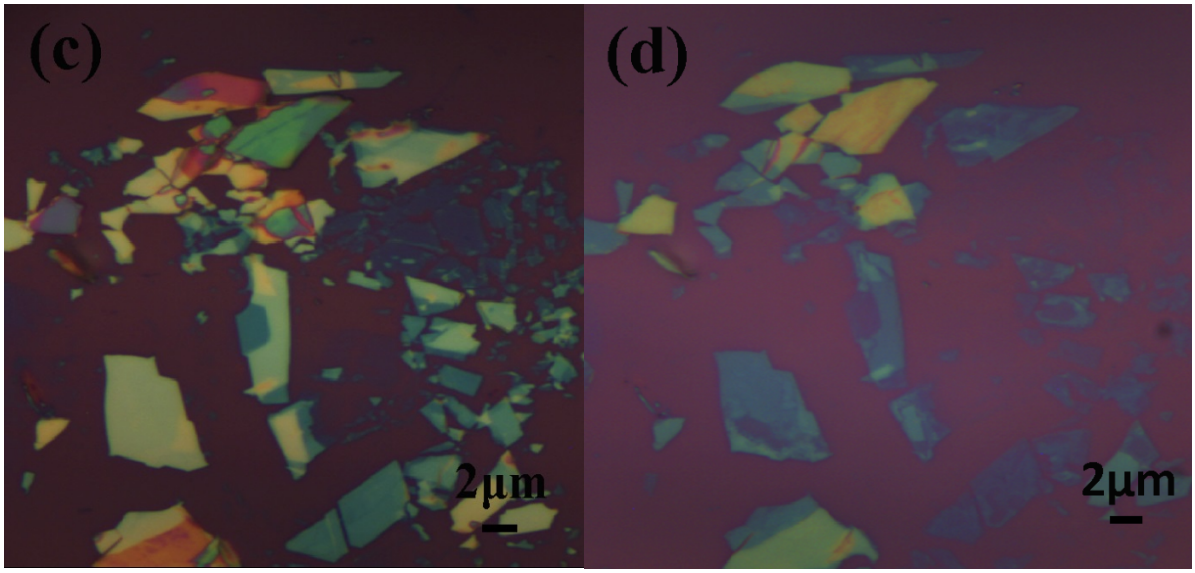


Figure 4S: (a) (c) The optical image of the GaSe nanosheets on the 300 nm SiO_2/Si substrate. (b) The optical image of the materials heat at 673 K in air for 5 h. (d) The optical image of the materials heat at 973 K in air for 5 h.

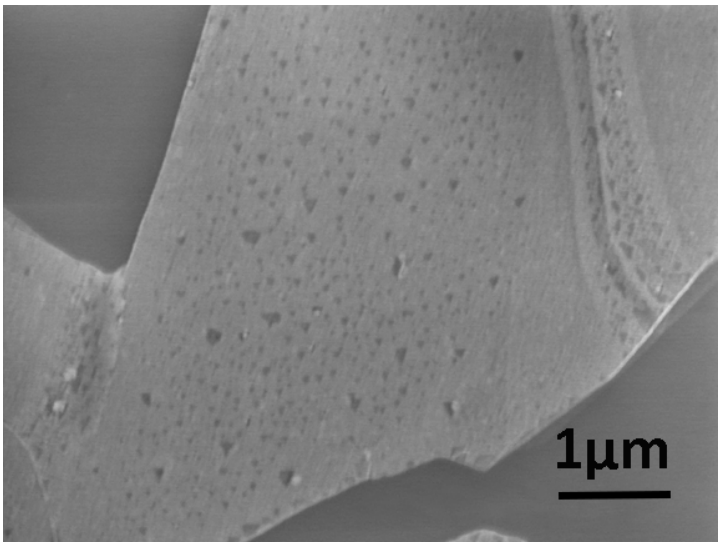


Figure 5S: SEM image of as-prepared 2D β-Ga_2O_3 nanosheets at 973 K in air for 5 h.

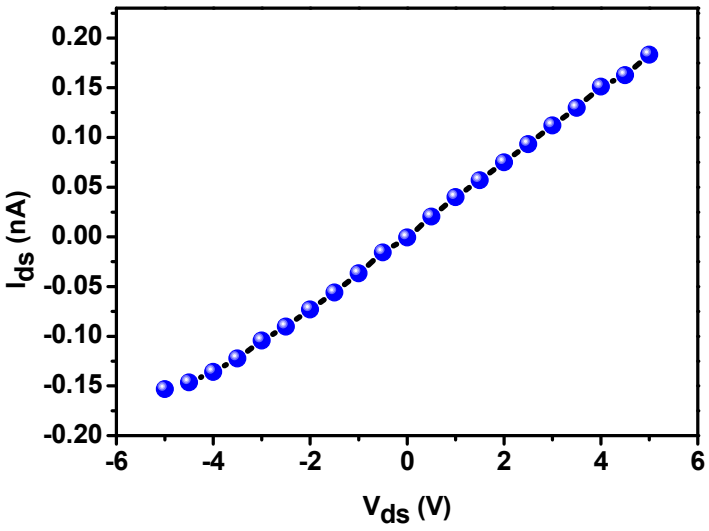


Figure 6S: Output characteristic of the Ga_2O_3 photodetector without illumination.

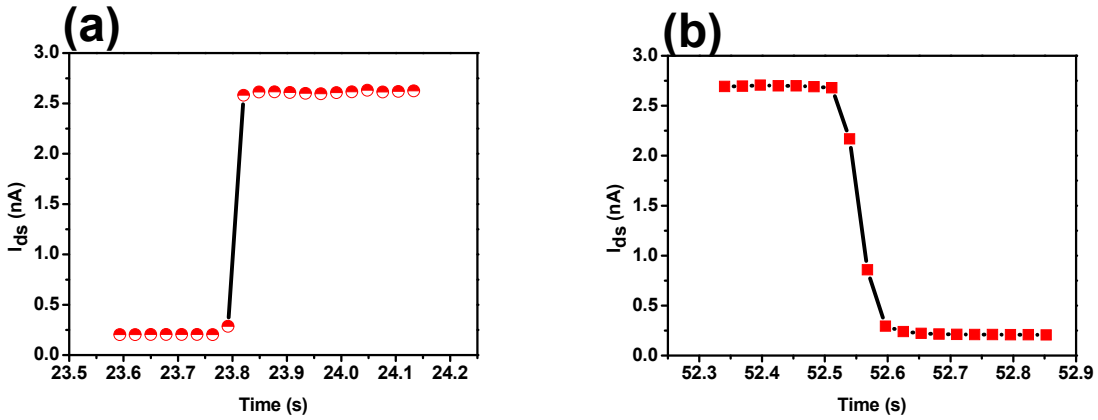


Figure 7S: The rise (a) and decay (b) process at V_{ds} = 10 V, light intensity = 0.5 mW/cm^2.

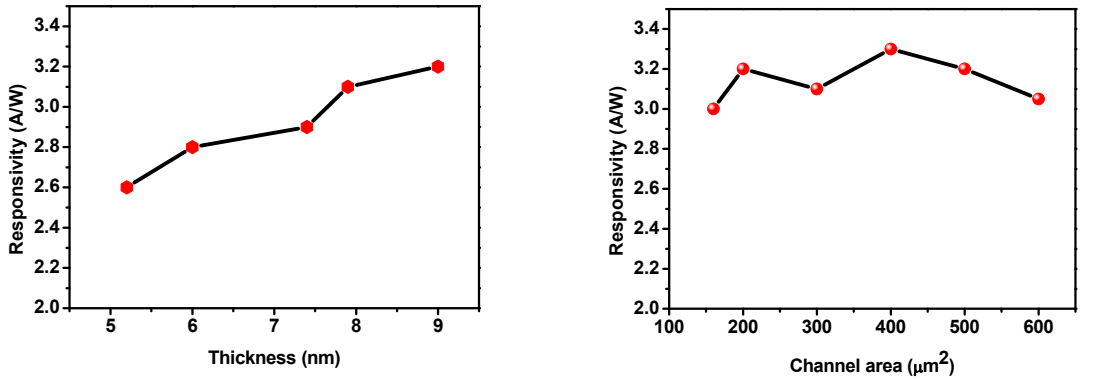


Figure 8S: The responsivity dependent channel thickness (All devices were chose with same structure, channel length ~ 20μm, width ~ 10μm) and area (All devices were chose with same structure, channel length ~ 20μm, thickness ~ 9 nm).