Electronic Supplementary Material (ESI) for Nanoscale.

Facile Synthesis of Hybrid Nanorods with $Sb_2Se_3/AgSbSe_2$ Heterojunction Structure for High Performance Photodetectors

*Shuo Chen, Xvsheng Qiao, Fengxia Wang, Qun Luo, Xianghua Zhang, Xia Wan, Yang Xu, Xianping Fan**

Synthesis of $AgSbSe_2$ nanoparticles: 24 mmol selenium dioxide and 30 ml 1-octadecene were added into a three-neck flask and heated to 200°C for several hours with stirring under argon atmosphere until selenium dioxide completely dissolved and formed a 0.8 M selenium precursor solution. And then 1 mmol antimony acetate, 1 mmol silver acetate, 8 mmol 1-hexadecylamine, 20 ml 1-octadecene and 8 ml oleic acid were mixed at 220°C for 1 h in another flask, which formed a transparent yellow antimony-silver precursor solution. The temperature of the antimony-silver precursor solution was heated up to 240°C, and then 8 ml 0.8 M selenium precursor solution which had been cooled to room temperature was swiftly injected. The mixture was stirred for 10 min and then cooled to room temperature. The obtained $AgSbSe_2$ nanoparticles were collected by centrifugation, washed with chloroform and isopropyl alcohol for several times, and finally dried at 60°C under vacuum.

Fabrication of photodetector: To explore the photoconductive characteristics, a prototype photodetector is constructed. Fig. S1 shows a schematic diagram of Sb_2Se_3 nanorods resting across the interdigital Au electrodes. The interdigitated Au electrodes with fingers (dimensions: width 20 μm, length 200 μm, interfinger spacing 20 μm) were fabricated on SiO_2/Si substrates using lithography. To better perform the electrical measurements, the as-prepared nanorods were repeatedly purified and then ultrasonically dispersed in chloroform, drop-cast on pre-patterned electrodes, and dried by vacuum-annealing at 40°C for 30 min before the photocurrent measurements.

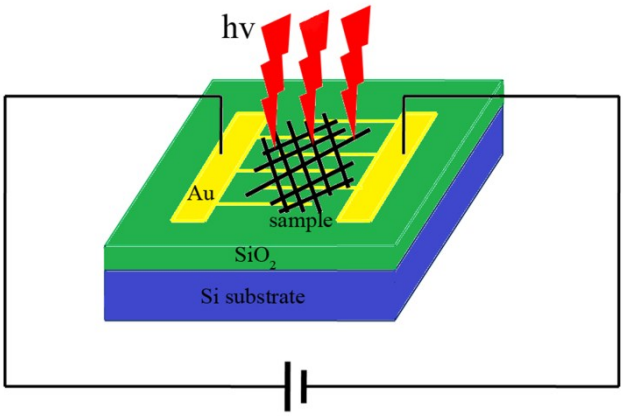

Fig. S1 Schematic illustration of the photodetector based on the Sb_2Se_3 nanorods film.

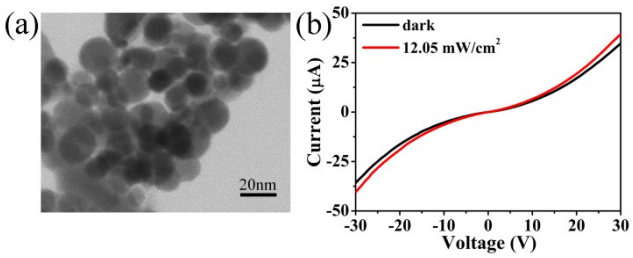

Fig. S2 (a) TEM image of $AgSbSe_2$ nanoparticles. (b) Dark current and photocurrent at an incident light density of 12.05 $mWcm^{-2}$ of the photodetector based on $AgSbSe_2$ nanoparticles film.

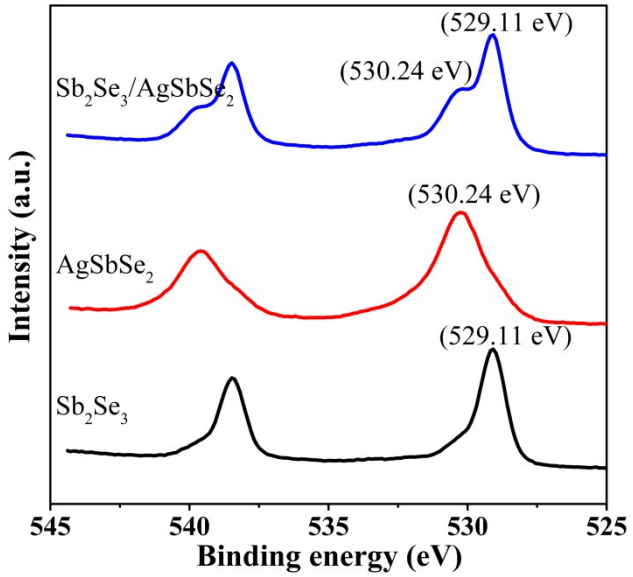

Fig. S3 Sb-3d x-ray photoelectron spectroscopy for $AgSbSe_2$, Sb_2Se_3 and $Sb_2Se_3/AgSbSe_2$ nanorods.

Table S1 Electrical properties of the as-synthesized samples

Sample	Resistivity (Ω cm)	Hall mobility ($cm^2\ V^{-1}\ s^{-1}$)	Carrier concentration (cm^{-3})	Conduction type
Sb_2Se_3	9.57×10^6	6.89	9.46×10^{10}	P
$AgSbSe_2$	17.71	4.91	7.19×10^{16}	P
$Sb_2Se_3/AgSbSe_2$	1.05×10^3	4.04	1.47×10^{15}	P