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# Supplementary data

## Tailoring photodetection performance of self-powered $Ga_2O_3$ UV solar-blind photodetectors through asymmetric electrodes

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**1. Transient photo-response of the self-powered UV photodetectors kept in the atmosphere for two months.**

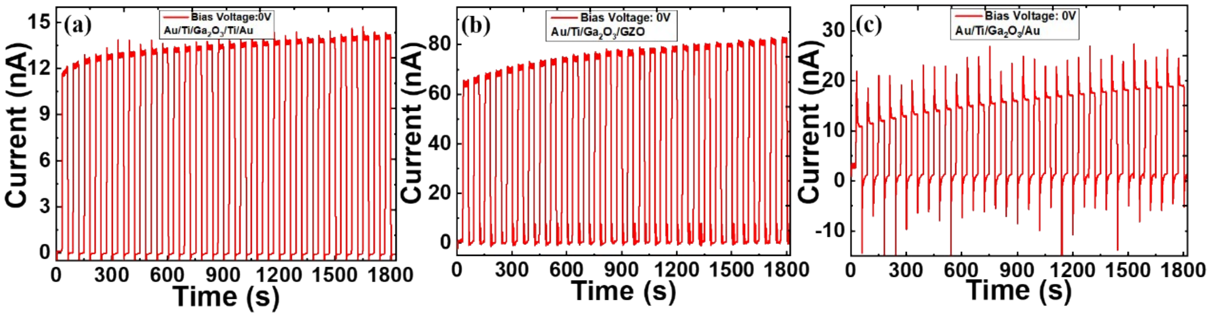


Fig. S1. Transient response of the amorphous $Ga_2O_3$ thin film photodetectors measured after placed in an atmospheric environment for two months (a) Asymmetric-electrode-size photodetector Au/Ti/$Ga_2O_3$/Ti/Au and Asymmetric-electrode-material photodetector (b) Au/Ti/$Ga_2O_3$/GZO (c) Au/Ti/$Ga_2O_3$/Au

The self-powered photodetectors were kept in the atmosphere. Fig. S1 shows the transient response performances of the amorphous $Ga_2O_3$ thin film photodetectors exposed to the atmosphere for two months. The current increased and decreased with the light turn on and off. It shows that these detectors have high-stability and high-repeatability of detection performances. All the self-powered detectors fabricated in this work show a promising potential to be applied in the long-time working applications in the harsh environment.

**2. Calculation of the Schottky barrier heights of an asymmetric-electrode-size photodetector between electrodes and $Ga_2O_3$ thin films.**

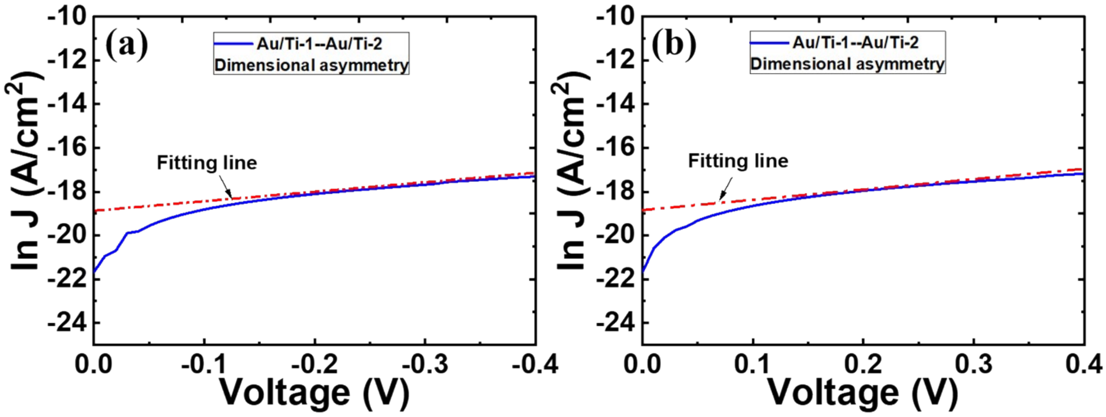


Fig. S2. The fitting of the linear region of the ln($J$)−$V$ characteristics for an asymmetric-electrode-size photodetector. (a) Reverse voltage; (b) Forward voltage

The two-side Schottky barrier height of an asymmetric-electrode-size photodetector can be calculated as

$$J_s = A^* T^2 \exp(-q\varphi_B / kT) \quad (1)$$

where $J_s$ is the saturation current density of the device, $k$ is Boltzmann's constant, $T$ is the evaluated temperature, and $e$ is the electron charge. The ln$J_s$ can be obtained through the intercept of tangent line of each ln$J$-$V$ curve, as shown in Fig. S2. Based on the Eq. (1), the $q\Phi_{BH} = (k_B T)[\ln T^2 A^* - \text{In} J_s]$. Thus, the $q\Phi_{BH}$ of $Ga_2O_3$ with left and right electrodes are calculated as values of 0.880 eV and 0.879 eV, respectively, indicating the heights of the Schottky barrier on both sides are almost equal.

**3. Calculation of the Schottky barrier heights of asymmetric-electrode-material photodetectors between two-side metal electrode and $Ga_2O_3$ thin film.**

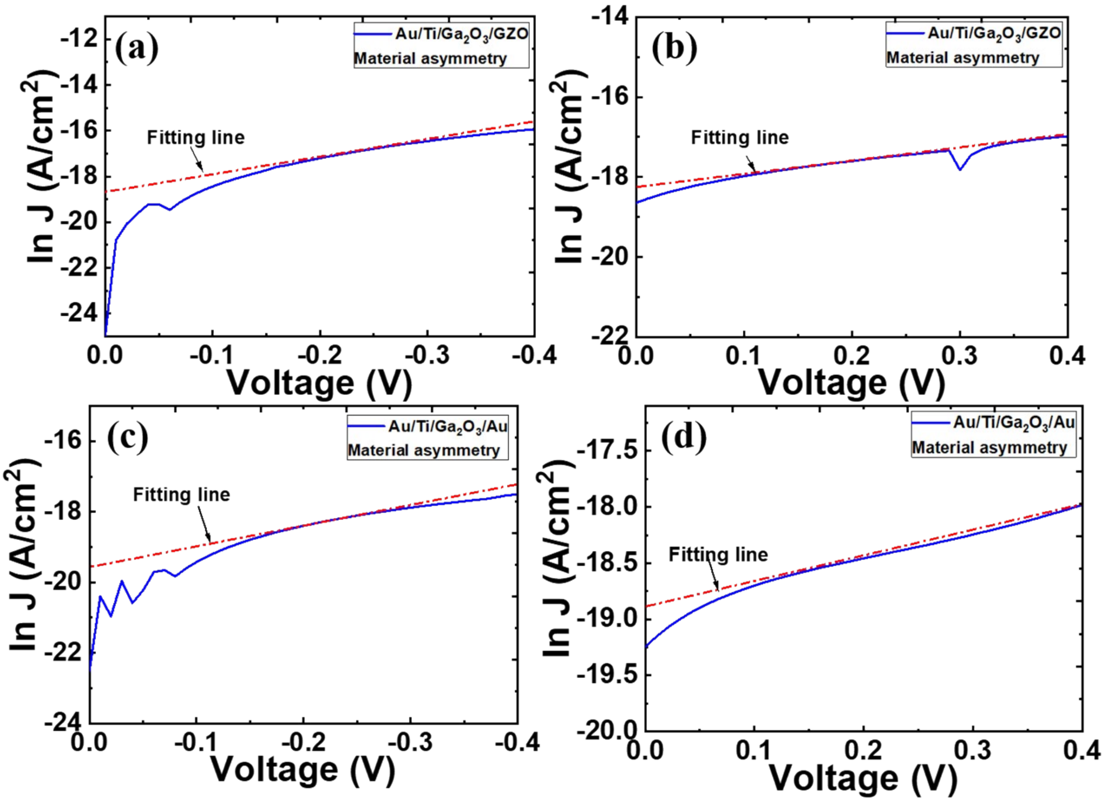


Fig. S3. The fitting of the linear region of the ln(*J*)-*V* characteristics for the Au/Ti/$Ga_2O_3$/GZO photodetector and the Au/Ti/$Ga_2O_3$/Au photodetector. (a) and (c) Reverse voltage; (b) and (d) Forward voltage.

Based on the Eq. (1), the $q\Phi_{B1}$ between the $Ga_2O_3$ and the Au/Ti, the $q\Phi_{B2}$ between the $Ga_2O_3$ and the GZO, and the $q\Phi_{B3}$ between the $Ga_2O_3$ and the Au are calculated as values of 0.880 eV, 0.863 eV and 0.898 eV, respectively.