Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Self-powered Solar-blind Ultraviolet-Visible Cu_2O/Ga_2O_3 Photodetectors

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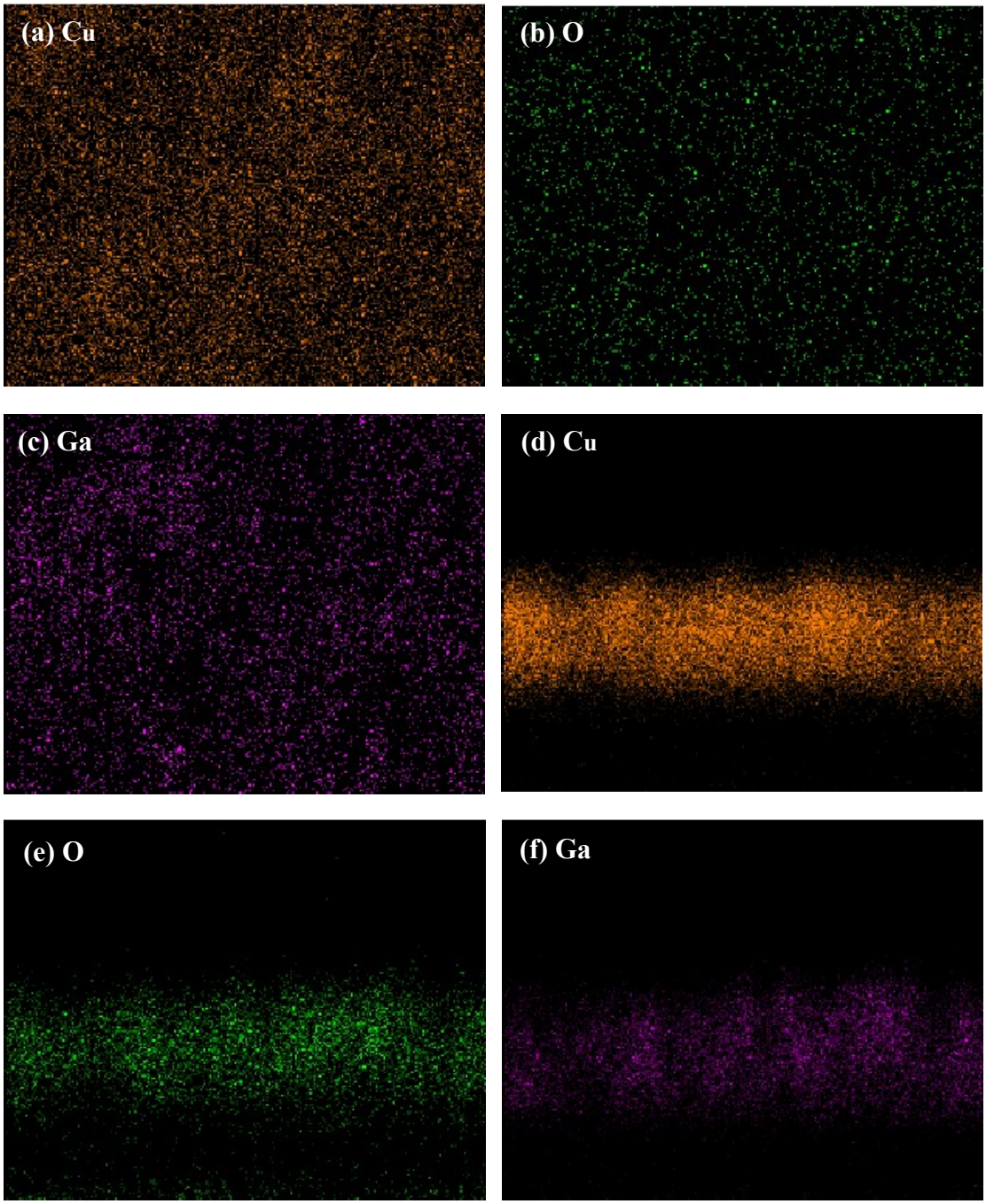

Fig. S1 EDS plots (a)-(c) and (d)-(f) cross-sections of $Cu_2O(9.5)/Ga_2O_3$NRs

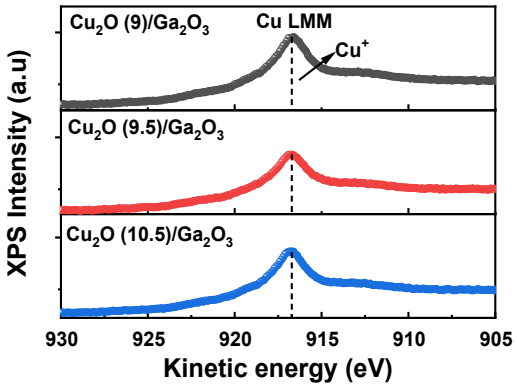

Fig. S2 Auger spectrum of Cu

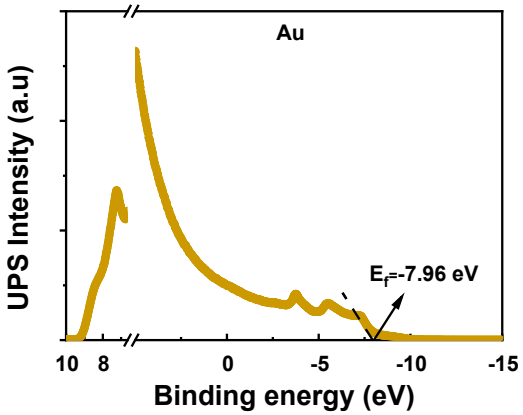

Fig. S3 Au calibrated UPS diagram

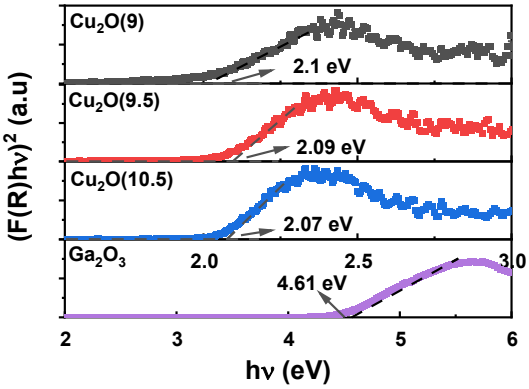

Fig. S4 Optical band gap of Ga_2O_3 and Cu_2O prepared at different pH values

The band gap (E_g) of the thin film can be calculated by Tauc formula (1.1)-(1.3) through diffuse reflectance spectrum, where F (R) is a function related to diffuse reflectance R, α is the absorption coefficient, which is proportional to F (R), hν is photon energy, A and B are constants, and n depends on the electron transition mode in the material, so take 1/2 for the direct band gap semiconductor and 2 for the indirect band gap semiconductor.

$$F(R) = \frac{(1-R)^2}{2R} \tag{1.1}$$

$$(\alpha h\upsilon)^{1/n} = A\,(h\upsilon - E_g) \tag{1.2}$$

$$(F(R)h\upsilon)^{1/n}\ B\,(h\upsilon - E_g) \tag{1.3}$$

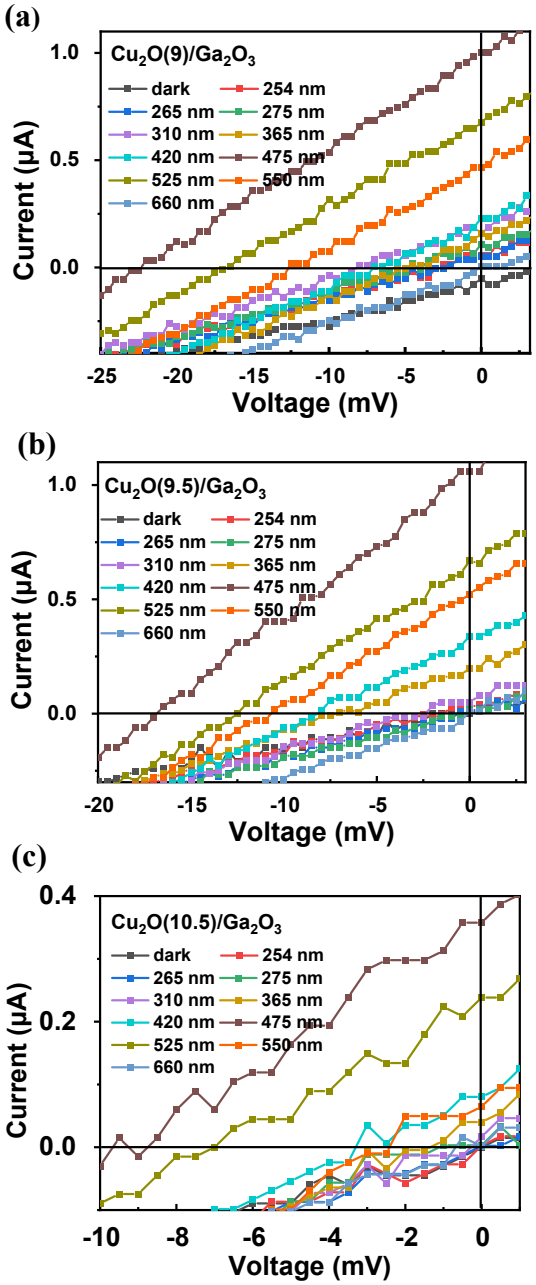

Fig. S5 Dark-state and light-state I-V curves of Cu_2O/Ga_2O_3 heterojunction devices prepared at different pH values and under optical power density of 4 mW/cm^2 illumination (b) pH = 9, (c) pH = 9.5 and (d) pH = 10.5

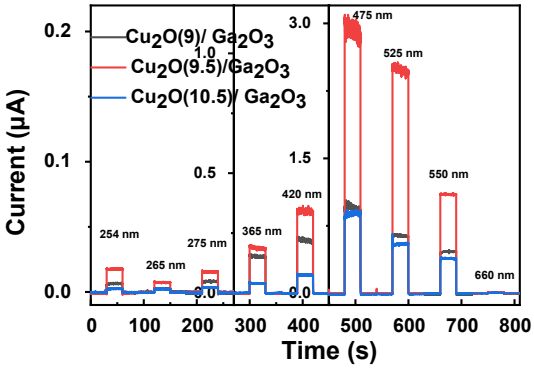

Fig. S6 I-t curves of Cu_2O/Ga_2O_3 heterojunction devices under 0 V bias and different wavelengths of light illumination

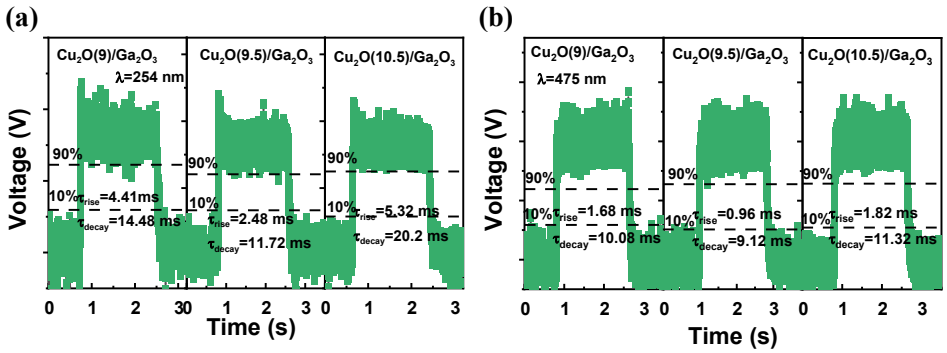

Fig. S7 Response velocity of Cu_2O/Ga_2O_3 prepared by different pH deposition solutions under (a) 254, (b) 475 nm illumination

Table S1. Comparison of the photoresponse time of the Cu_2O/Ga_2O_3 PDs with the other previously reported Ga_2O_3 based PDs without external power supply

Heterojunction	Wavelength	τ_{rise}	τ_{decay}	Ref
β-Ga_2O_3/GaN	254 nm	0.14 s	0.07 s	[41]
NiO/Ga_2O_3	254 nm	0.34 s	3.65 s	[42]
Ga_2O_3/Spiro-MeOTAD	248 nm	2.98 μs	28.49 μs	[43]
PEDOT:PSS/Ga_2O_3	248 nm	3.31 μs	71.2 μs	[44]
$SnSrO_3$/Ga_2O_3	254 nm	0.15 s	0.06 s	[45]
Au/Ga_2O_3/Si	254 nm	32.2 ms	78 ms	[46]
Ga:ZnO/Ga_2O_3	254 nm	179 ms	272 ms	[47]
Pt NPs/NiO/Ga_2O_3	254 nm	4.6 ms	7.6 ms	[48]
NSTO/Ga_2O_3	254 nm	0.21 s	0.07 s	[49]
Cu_2O/Ga_2O_3	254 nm	2.48 ms	11.72 ms	This Work