### **Supporting Information**

## Plasmon mediated Fe-O in octahedral site of cuprospinel by Cu NPs

## for photocatalytic hydrogen evolution

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Fig S1: XRD patterns of CuFe<sub>2</sub>O<sub>4</sub> before and after photoreduction



**Fig S2**: The light source for the light intensity at 100 mW  $cm^{-2}$ 

#### The calculation of quantum efficiency (*QE*)

QE was conducted using the same procedure reported in literature.<sup>[1]</sup>

$$QE = \frac{2R_p^r}{R_p^a} \times 100\%$$
$$= \frac{\text{number of reacted electrons}}{\text{number of incident photons}} \times 100\%$$
$$= \frac{2 = \text{r of incident photons} - 45A}{\text{number of incident photons}} \times 100\%$$

$$= \frac{2\nu t N_{\rm A}}{R_p^a} \times 100\%$$

$$R_p^a = \int_{340}^{800} \frac{S \times a \times I \times \lambda}{h \times c}$$

where v is the average hydrogen evolution rate (mol·s<sup>-1</sup>), t is the irradiation time (s),  $N_A$  is Avogadro's constant  $6.022 \times 10^{23}$  (mol<sup>-1</sup>), I is the light density of incident light (W cm<sup>-2</sup>), S is the irradiation area (cm<sup>2</sup>),  $\lambda$  is the wavelength of incident light (nm), h is Planck constant  $6.626 \times 10^{-34}$  (J s), and c is the speed of light  $3 \times 10^8$  m·s<sup>-1.</sup> a is the light absorption. The light intensity is 100 mW·cm<sup>-2</sup>, and the average hydrogen evolution rate v of CuFe<sub>2</sub>O<sub>4</sub> and 1.2%Cu/ CuFe<sub>2</sub>O<sub>4</sub> were estimated to be 4.5 µmol·h<sup>-1</sup> and 22.6 µmol·h<sup>-1</sup>, and the R<sup>A</sup><sub>p</sub> of CuFe<sub>2</sub>O<sub>4</sub> and 1.2%Cu/CuFe<sub>2</sub>O<sub>4</sub> were determined to be 2.149×10<sup>18</sup> quanta·s<sup>-1</sup> and 2.192×10<sup>18</sup> quanta·s<sup>-1</sup> thus the calculation was illustrated by the following equation <sup>[2]</sup>:

QE (CuFe<sub>2</sub>O<sub>4</sub>) = 
$$\frac{6.022 \text{ N}10^{23} 3022 \text{ N}10^{-6}/(3.6 10^{3})}{2.149 \times .1^{18}} \times 100\%$$
  
= 0.069%

QE (1.2%Cu/CuFe<sub>2</sub>O<sub>4</sub>) = 
$$\frac{6.022 \text{ Cu}10^{23} \text{ 3022 } Cu/10^{-6}/(3.6 \text{ 10}^3)}{2.192 \times .1^{18}} \times 100\%$$

= 0.34%

Sample	Cu: Fe (atom ratio)	Cu: CuFe Weight (wt%)	Theoretical Weight (wt%)
CuFe	0.5	0	0
0.6%Cu/CuFe	0.5075	0.38	0.6
1.2%Cu/CuFe	0.514	0.69	1.2
3.1%Cu/CuFe	0.5515	2.67	3.1
6.2%Cu/CuFe	0.6135	5.68	6.2
12%Cu/CuFe	0.7305	10.91	12

Table S1: ICP-AES of CuFe2O4 and different amount Cu NPs on CuFe2O4



Fig S3: The PL spectra of the blank CuFe<sub>2</sub>O<sub>4</sub>, 1.2%Cu/CuFe<sub>2</sub>O<sub>4</sub> and 6.2%Cu/CuFe<sub>2</sub>O<sub>4</sub>

# **References:**

[1] H. Irie, K. Kamiya, T. Shibanuma, S. Miura, D. A. Tryk, T. Yokoyama, K. Hashimoto, *The Journal of Physical Chemistry C* **2009**, *113*, 10761.

[2] M. Liu, R. Inde, M. Nishikawa, X. Qiu, D. Atarashi, Acs Nano 2014, 8, 7229.