Supporting information

Cu-enhanced Photoelectronic and Ethanol Sensing Properties of Cu_2O/Cu Nanocrystals Prepared by One-step Controllable Synthesis

Yao Hu;[a] Muwei Ji;[a,b,c] Yiqing He;[a] Ziyi Liu;[a] Qinghua Yang;[a] Chaozheng Li;[d] Jiajia Liu;[d] Bo Li;[a] Jiatao Zhang;[d,*] Caizhen Zhu;[b,*] and Jin Wang[a,*]

a. *Graduated school at Shenzhen, Tsinghua University, Shenzhen, 518065, China*

b. *College of Chemistry and Environment Engineering, Shenzhen University, Shenzhen, 518060, China*

c. *Institute of Chemistry, Chinese Academy of Sciences, Beijing , 100190, China*

d. *Beijing Key Laboratory of Construction Tailorable Advanced Functional Materials and Green Applications, School of Materials Science and Engineering, Beijing Institute of Technology, Beijing 100081, China.*

Tab. S1 The molar ratio of Cu_2O and Cu in the four samples.

Sample	Cu_2O: Cu (molar ratio)
Cu_2O (2 mmol A.A.)	∞
Cu_2O:Cu (4 mmol A.A.)	**5:1**
Cu_2O:Cu (8 mmol A.A.)	**1:4**
Cu (12 mmol A.A.)	**0**

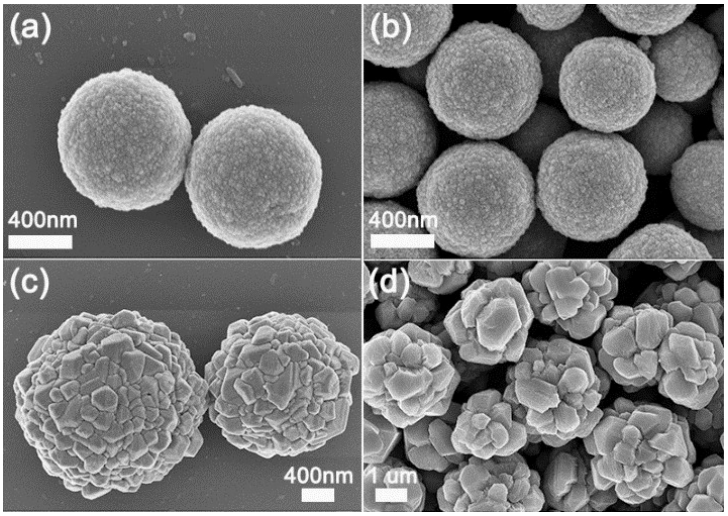

Fig. S1 The SEM images with high magnification for (a) Cu_2O (2 mmol A.A.), (b) Cu_2O/Cu (4 mmol A.A.), (c) Cu_2O/Cu (8 mmol A.A.) and (d) Cu (12 mmol A.A.).

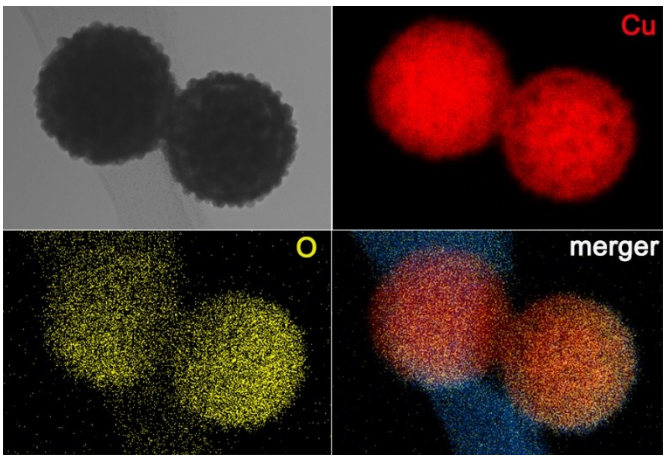

Fig.S2 Elemental mapping of the Cu_2O/Cu structure.

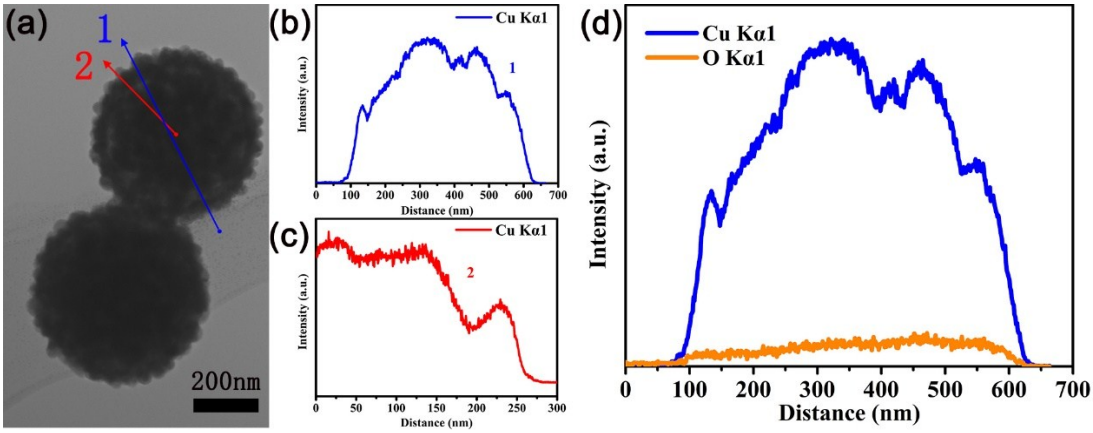

Fig. S3 (a) The LRTEM images of the prepared Cu_2O/Cu particles; (b) and (c) are the concentration of the element copper along the line 1 and 2, respectively; (d) The comparison of Cu and O element intensity along line 1.

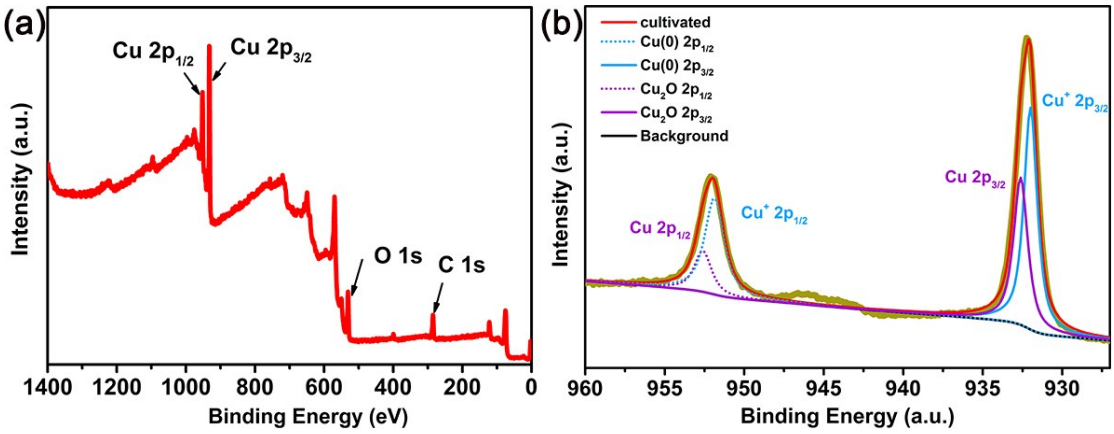

Fig. S4 XPS spectra of the as-prepared samples: (a) overall survey spectra; indicating there are elemental C, O and Cu. Carbon element is attributed to the absorption in the air and the hydrocarbon of the XPS instrument itself. Besides existing in Cu_2O, part of the oxygen element is ascribed to air adsorption like carbon; (b) the Cu XPS peaks of as-prepared Cu_2O/Cu.

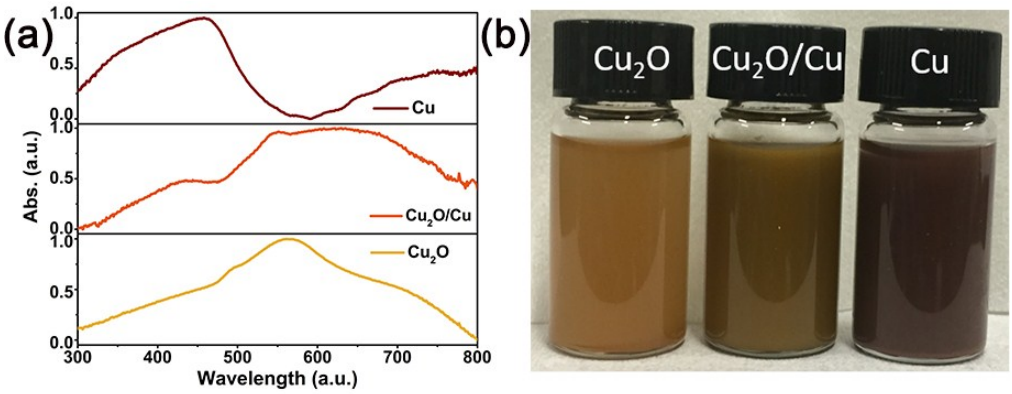

Fig. S5 The UV-vis absorption spectrum (a) and photograph (b) of as-prepared Cu_2O (2 mmol A.A.), Cu_2O/Cu (4 mmol A.A.) and Cu (12 mmol A.A.) nanocrystals.

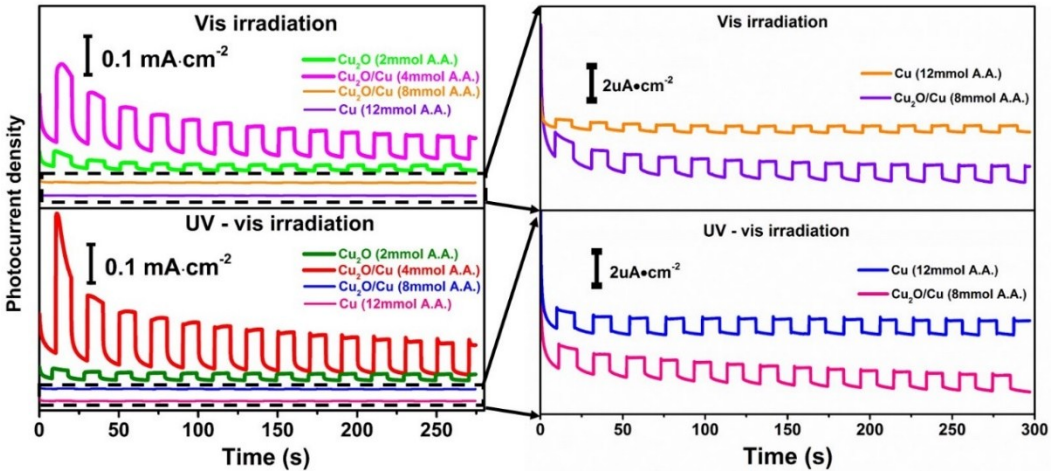

Fig.S6 The photocurrent of Cu-rich Cu_2O/Cu prepared with 8 mmol A.A. and pure Cu prepared with 12 mmol A.A. under UV-vis light and Vis light.

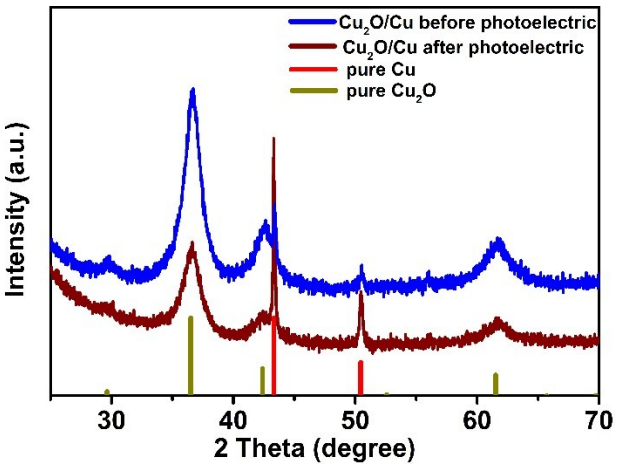

Fig.S7 XRD pattern of Cu_2O/Cu (4 mmol A.A.) before and after UV-vis irradiation.

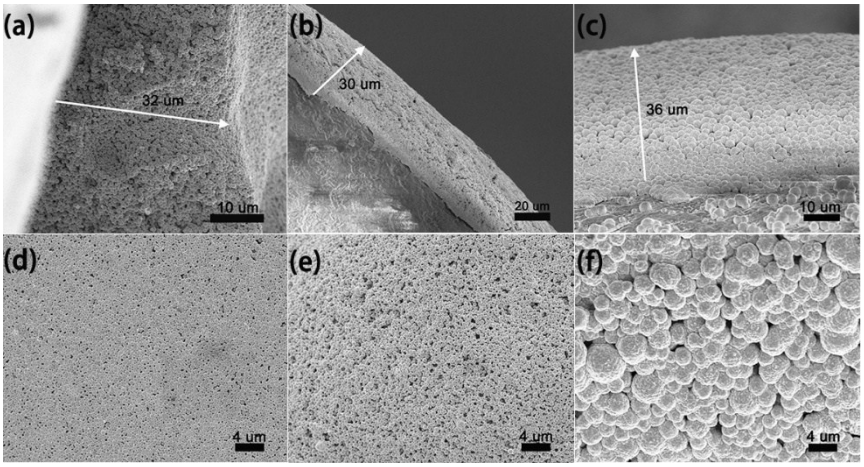

Fig.S8 The sectional SEM image views of (a) Cu_2O (2 mmol A.A.), (b) Cu_2O/Cu (4 mmol A.A.) and (c) Cu_2O/Cu (8 mmol A.A.) after ethanol sensing test; the surface SEM images of (d) Cu_2O (2 mmol A.A.), (e) Cu_2O/Cu (4 mmol A.A.) and (f) Cu_2O/Cu (8 mmol A.A.) after ethanol sensing test.

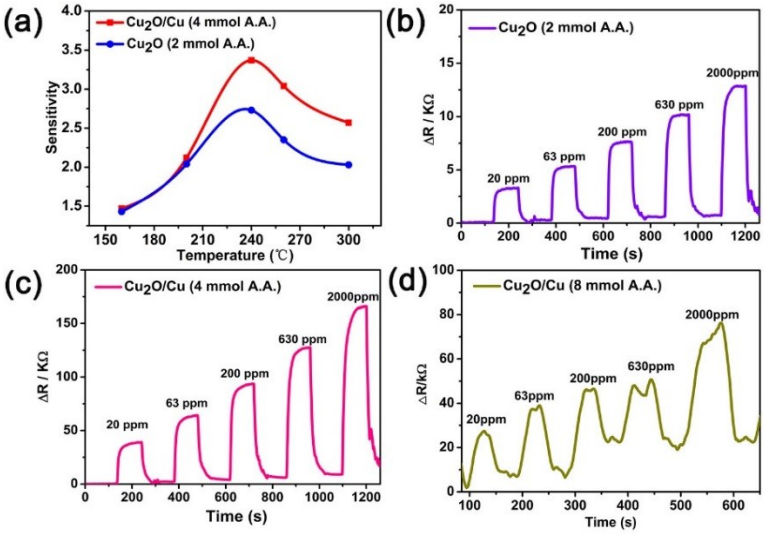

Fig.S9 (a) The relationship of sensitivity and temperature with the ethanol concentration of 200ppm; the resistance for different ethanol gas concentration at 240°C with (b) Cu_2O (2 mmol A.A.), (c) Cu_2O/Cu (4 mmol A.A.) and (d) Cu_2O/Cu (8 mmol A.A.).

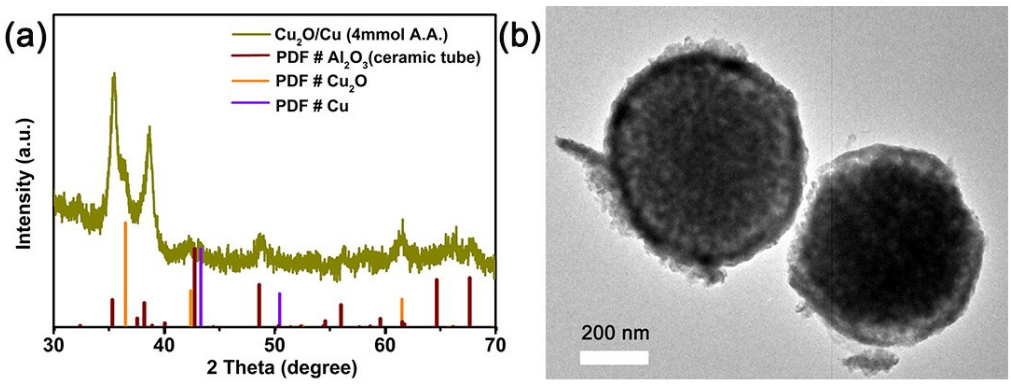

Fig.S10 (a) The XRD pattern of Cu_2O/Cu (4 mmol A.A.) after ethanol sensing test; (b) XRD pattern of Cu_2O/Cu (4 mmol A.A.) after ethanol sensing test.

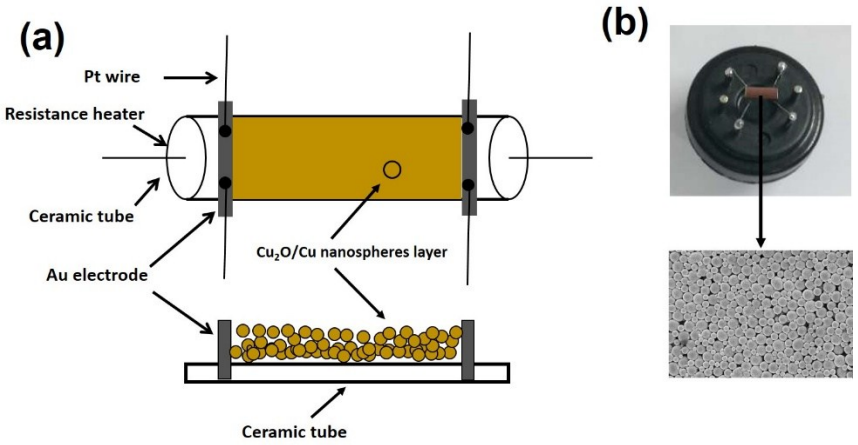

Fig.S11 (a) The photograph of the sensor and the SEM images of pure Cu_2O or Cu_2O/Cu layer; (b) the schematic diagram of the sensor and the sectional view.