Supporting Information

Microwave-Assisted Hydrothermal Synthesis of Cu/Cu$_2$O Hollow Spheres with Enhanced Photocatalytic and Gas Sensing Activities at Room Temperature

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Measurement of adsorption activity

Measurement of electrochemical impedance spectroscopy (EIS)

The electrochemical impedance spectroscopy (EIS) measurements were performed with an electrochemical workstation (CHI660e, Chenhua, Shanghai, China) in a frequency range from 10 mHz to 100 kHz and an AC amplitude of 5 mV at room temperature under visible light irradiation. Typically, 5 mg of as-prepared Cu-Cu$_2$O hollow spheres composite was added to 2 mL of ethanol and then grinded for 15 min. Afterward, the viscous paste was bound onto the ITO glass via doctor-blading method, which formed the Cu-Cu$_2$O/ITO glass working electrode and then dried at 70 °C in air for 6 h. A Pt sheet and Ag/AgCl electrode were used as counter electrode and reference electrode, respectively. Na$_2$SO$_4$ (0.01 M) aqueous solution was employed as electrolyte.
Measurement of hydroxyl radicals

Hydroxyl radical $^\cdot\text{OH}$ can be detected by a photoluminescence (PL) method using terephthalic acid (TA) as a probe molecule. The test procedure is similar to the photocatalytic degradation measurement, except that the aqueous MO solution is replaced with 0.4 mM TA and 2 mM NaOH. TA readily reacts with the generated $^\cdot\text{OH}$ to produce a highly fluorescent 2-hydroxy-TA (TA-$^\cdot\text{OH}$), which is measured by a fluorescence spectrophotometer (Hitachi F-4600, Japan) at 425 nm emission wavelength and 315 nm excitation wavelength. Fig. S2 shows fluorescence emission spectra for the different products at same irradiation time of 30 min.

![Fluorescence emission spectra](image)

Fig. S2 Fluorescence emission spectra in the presence of different products at same irradiation time of 30 min