Electronic supplementary information

Facile hydroxyl-assisted synthesis of morphological Cu_2O architectures and their shape-dependent photocatalytic performances†

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Characterization

The crystalline phase of the sample was characterized by an X-ray diffractometer (Bruker-AXS D8 ADVANCE) with Cu-Kα (λ=1.54060 Å) in the range (20~80°). The morphologies of the products were investigated by field-emission scanning electron microscopy (FE-SEM) using a JEOL (JSM-7000F) at an accelerating voltage of 20 KV.

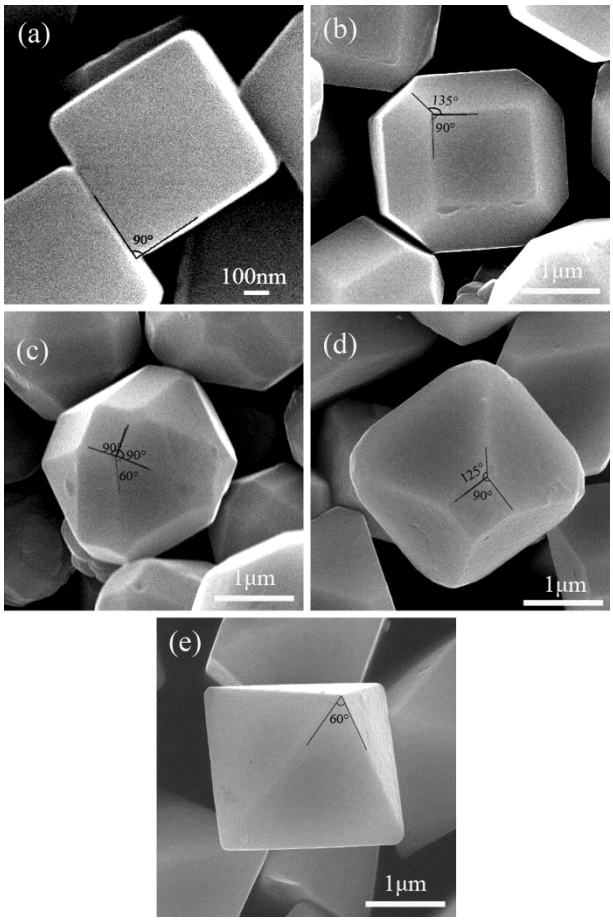

Fig. S1 The interfacial angles of these typical morphologies: (a) cubes; (b) edge-truncated cubes; (c) edge- and corner-truncated octahedra; (d) truncated octahedra; (e) octahedra.

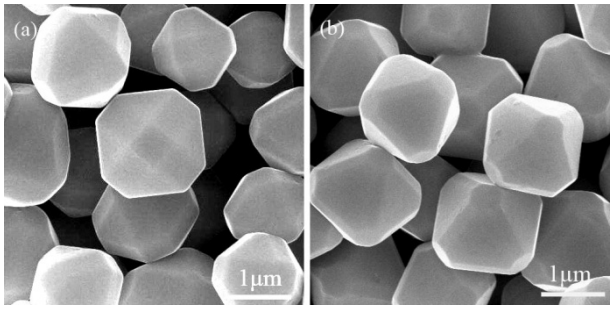

Fig. S2 SEM images of Cu_2O crystals of different morphologies with 3.96 M NaOH: (a) 1 mmol EDTA, edge- and corner-truncated octahedra; (b) 0 mmol EDTA; rhombicuboctahedra.

Measurement of photocatalytic activity

The adsorption and photocatalytic activity for the different shapes Cu_2O crystals were investigated with using of methyl orange (MO) as a pollutant under a 500W xenon lamp as a visible light source. Briefly, 100 mg samples of Cu_2O with different morphologies were dispersed in 50 mL MO solution (10 mg/L), respectively. Before the light

was switched on, the solution was stirred in the dark for 30 min to ensure adsorption/desorption equilibrium between the Cu_2O and dye. Under constant stirring in the visible light, about 3 mL of the mixture was taken out at different intervals. After centrifugation, the adsorption behavior of MO was analyzed though a UV-vis spectrophotometer (UV-vis/NIR spectrophotometer (Hitachi U-4100)).

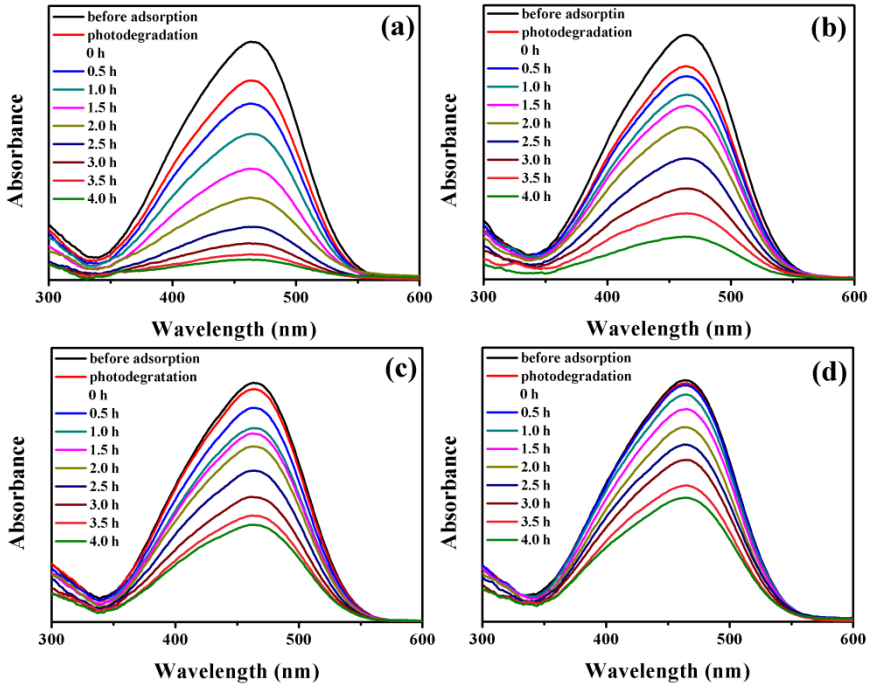

Fig. S3 (a) Absorption spectra of MO solution in the presence of Cu_2O edge- and corner-truncated octahedra; (b) Absorption spectra of MO solution in the presence of Cu_2O edge-truncated cubes; (c) Absorption spectra of MO solution in the presence of Cu_2O octahedra; (d) Absorption spectra of MO solution in the presence of Cu_2O truncated octahedra;

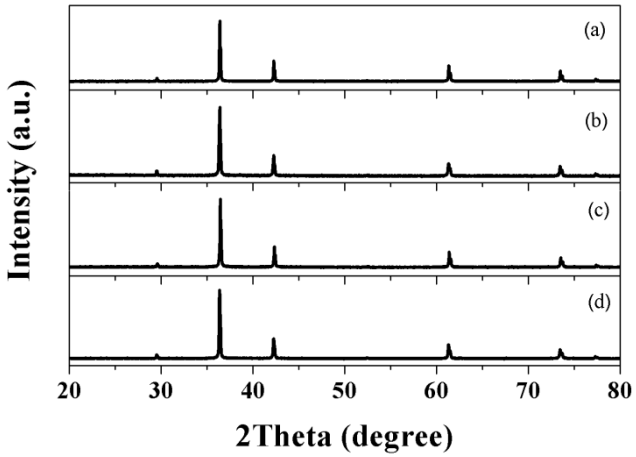

Fig. S4 XRD patterns of the Cu_2O crystals with different morphologies after photocatalytic reaction: (a) edge-truncated cubes; (b) edge- and corner-truncated octahedra; (c) truncated octahedra; (d) octahedra.

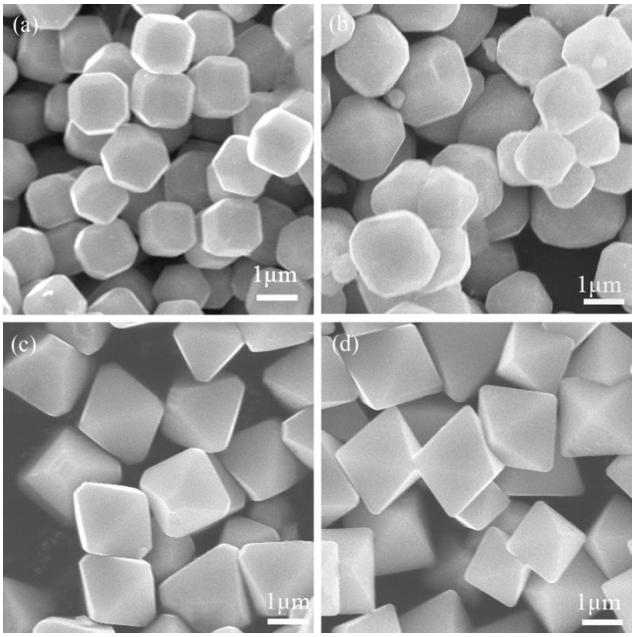

Fig. S5 XRD patterns of the Cu_2O crystals with different morphologies after photocatalytic reaction: (a) edge-truncated cubes; (b) edge- and corner-truncated octahedra; (c) truncated octahedra; (d) octahedra.

Based on the SEM results, we can get the geometrical parameters of different Cu_2O through statistic according to SEM images. Then, we can calculate the size and percentages of different crystal facets in the as-prepared Cu_2O crystals are as follows:

edge-truncated cubes

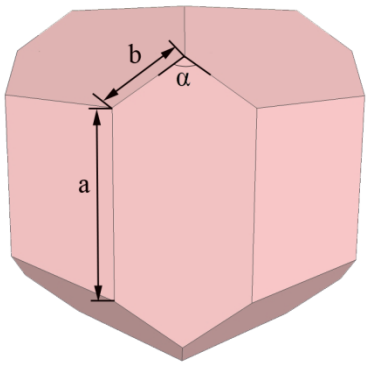

Fig. S6 Corresponding simulated structures of edge-truncated cubes Cu_2O crystals

a = 0.61 b = 0.22 α = 120°

$$S_{100} = a^2$$

$$S_{110} = 2 \times \frac{1}{2} b^2 \cdot \sin\alpha + 2a \cdot b \cdot \sin\frac{\alpha}{2}$$

$$P_{100} = \frac{6 \times S_{100}}{6 \times S_{100} + 12 \times S_{110}} = 40.4\%$$

$$P_{110} = \frac{12 \times S_{110}}{6 \times S_{100} + 12 \times S_{110}} = 59.6\%$$

edge- and corner-truncated octahedra:

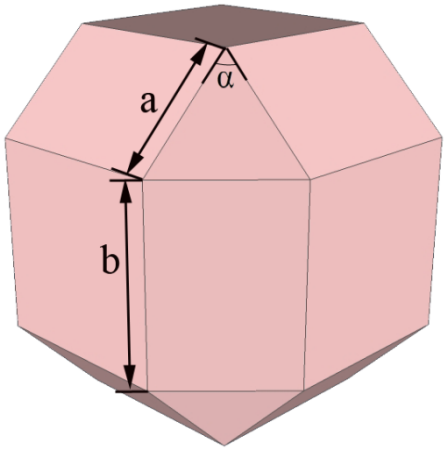

Fig. S7 Corresponding simulated structures of edge- and corner-truncated octahedra Cu_2O crystals

a = 0.7 b = 0.38 α = 60°

$$S_{100} = b^2 \qquad S_{110} = a \cdot b \qquad S_{111} = \frac{1}{2} a^2 \cdot \sin\alpha$$

$$P_{100} = \frac{6 \times S_{100}}{6 \times S_{100} + 12 \times S_{110} + 8 \times S_{111}} = 15.1\%$$

$$P_{110} = \frac{12 \times S_{100}}{6 \times S_{100} + 12 \times S_{110} + 8 \times S_{111}} = 55.5\%$$

$$P_{111} = \frac{8 \times S_{111}}{6 \times S_{100} + 12 \times S_{110} + 8 \times S_{111}} = 29.4\%$$