Electronic supplementary information

Seed-mediated synthesis of polyhedral 50-facet Cu_2O architectures

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Synthesis of cubic Cu_2O seeds: In a typical synthesis, 0.9982 g of $Cu(CH_3COO)_2$ was dissolved in deionized water (100 mL) using a beaker under a constant stirring at 70 °C for 2 min. A dark precipitate was produced when a sodium hydroxide solution (6 M, 5 mL) was added dropwise to the above solution. After being stirred for 5 min, D-(+)-glucose powder (0.2 g) was added into the dark precursor with a constant stirring for another 60 min at 70 °C, and then was allowed to cool to room temperature naturally. Afterward, the obtained products were centrifuged at 5000 rpm for 1min (XIANYI TG16-WS centrifuge). The precipitates were centrifuged twice more in deionized water and anhydrous ethanol, respectively. And finally were dried at 70 °C for 12 hours in a vacuum oven.

Synthesis of 14-facet Cu_2O crystals: In a typical synthesis, 2.9946 g of $Cu(CH_3COO)_2$ was dissolved in deionized water (20 mL) using a beaker, and then 0.10 g of cubic Cu_2O powder was added into the solution under a constant stirring at 70 °C for 2 min. A dark precipitate was produced when a sodium hydroxide solution (9 M, 10 mL) was added dropwise to the above solution. After being stirred for 5 min, D-(+)-glucose powder (0.3 g) was added into the dark precursor with a constant stirring for another 25 min at 70 °C, and then was allowed to cool to room temperature naturally. The precipitates were centrifuged twice more in deionized water and anhydrous

ethanol, respectively. And finally they were dried at 70 °C for 12 hours in a vacuum oven.

Synthesis of octahedral Cu_2O seeds: In a typical synthesis, 2.9946 g of $Cu(CH_3COO)_2$ was dissolved in deionized water (20 mL) using a beaker under a constant stirring at 70 °C for 2 min. A dark precipitate was produced when a sodium hydroxide solution (9 M, 10 mL) was added dropwise to the above solution. After being stirred for 5 min, D-(+)-glucose powder (0.3 g) was added into the dark precursor with a constant stirring for another 60 min at 70 °C, and then was allowed to cool to room temperature naturally. Afterward, the obtained products were centrifuged at 5000 rpm for 1min (XIANYI TG16-WS centrifuge). The precipitates were centrifuged twice more in deionized water and anhydrous ethanol, respectively. And finally were dried at 70 °C for 12 hours in a vacuum oven.

Synthesis of polyhedral M-pyramid Cu_2O architecture *via* octahedral Cu_2O seeds: In a typical synthesis, 0.9982 g of $Cu(CH_3COO)_2$ was dissolved in deionized water (100 mL) using a beaker, and then 0.10 g of octahedral Cu_2O powder (SEM image are shown in Fig. 3a) were added into the solution under a constant stirring at 70 °C for 2 min. A dark precipitate was produced when a sodium hydroxide solution (6 M, 5 mL) was added dropwise to the above solution. After being stirred for 5 min, D-(+)-glucose powder (0.2 g) was added into the dark precursor with a constant stirring for another 3 min at 70 °C, and then was allowed to cool to room temperature naturally. Afterward, the obtained products were centrifuged at 5000 rpm for 1min (XIANYI TG16-WS centrifuge). The precipitates were centrifuged twice more in deionized water and anhydrous ethanol, respectively. And finally were dried at 70 °C for 12 hours in a vacuum oven.

The crystal phase of as-prepared products was characterized by an X-ray diffractometer Bruker-AXS D8 ADVANCE) using Cu Kα radiation (λ = 1.54 Å) in the range (20 ~ 80 °). The morphology of the products was investigated by field-emission scanning electron microscopy (FE-SEM) using JEOL (JSM-7000F) at an accelerating voltage of 20 KV.

Photocatalytic property

The catalytic activity experiments of the different kinds of Cu_2O (including the as-prepared 50-facet and 14-facet Cu_2O crystals) for the oxidation and decoloration of the methyl orange (MO) dye were carried out at ambient temperature. The original solution was prepared by adding 50 mL MO solution (5 mg/L), and then 0.1 g Cu_2O powder was added into the solution to form the aqueous dispersion. Before illumination, the solution was vigorously stirred in the dark for 0.5 h to evaluate the adsorption property. Afterwards, the dispersion was irradiated by a 500 W xenon lamp equipped with a filter cutoff ($\lambda \geqslant 420$ nm) under magnetic stirring. At given time intervals, the dispersion was sampled and centrifuged to separate the catalyst. UV-vis absorption spectra were recorded at different intervals to monitor the reaction using a UV/vis/NIR spectrophotometer (Hitachi U-4100).

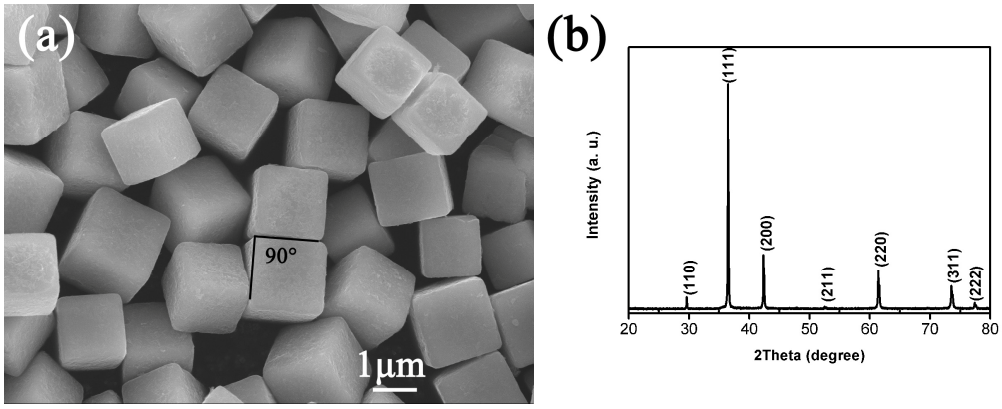

Fig. S1 (a) FESEM image and (b) XRD pattern of the cubic Cu_2O seeds.

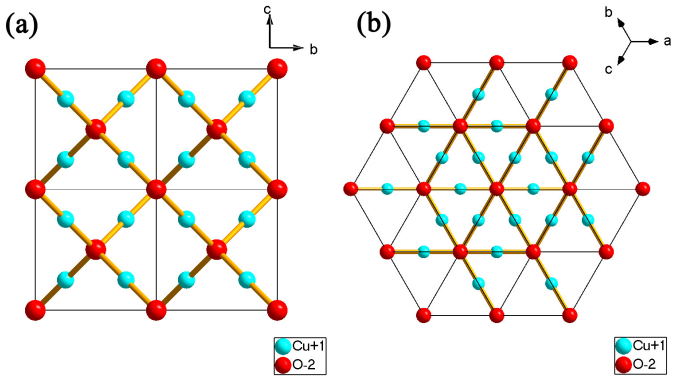

Fig. S2 The crystallographic structures of {100} (a) and {111} (b) facets of Cu_2O crystal.