

## Supporting Information

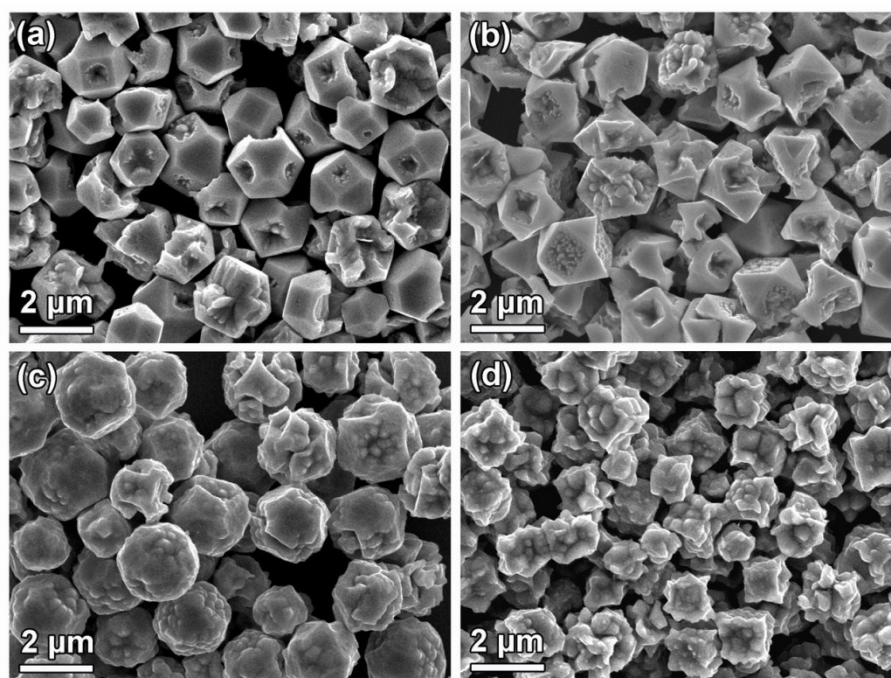


Figure S1. The oxygen concentration effect on the formation of concave Cu<sub>2</sub>O truncated cubes with velocity of 10 mL/min and etching time of 0.5 h, (a) air, (b) 50%, (c) 80%, (d) pure oxygen.

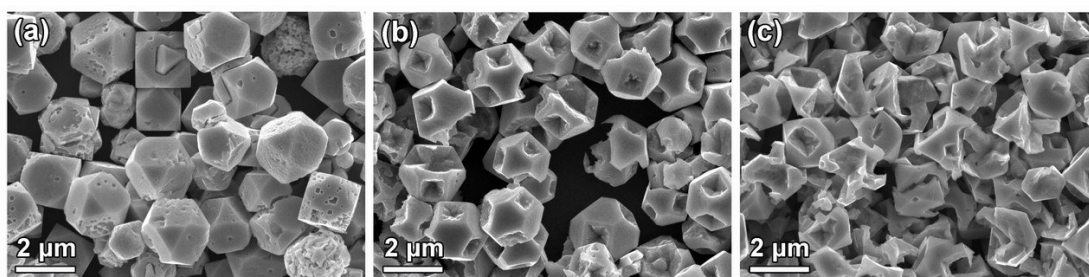


Figure S2. The flow velocity effect on the formation of concave  $\text{Cu}_2\text{O}$  truncated cubes with air and etching time of 1 h, (a) 5 mL/min, (b) 10 mL/min, (c) 20 mL/min.

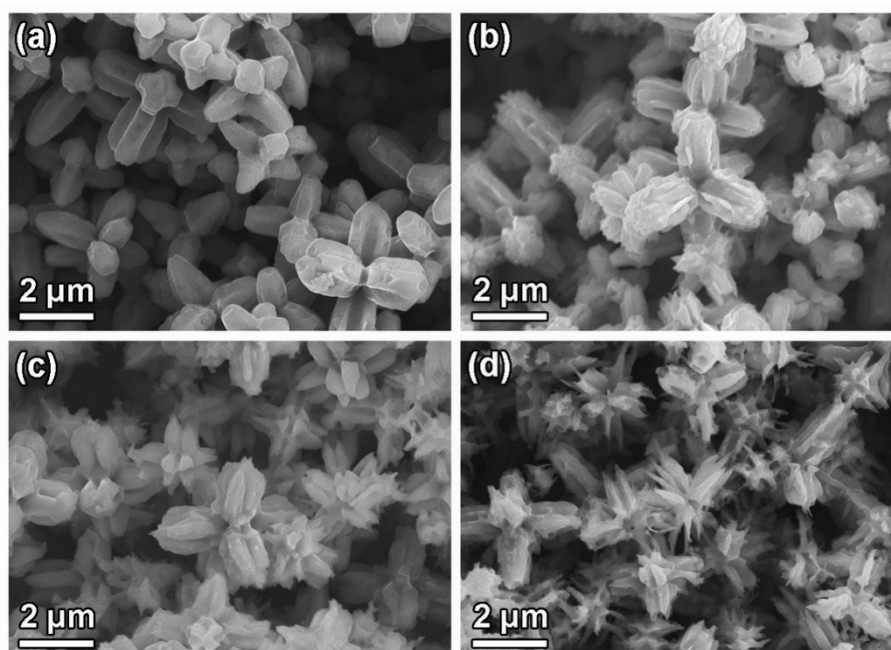


Figure S3. Selective etching of  $\{100\}$  facets for  $\text{Cu}_2\text{O}$  hexapod microcrystals with the assistance of PVP at air velocity of 10 mL/min, (a) 0 h, (b) 1 h, (c) 2 h, (d) 2.5 h.

The experimental details for the synthesis of hexapod  $\text{Cu}_2\text{O}$  microcrystals: In a typical procedure, an aqueous solution was first prepared by mixing 34 mL of deionized water (18  $\text{M}\Omega$ ) and 2 mL of 0.68 M  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  in a 100 mL flat bottomed flask. After the mixture was stirred with a magnetic blender for about 15 min, 2 mL mixed solution of 0.74 M  $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$  and 1.2 M  $\text{Na}_2\text{CO}_3$  were dropped into the solution. Stirred for another 10 min, then, 0.5 g NaCl was added. When the NaCl powder was dissolved, 2 mL of 1.4 M glucose was slowly added in a dropwise manner. Kept the solution in water bath at temperature of 80 °C for 15 min, then, introduced the air into the reaction system, at flow velocity of 10 mL/min. Controlling the speed of magnetic stirring to make sure the gas was uniformly diffused in the solution. 2 h later, the brick red precipitate was centrifuged and washed with distilled water and absolute alcohol for several times, dried in a vacuum oven at 60 °C for further characterization.

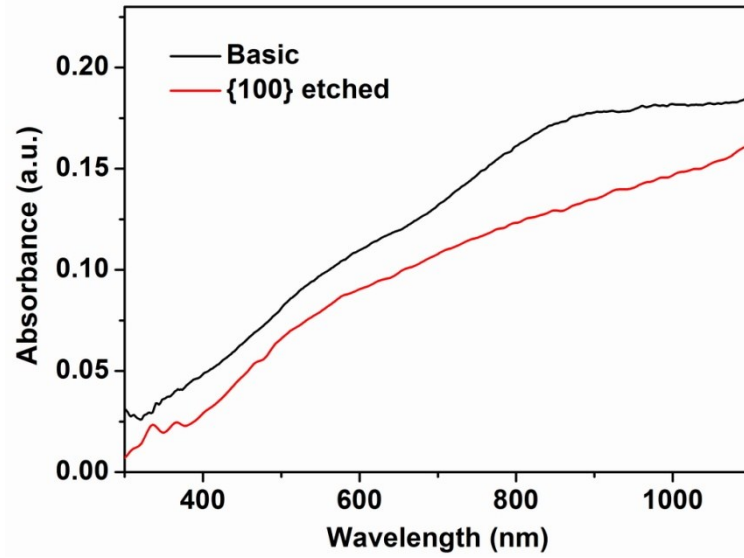


Figure S4. Absorption spectra of  $\text{Cu}_2\text{O}$  cuboctahedrons and  $\text{Cu}_2\text{O}$  cuboctahedrons etched.

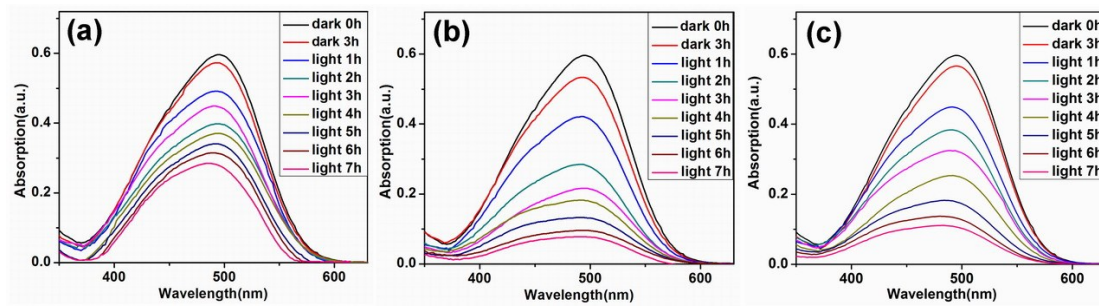


Figure S5. Absorption spectra of CR solution in the presence of the as-prepared  $\text{Cu}_2\text{O}$ , (a) basic structure, (b)  $\{100\}$  facets etching, (c)  $\{111\}$  facets etching.