Supporting information

One-step synthesis of AgCl concave cubes by preferential overgrowth along <111> and <110> directions

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Experimatal procedure

All reagents were analytical grade. 0.1×50 mm Ag plate, $NaClO_2$ 80% (NaCl 20%), citrate acid and $AgNO_3$ were purchased and used without any further purification.

Synthesis of AgCl concave cubes

The AgCl concave cubes were prepared by wet chemcial oxidization method, using $NaClO_2$ as oxidizer. In a typical procedure, 0.1×10×10 mm Ag plates was washed with water and alcohol for three times, and dried in the air. The cleaned Ag plate was added into 100 ml mixed solution which containing 2 mM $NaClO_2$, 0.8 mM NaCl and 1 mM citrate acid. After certain reaction time 0.5h, 1 hour, 4 hours and 8 hours, the Ag plate was taken out of the solution and washed with deionized water for three times, dried in the air. The concave cubic samples were collected from the surface of Ag plate. Other samples were obtained by following above method, the concentration of NaCl was tuned by using different volums of 0.1 mM NaCl solution. Cubic AgCl was synthesized by hydrothermal method, 10 ml 0.1mM $AgNO_3$ was mixed with 90 ml 2 mM NaCl solution. The mixed solution was stirred for 20 minutes and transferred into 120 ml Teflon-lined stainless vessel. After heat treat at 160 °C for 4 hours, the vessels were cooled down to room temperature. The products were collected by filtered, washed with water for three times and dried in the air.[15]

Oxygen evolution

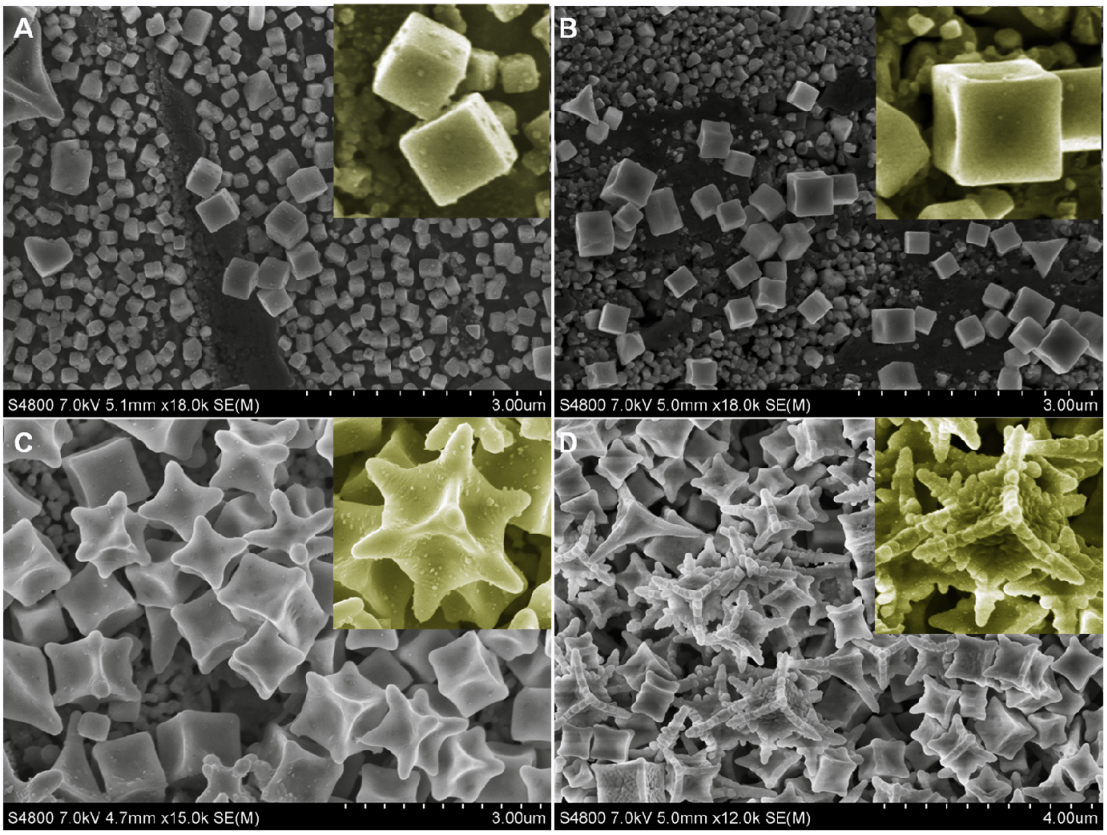
The oxygen evolution experiment was carried following the reported method.[19] The AgCl powders (0.2 g) were dispersed by a magnetic stirrer in 100 ml of H_2O. The concave cubic AgCl which was prepared by 2 mM $NaClO_2$, 0.8 mM NaCl and 1 mM citrate acid for 8 hours was used in oxygen evolution experiment.The reaction acts in LabSolar-H_2 system.(Beijing PerfectLight Co. Ltd) $AgNO_3$ (0.5 g) was added for

sacrificial reagent in the experiments. The light source was 300 W Xe arc lamp (PLS-SXE300, Beijing Trusttech Co. Ltd). The amounts of evolved oxygen were was determined using a gas chromatograph.(VARIAN, CP-3800, TCD, N_2 carrier).

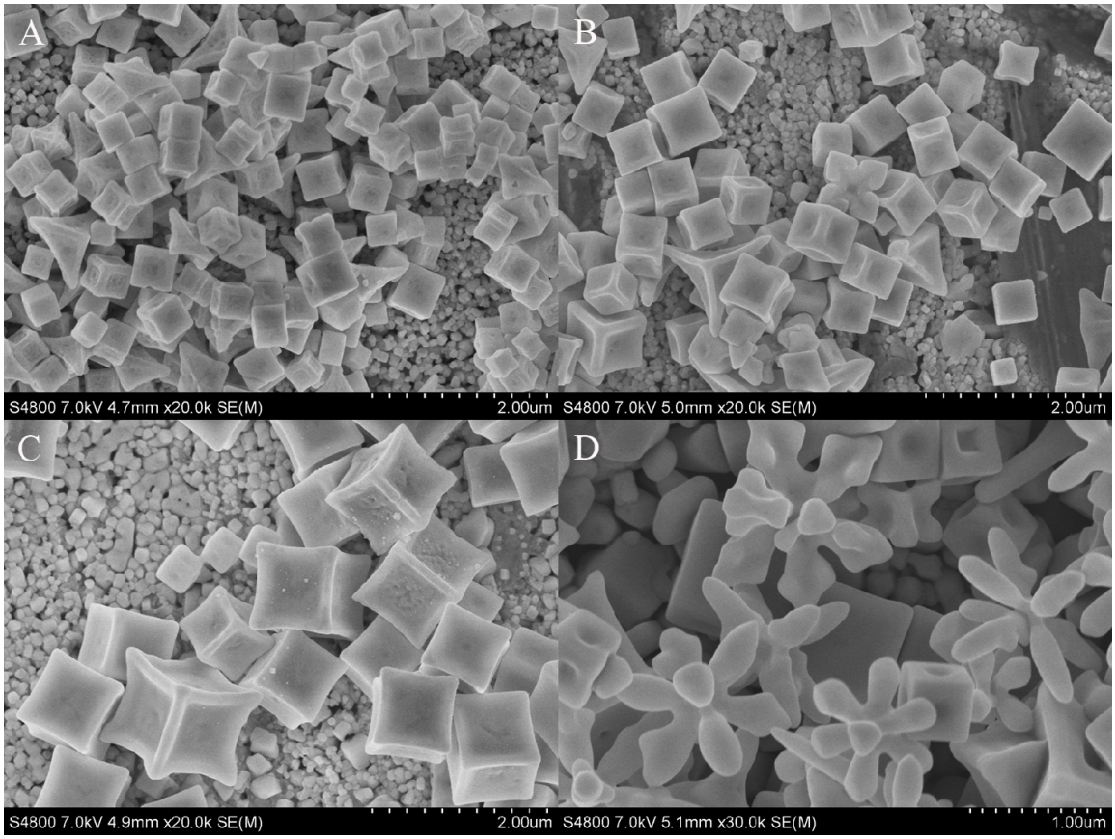
Decomposition of MO

0.1 g concave cubic AgCl which was prepared by 2 mM $NaClO_2$, 0.8 mM NaCl and 1 mM citrate acid for 8 hours was mixed with 100 ml (20mg/L) methyl orange (MO) solution in a 200 ml breaker. The mixture solution was stirred until be bleached under visible light (λ >420 nm) provided by a 300 W Xe arc lamp, and the concave cubic Ag@AgCl was obtained after washed and dried at room temperature for 12 hours. The photocatalytic activity of plasmonic photocatalysts Ag@AgCl was characterized by the degradation of methyl orange (MO) under visible light. In a typical procedure, 0.1 g photocatalyst was added in to 100 ml MO (20 mg/L) solution in a 200 ml breaker. The mixture solution was stirred for 30 minutes in dark until the dye absorption balance on surface of catalysts and carried photocatalystic reaction with stirring under visible light provided by a 300 W Xe arc lamp, and 5 ml solution was taken out for every 5 minutes until the solution was blanched. The concentration of MO was tested by measuring the absorption of aqueous methyl organic solution with Shimadzu UV2550 recording spectrophotometer

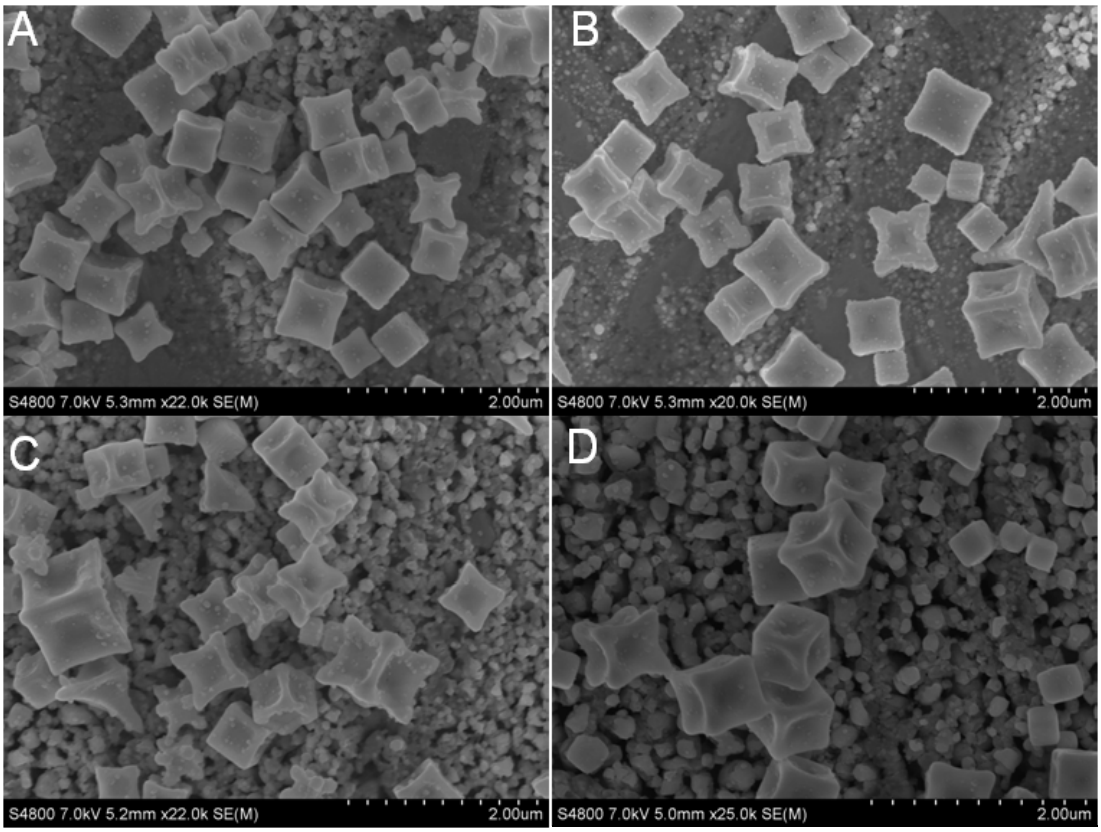
Characterization: The X-ray diffraction patterns (XRD) of samples were obtained on Bruker D8-advanced X-ray powder diffractometer with Cu Kα radiation λ=1.5418 Å. The electron scanning microscopy (SEM) measurements were carried out by Hitachi S-4800 microscope. The UV/vis light was provided by a 300 W Xe arc lamp (PLS-SXE300, Beijing Trusttech Co. Ltd).



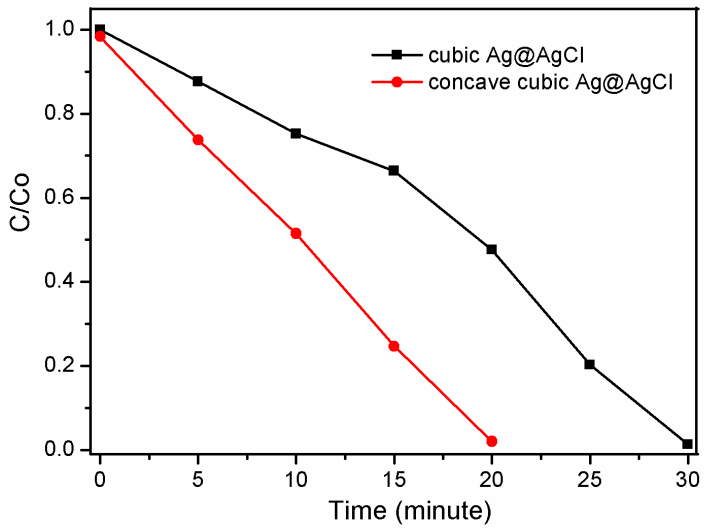
S1. SEM images of AgCl samples under 2 mM $NaClO_2$, 0.8 mM NaCl and 1 mM citrate acid with different reaction time: A(0.5 hr), B(1 hr), C(4 hrs), D(8 hrs).



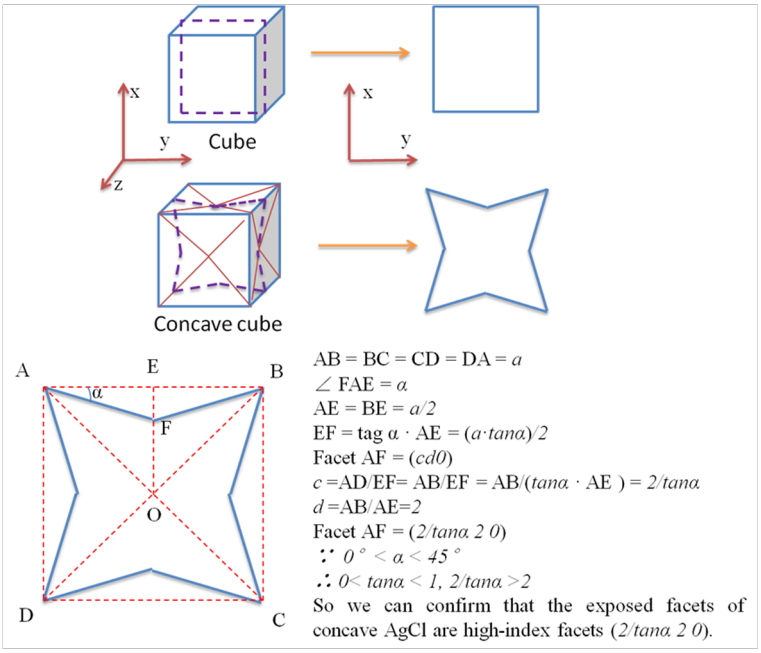
S2. SEM images of samples prepared by 2 mM $NaClO_2$ and different concentrations of NaCl 0.78 mM(A), 1.00 mM(B), 1.37 mM(C) and 1.97 mM(D) for 1 hours.



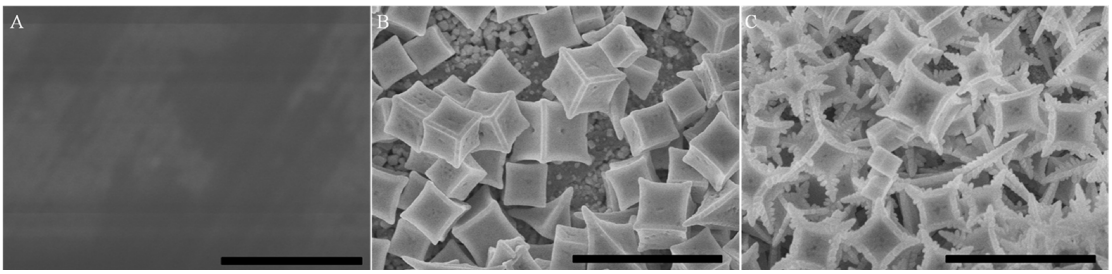
S3. The SEM images of AgCl concace cube prepared with 2 mM $NaClO_2$, 0.8 mM NaCl and 2 mM(A), 3 mM(B), 4 mM(C) and 5 mM(D) citrate acid.



S4. The photocatalytic decomposition of organic dye (MO) by cubic Ag@AgCl(■)and concave cubic Ag@AgCl(●).



S5. Crystallographic orientations of concave cubic AgCl



S6. SEM images of samples prepared with different $NaClO_2$ concentration: 0 mM(A), 2 mM(B) and 4 mM(C). NaCl: 1.5 mM. Scale bar: 3 μm.