

Supporting information

Chemicals

Silver trifluoroacetate (CF_3COOAg , reagent grade, 98%) was purchased from Alfa Aesar. Aluminum nitrate ($\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, reagent grade), iron(III) nitrate ($\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, reagent grade), Magnesium nitrate ($\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, reagent grade), zirconium nitrate ($\text{Zr}(\text{NO}_3)_4 \cdot 5\text{H}_2\text{O}$, reagent grade), zinc acetate ($\text{Zn}(\text{CH}_3\text{COO})_2$, reagent grade), titanate sulfate ($\text{Ti}(\text{SO}_4)_2 \cdot 9\text{H}_2\text{O}$, reagent grade), cobalt sulfate ($\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$, reagent grade), nickel acetate tetrahydrate ($\text{C}_4\text{H}_6\text{O}_4\text{Ni} \cdot 4\text{H}_2\text{O}$, reagent grade) analytical grade benzyl alcohol were obtained from Sionpharm Chemical Reagent. Polyvinylpyrrolidone (PVP, $M_w \sim 10,000$, reagent grade) were purchased from Damao Reagent. All chemicals were used as received without further treatment. All the syntheses were carried out using Teflon-lined stainless autoclaves with volume of 12 ml.

Characterization

The size and morphology of Ag nanocrystals was characterized by using a Hitachi H-800 transmission electron microscope (TEM) and a JEOL 2011 high-resolution transmission electron microscope (HRTEM). The purity and composition of nanoparticles were analyzed using a JEOL JXA-8230 electron probe X-ray microanalysis (EPMA) at 20 kv plasma atomic emission spectroscopy (ICP-AE). X-Ray powder diffraction experiments were performed on a Rigaku RU-200b with CuK α radiation.

Synthesis of Ag nanoparticles with different metal ions

In a typical solvothermal reduction, CF_3COOAg (20mg, 0.09mmol),

polyvinylpyrrolidone (PVP, Mw~10000g/mol, 50mg, 0.45mmol) were dissolved in 5ml benzyl alcohol under vigorous stirring at room temperature in air. After 10 minutes, metal salts including $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, etc. was separately added into the mixture with more 5 minutes stirring. For complex metal ions system of Fe^{3+} and Al^{3+} , 0.0025mmol $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ and 0.0025mmol $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ were injected to the mixture simultaneously. The above procedures were all done at room temperature in the air. Furthermore, all of the solutions were moved into the Teflon-lined stainless autoclaves, those were kept at 120°C for 6h and then naturally cooled down to room temperature. The final products were collected by centrifugation at 12,500 rpm for 5minutes, and the precipitate was redispersed into ethanol and sonicated for 1 minute, followed by the centrifugation again. This procedure was repeated 3 times to remove the excess PVP. The Ag nanoplates were dispersed in ethanol (~3 ml) for posterior using.

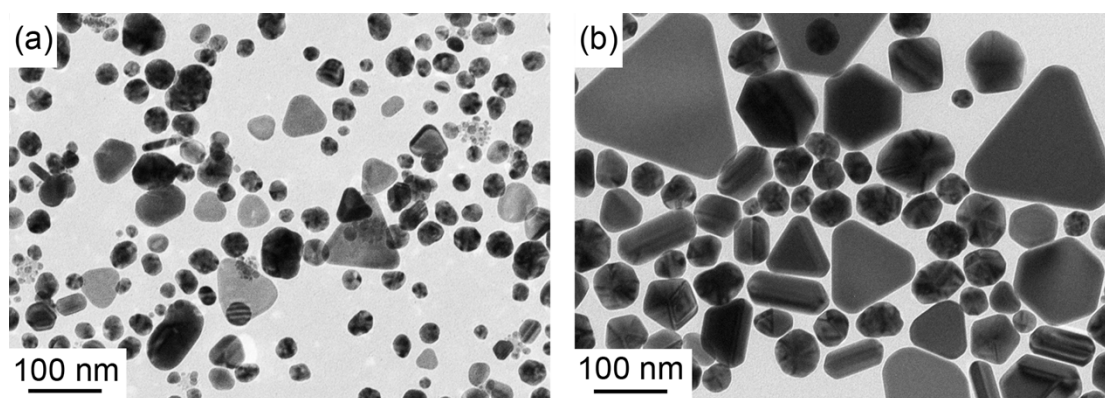


Figure S1. (a) TEM micrograph of AgNPs obtained in the presence of PVP and $\text{Al}_2(\text{SO}_4)_3$. (b) TEM micrograph of AgNPs obtained in the presence of PVP and $\text{Fe}_2(\text{SO}_4)_3$.

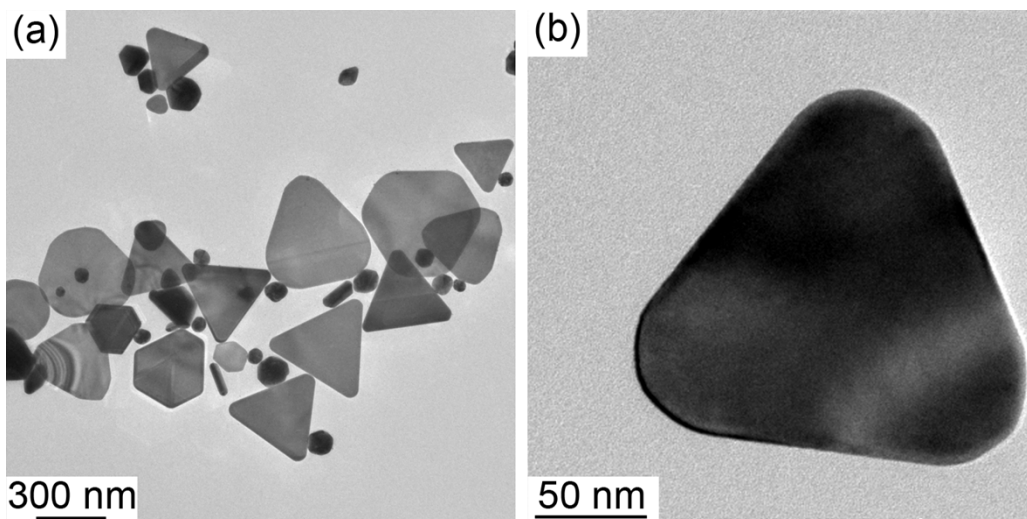


Figure S2. (a) TEM micrograph of AgNPs obtained in the presence of PVP and low concentration $\text{Fe}(\text{NO}_3)_3$. (b) Corresponding individual triangular nanoplate.

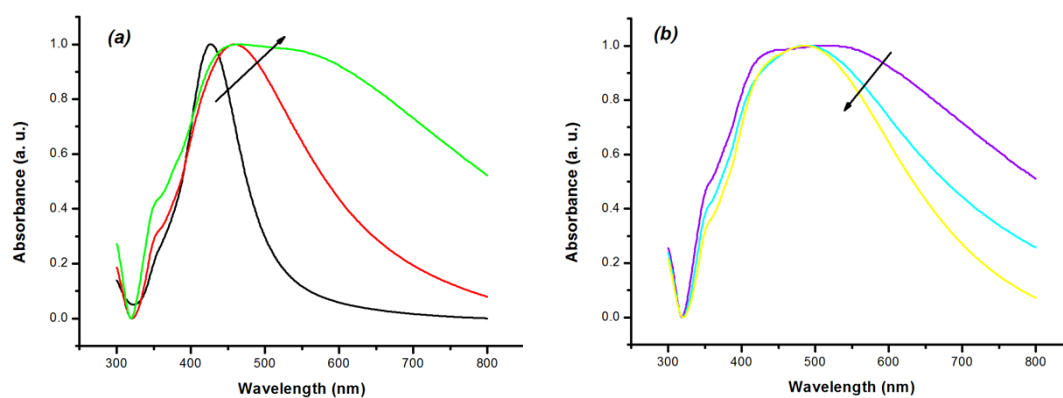


Figure S3. (a) UV-Vis spectra of AgNPs obtained in the presence of PVP and $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$. Each step from the black towards the green spectrum corresponds to an increasing addition of $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$. (b) UV-Vis spectra of AgNPs obtained in the presence of PVP and $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$. Each step from the purple towards the yellow spectrum corresponds to an increasing addition of $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$.

Figure S3 shows the UV-Vis spectra of colloidal Ag nanocrystals obtained with PVP and metal ions. From part (a), we found that the maximum of the peak red-shifted when improving the concentration of Al^{3+} ions. However, in part (b), the maximum of the peak blue-shifted when improving the concentration of Fe^{3+} ions.