Electronic Supplementary Material (ESI) for Nanoscale.
This journal is © The Royal Society of Chemistry 2014

Electronic Supplementary Information (ESI)

High-yield synthesis of triangular gold nanoplates with improved shape uniformity, tunable edge length and thickness

Youju Huang, Abdul Rahim Ferhan, Yi Gao, Anirban Dandapat and Dong-Hwan Kim*

School of Chemical and Biomedical Engineering, Nanyang Technological University, 637457, Singapore

Experimental Section

* Corresponding author: e-mail: dhkim@ntu.edu.sg; Tel: 65-67904111; Fax: 65-67911761 (DH. Kim)

Chemicals and instrument

Cetyltrimethylammonium bromide (CTAB), hydrogen tetrachloroaurate (III) trihydrate ($HAuCl_4.3H_2O$), ascorbic acid (AA) and sodium citrate were purchased from Sigma–Aldrich. All other reagents were used as received. The UV–vis–NIR absorption spectra were collected from 400 to 1400 nm on a spectrophotometer (Varian Cary 5000). Field-emission scanning electron microscopy (FE-SEM) was performed on the JEOL instrument (JSM-6700F) at an acceleration voltage of 5 kV and a working distance between 7 and 8 mm. The AFM images were obtained in air from an Asylum Research MFP-3D AFM system conducted in tapping mode using a super sharp silicon AFM tip purchased from NanoWorld.

Preparation of triangular Au nanoplates

Triangular Au nanoplates were synthesized according to a previously proposed approach[1, 2] with some modifications. Briefly, 0.5 mL of 20 mM $HAuCl_4$ solution was mixed with 1 mL of 10 mM sodium citrate and 36.5 mL water. Then 1.0 mL of 0.1 M $NaBH_4$ was added to the mixed solution with vigorous stirring for 2 min. The obtained solution turned yellowish pink and was kept at room temperature for at least 4 hours before use. Next, growth solution was prepared by mixing 108 mL of 0.025 M CTAB solution, 1.5 mL of 0.02 M $HAuCl_4$, and 0.6 mL of 0.1 M NaOH, 54 μL of 0.1 M KI and 0.6 mL of 0.1 M ascorbic acid. In order to favor the formation of uniform triangular Au nanoplates, Au seeds were fast handled during multiple-step growth. First, 0.1 mL of seeds solution was added into 0.9 mL of growth solution with gentle shaking for 3 s, and then immediately, 9 mL of growth solution was added. After 3 s of gentle shaking, the mixed solution was added into another 92 mL of growth solution in a glass beaker. After half an hour, the solution turned deep purple, indicating the formation of AuNPs. The solution was then kept without any alteration for 24 hours, allowing attachment of triangular Au nanoplates to the walls of the beaker. Then, the solution was gently poured out and 20 mL of 0.025 M CTAB

solution was added to redisperse triangular Au nanoplates. The solution is green with a strong absorption in the NIR region.

Overgrowth of triangular Au nanoplates

A series of experiments were performed to study the influence of the amount ratio of growth solution to triangular Au nanoplate solution on the final morphology of enlarged Au nanoplates. Specifically, six 20 mL conical flasks (Labeled A, B, C, D, E, and F, respectively) were filled with 10 mL of growth solution containing a mixture of 2.5×10^{-4} M $HAuCl_4$ and 0.01 M CTAB. Then, 55 μL of 0.1 M freshly prepared ascorbic acid was added into each flask followed by gentle stirring for 2 min. Finally triangular Au nanoplate solution with different amount as seed solution was added into each flask, and the mixtures were kept at 30 °C in a water bath for at least 6 hours.

References

1. **S. Hong, K. L. Shuford and S. Park, *Chem. Mater.*, 2011, 23, 2011-2013.**
2. **J. E. Millstone, S. Park, K. L. Shuford, L. Qin, G. C. Schatz and C. A. Mirkin, *J. Am. Chem. Soc.*, 2005, 127, 5312-5313.**