Supporting Information

Continuous Production of Nitrogen-Functionalized Graphene Nanosheets for Catalysis Applications

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Properties of citrate-stabilized AuNCs

An important feature of the synthesis method of citrate-stabilized gold nanocrystals (AuNCs) is that the energy passed from the microwave source induces the fast formation of AuNCs. The synthesis of AuNCs was achieved by employing triosodium citrate (TSC) as a reducing agent under microwave conditions in aqueous boiling solutions. The characteristics of as-prepared citrate-stabilized AuNCs were analyzed. Transmission electron microscopy (TEM) analysis was used to investigate the size distribution and inter planer spacing of AuNCs (Figure 1). The TEM images and corresponding size distribution histogram indicate that the AuNCs had a size of 4-12 nm. The HR-TEM image shows that the inter planar spacing of AuNCs is around 0.238 nm, which is related to the (111) lattice plane of face-centered-cubic gold.[1] The size distribution histogram of AuNCs was obtained by counting at least 300 AuNCs from different images of a given sample. An energy-dispersive X-ray (EDS) detector connected to TEM revealed the presence of the Au element. These results are in good agreement with those reported in the literature.[2]

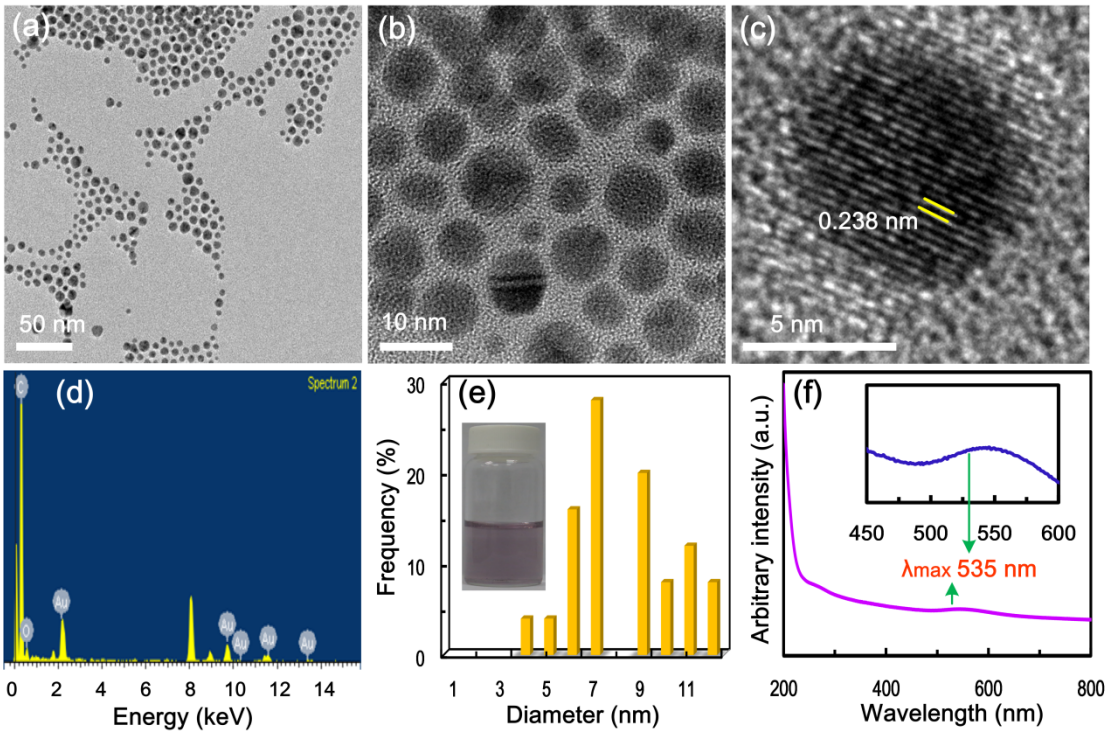

Figure S1. Characterizations of citrate-stabilized AuNCs: (a) low-magnification TEM image of AuNCs; (b) HR-TEM image of AuNCs; (c) HR-TEM image of a single AuNC, showing inter planar spacing of around 0.238 nm; (d) EDS spectra of AuNCs, indicating presence of Au element; (e) size distribution histogram showing AuNCs size of 4-12 nm (inset shows photograph of AuNCs in aqueous solution); (f) UV-vis spectrum of AuNCs. Reaction conditions: $H[AuCl_4]$ (33 ml, 0.25 mM), TSC (6 ml, 0.03 M), microwave irradiation (90 W) at 120 °C for 3 min.

To verify the TEM results of citrate-stabilized AuNCs, the evolution of UV-vis absorption spectra was examined. The easily detectable surface plasmon resonance (SPR) peak of AuNCs allows UV-vis spectroscopy to be used to monitor their properties. The optical properties, such as absorption maxima (λ_{max}) and absorption intensity, reflect the size and nature of AuNCs. The UV-vis spectra of AuNCs show λ_{max} at 535 nm, which is consistent with the size of AuNCs (4-12 nm, as per TEM analysis). The TEM results are in good agreement with results obtained from UV-vis spectroscopy analysis and those reported in the literature.[2]

References

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2. Ji, X.; Song, X.; Li, J.; Bai, Y.; Yang, W..; Peng, X. "Size control of gold nanocrystals in citrate reduction: the third role of citrate" *J. Am. Chem. Soc.* **2007**, *129*, 13939-13948.