Poster

INFLUENCE OF THE CONCENTRATION OF CTAB AND PHOTOCATALYST ON THE SIZE OF AU NANOTRIANGLES SYNTHESIZED BY A PHOTOCATALYTIC METHOD

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Shape-controlled synthesis of Au nanoparticles has received considerable attention, mainly due to the interesting optical properties of anisotropic Au nanostrutures, namely a strong plasmon band in the NIR region. In particular, several methods for the preparation of Au nanoplates have been reported, including the use of plant extracts,[1] seed mediated synthesis,[2] use of polymers as capping agents,[3] and thermal reduction.[4] Nevertheless, the control over the size of the nanoplates is still a major challenge, with most of the methods yielding nanoplates with widhts from a few hundred nanometers to a few micrometers, and large size dispersion.

We report a method for the preparation of Au nanoplates based on a photocatalytic approach[5] to reduce the Au(III) precursor, in aqueous solution, in the presence of CTAB and a weak reducing agent. Changing the concentration of the photocatalyst it was possible to prepare samples with average side length 50 nm; 80 nm; 140 nm; and 250 nm (Fig. 1). Further control of the size of the nanotriangles can be achieved by changing the concentration of CTAB for each of the photocatalsyt concentrations used. For instance, it was possible to prepare nanotriangles with average size length of 90 nm, 65 nm, and 35 nm, by increasing the concentration of CTAB (Fig. 2). In order to further understand the mechanism of formation of the nanoplates, we have followed the reaction by UV-vis spectrometry and TEM. The results obtained show that the reduction of the gold precursor is relatively fast, and after a few minutes of irradiation spherical nanoparticles are formed with diameters in the range 5-10 nm. These nanoparticles tend to fuse and grow by deposition of Au, until depletion of the Au precursor that, under the typical experimental conditions used, takes place within 2 hrs. The nanoplates formed after 2 hrs of irradiation are usually quite irregular, but after 48 hrs the samples contain well formed nanotriangles (Fig. 3).

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References:

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Figures:

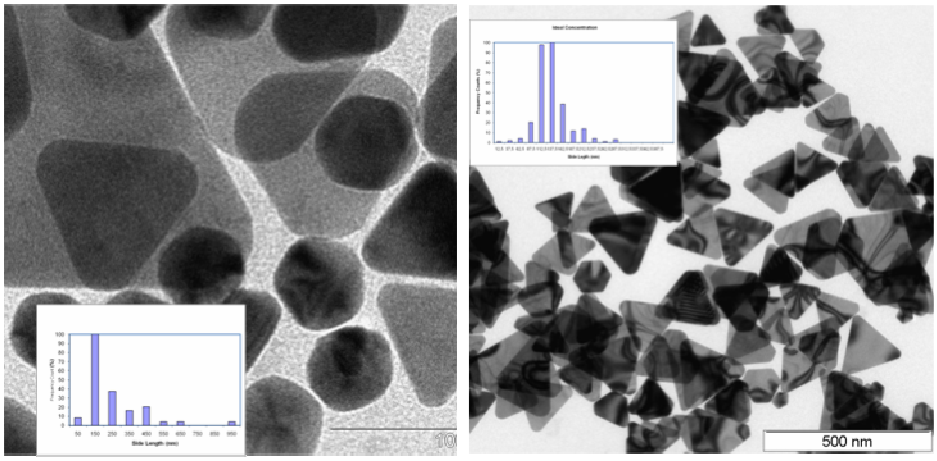

Figure 1. TEM images of nanotriangles obtained with a photocatalyst concentration of 1 nM (left) and 10 nM (right) Size distribution plots are shown as insets.

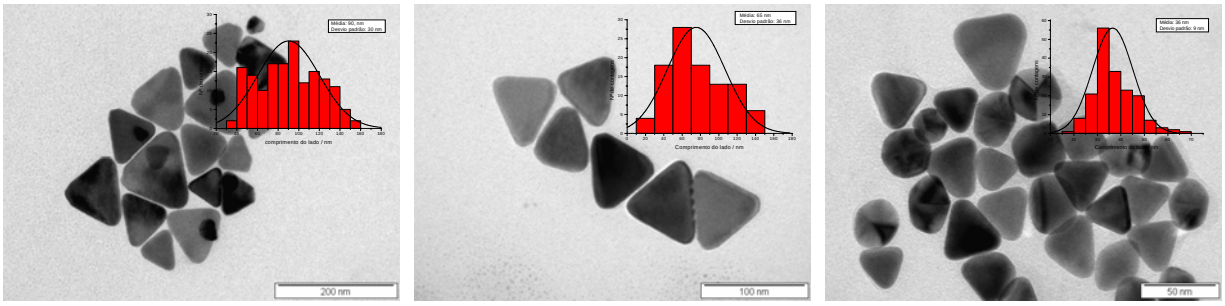

Figure 2. TEM images of nanotriangles obtained with a photocatalyst concentration of 50 nM and CTAB concentration of 0.8 mM (left, average length 90 nm), 1.6 mM (center, average length 65 nm) and 2.3 mM (right, average length 36 nm). Size distribution plots are shown as insets.

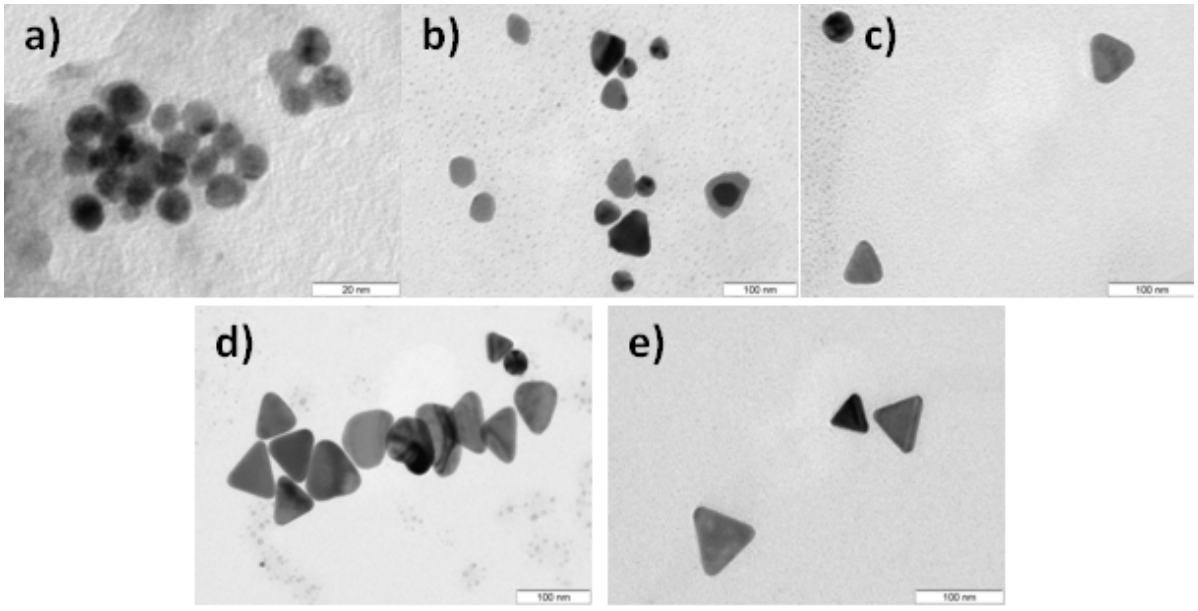

Figure 3: Representative TEM images of products collected after a) 30 min. irradiation; b) 60 min. irradiation; c) 90 min. irradiation; d) 120 min. irradiation; e) 120 min. irradation and after 24 hrs in solution.