

Recipe for Au Nanoparticles

(Edited by Shan Jiang)

General comments

all the glasswares must be cleaned thoroughly, best by mixture of concentrated acid solutions Aqua Regia (instead of base bath or Piranha). Please refer to the How to clean glassware link for more details. Pouring the reducing agent as fast as possible; and the reducing agent should be added only when the auric solution is boiling. After the particles are prepared, do NOT use fresh particles. After aging at ambient condition for at least a week may narrow the particle size distribution. Finally, vigorous stir is necessary.

Details

Please refer to Frens' method. [G. Frens. *Nature* **241** (1973)]. Typically, 10 mL 1% (w/v) sodium citrate solution is added into a boiling solution of 290 mL 0.015% (w/v) HAuCl₄. Within 3 minutes the clear solution changes to a wine-red color, which indicates the formation of Au nanoparticles. After further boiling for 10 minutes, the heat source is removed and the dispersion is cooled down to room temperature. Reducing the volume of sodium citrate solution to 4.3 mL leads to 28 nm Au nanoparticles.

The synthesis of 6 nm Au nanoparticles is quite similar to that of the 12 nm nanoparticles. In a typical experiment, a freshly prepared 100 ml solution of 0.01% HAuCl₄ is transferred to a 500-mL flask, stirred vigorously and is brought to the boiling in 6-7 minutes. Then, the reducing agent (2 mL of 1% sodium citrate and 0.45 mL of 1% tannic acid) is added, inducing a violet color immediately. Within 30 seconds, the solution becomes clear!

After further boiling for 10 minutes, the heat source is removed and the dispersion is cooled down to room temperature. In this case, the size of the flask and the rate of addition of reducing solution have significant influence on the quality of the product. From TEM, 12 nm and 6 nm nanoparticles are monodispersed and exhibit spherical shape, whereas the 28 nm nanoparticles are relatively polydispersed and are highly faceted. All these nanoparticles display distinct surface-plasmon absorption.