

# Size-controlled Synthesis of Gold Nanoparticles by Thermolysis of a Gold(I)-Sulfide Complex in the Presence of Alkylamines

Mari Yamamoto, Yukiyasu Kashiwagi, and Masami Nakamoto

Osaka Municipal Technical Research Institute, 6-50, 1-Chome, Morinomiya, Joto-ku,  
Osaka 536-8553, Japan

Reprint requests to Dr. Masami Nakamoto. Fax: +81-6-6963-8099.  
E-mail: nakamoto@omtri.city.osaka.jp

*Z. Naturforsch.* **2009**, *64b*, 1305–1311; received September 16, 2009

*Dedicated to Professor Hubert Schmidbaur on the occasion of his 75<sup>th</sup> birthday*

A size-controlled synthesis of gold nanoparticles has been developed by the thermolysis of AuCl(SMe<sub>2</sub>) in the presence of alkylamines at 120 °C. In the procedure, the key intermediate was [Au(NH<sub>2</sub>R)<sub>2</sub>]Cl, detected by electrospray ionization (ESI) mass spectrometry. This thermally unstable intermediate was reduced by alkylamines under mild conditions to produce alkylamine-capped gold nanoparticles. The average diameters of the gold nanoparticles could be regulated in a range from 4.3 to 6.1 nm by applying primary alkylamines with alkyl chains of different lengths. Larger gold nanoparticles with diameters from 10 to 22 nm were prepared by a combination of alkylamines and alkylcarboxylic acids with various lengths of the alkyl chains. The gold nanoparticles were characterized by transmission electron microscopy (TEM), UV/Vis absorption spectroscopy, powder X-ray diffraction (PXRD), X-ray photoelectron spectroscopy (XPS), gas chromatography/mass spectroscopy (GC/MS), and thermogravimetric and differential thermal analyses (TG/DTA).

*Key words:* Gold Nanoparticle, Controlled Thermolysis, Amine, Carboxylic Acid, Gold Complex