

## Sample Abstract

# **SOLVENT-ASSISTED ONE-POT SYNTHESIS AND SELF-ASSEMBLY OF 4-AMINOTHIOPHENOL-CAPPED GOLD NANOPARTICLES**

**Sharma J.†, Mahima S., Kakade B. A., Pasricha R., Mandale A. B., and Vijayamohanan K.**

Physical and Materials Chemistry Division and Centre for Materials Characterization, National Chemical Laboratory, Dr. Homi Bhabha Road, Pune-411008, India

Single-step preparation of smaller sized (ca. 3 nm, approximate composition Au<sub>923</sub>ATP<sub>241</sub>) gold nanoparticles (AuNPs) followed by their self-assembly is demonstrated using 4-aminothiophenol (ATP) as a reducing agent in water/N,N-dimethylformamide (DMF). Water and DMF play a crucial role during the reduction process, since nanoparticles are formed neither in water nor in DMF alone at room temperature. Moreover, the morphology of the particles is found to be strongly dependent on the pH of the medium. The instantaneous UV-visible absorption spectrum shows a relatively sharp peak at 550 nm, which becomes a broad band after 1 h of mixing, due to the formation of aggregates. The size of the gold nanoparticles is controlled in the stipulated range by maintaining a critical AuCl<sub>4</sub><sup>-</sup>/ATP ratio. Transmission electron microscopic images reveal close-packed assembly of gold nanoparticles induced by the bifunctionality of ATP. Powder X-ray diffraction patterns confirm the metallic face-centered cubic (fcc) lattice structure with (111), (200), (220), and (311) crystal planes. Thermogravimetric analysis shows 22% organic molecules on the surface of AuNPs. The molecular level analysis of the as prepared gold nanoparticles by Fourier transform infrared spectrum shows the presence of -SO stretching. X-ray photoelectron spectroscopic results also confirm the oxidation of -SH during the reduction of AuCl<sub>4</sub><sup>-</sup> ions. The cyclic voltammograms of the monolayer-protected Au nanoparticles show quasi-reversible redox behavior, though the electrochemical features are different from those of the self-assembled monolayer (SAM) of ATP on a gold electrode.

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†- Presenting Author