

Name (Title): Professor Tarasankar Pal

Affiliation: Indian Institute of Technology, Kharagpur, India

Address: Department of Chemistry, Indian Institute of Technology, Kharagpur – 721 302, India

Home Page: [www.iitkgp.ernet.in](http://www.iitkgp.ernet.in)

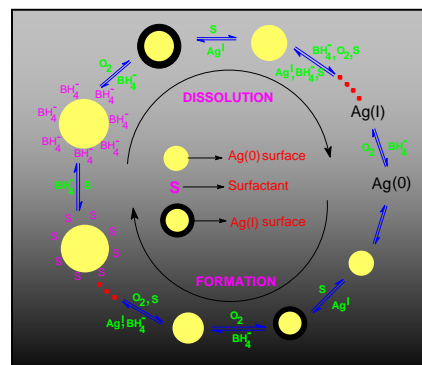


**Presentation Title:** Reversible formation and Dissolution of Nanoparticles

**Abstract:**

Properties related to decreased particle size and the effect of nucleophiles onto metals surfaces are now well documented. It has a noticeable impact on the electrode potential values<sup>1</sup>. Such an effect can be visualized easily and can be demonstrated there after when coinage metals are exploited in their nanoregime. Especially silver and gold nanoparticles are best suited for the demonstration purposes as they have strong plasmon absorption bands in the visible region. These two coinage metals in their bulk stage are not corroded and hence not tarnished under ordinary ambient conditions. They are thus taken for granted as noble metals (standard electrode potential values are +0.79 V & + 1.68 V for silver and gold respectively). Mineral acids do not easily attack them.

Gold is certainly nobler than silver and because of their lattice matching they form alloy particles even in their nanoregimes. However, they give rise to another type of bimetallic core-shell nanoparticles structure. The Au<sub>core</sub>-silver<sub>shell</sub> structures are generally obtained by wet chemical technique with skillful manipulation<sup>2</sup>. The core-shell formation strategy has a simple bearing that again speaks for their difference in the nobility of the participating metals in question. Taking the core-shell structure as a SERS (surface enhanced Raman scattering) substrate one can detect a test substance in solution down to a single molecular level<sup>3</sup>. On the other hand, one can use an effective nucleophile to dissolve out silver or gold metal in aqueous solution without the need of any acid or whatever. May be a surfactant is indeed needed to clean the oxidized material on the metal surface in a stepwise fashion<sup>4</sup>. This nucleophile induced dissolution of metal has a bearing with the shift of plasmon band to a more negative potential value of the metals in the nanoregime. The dissolution (above scheme) of silver and gold in water again can be visualized using a spectrophotometer but the demonstration can be observed visually. This would build a future even for a particular metal in its nanoregimes as effective catalyst particle for very many reactions<sup>5</sup>.



**References :**

1. Hengelin, A., *J. Phys. Chem.* **1993**, 97, 5457.
2. Pal, T. et al., *Nano Lett.* **2001**, 1, 319.
3. Pal T. et al., *J. Nanoparticle Res.* 2004, 6, 53.
4. Pal T. et al., *Langmuir* **1997**, 13, 1481. .
5. Pal T. et al., *J. Phys. Chem.B*, **2001**, 105, 9266.