Chapter - 8

MONOLAYER PROTECTED NANOPARTICLES
Figure 1. Schematic showing the Brust method of preparing monolayer protected clusters.
**Figure 2.** UV-vis spectrum of Au@hexanethiol showing the presence of surface plasmon resonance at 520 nm. Inset shows the spectrum for subnanosized metal clusters for which the plasmon is very weak, From the Author’s work.
Figure 3. Differential pulse voltammetry of 0.1 mM C₆MPCs in CH₂Cl₂ measured at a 1.6 mm diameter Pt working electrode using 50 mM Bu₄NCIO₄ as the supporting electrolyte, From (Y. Song and R. W. Murray, J. Am. Chem. Soc., 124 (2002) 7096).
**Figure 4.** Differential scanning calorimetry of alkanethiol capped gold clusters showing the peak corresponding to the alkyl chain melting. The melting temperature as well as the transition enthalpy increase with increasing the chain length of the thiol, From [A. C. Templeton, W. P. Wuelfing and R. W. Murray, Acc. Chem. Res., 33 (2000) 27.].
Figure 5. Cartoon of thiol protected gold clusters showing the possible regions of crystallinity. Circle showing the region of crystallinity because of the interdigitation of alkyl chains and square shows the possibility of interstitial folding.
Figure 6. Various functionalized nanoparticles, with their chemical functionalities.
Figure 7. Reversible binding of amino acids with spiropyran capped gold nanoparticles, From [B. Ipe, S. Mahima and K. G. Thomas, J. Am. Chem. Soc., 125 (2003) 7174.].
Figure 8. Gold nanoparticles assisted enhancement of fluorescence in pyrene methyl amine. Due to the attachment of nitrogen onto the nanoparticles, conjugation between lone pair on nitrogen and the pyrene ring is blocked. This is indicated by an arrow with a cross mark, From [K. C Thomas and P. V. Kamat, J. Am. Chem. Soc., 122 (2000) 2655].
**Figure 10.** Selective detection of lithium ion by gold nanoparticles. The structure of the ligand used is shown in Figure b. Figure c shows the TEM picture of the aggregate, From [S. Obare, R E. Hollowell and C. J. Murphy, Langmuir, 18 (2002) 10407.].
Figure 11. Ion assisted chelation for the detection of heavy metals, Picture taken from the Table of Contents entry link of [Y. Kim, R. C. Johnson and J. T. Hupp, Nano Letters, 1 (2001) 165.].
Figure 12. Temperature sensor based on gel coated nanoparticles. HCST refers to higher critical solution temperature, From [M.-Q. Zhu, L.-Q. Wang, G. J. Exarhos and A. D. Q. Li, J. Am. Chem. Soc., 126 (2004) 2656.].
**Figure 13.** Potential energy-distance curve showing the resultant interaction energy (iii) due to contribution from attractive (i) as well as repulsive forces (ii). M₂ refers to the shallow minimum which can lead to particles associated reversibly and M₁ refers to the stable minimum leading to the irreversible aggregation. H is the interparticle distance and ΔG denotes the change in Gibbs free energy. From [D. H. Everett, Basic Principles of Colloidal Science, Royal Society of Chemistry, London, 1988, 26-27].
Figure 14. Superlattices built from a solution of CdSe crystals in nonanoic acid. a) Optical micrograph of the superlattice and b), c) fluorescence microscopic images of the superlattices made from 3.5 and 5.3 nm nanocrystals, respectively. d) TEM image taken from the edge of a superlattice made from 5.3 nm CdSe nanocrystals with the inset showing a low magnification image. From [N. Zaitseva, Z. R. Dai, F. R. Leon and D. Krol, J. Am. Chem. Soc., 127 (2005) 10221.].
Figure 15. Pictorial representation of superlattice.
Figure 16. Picture showing the microscope images of the superlattices. Inset shows the low angle diffraction form one of the superlattice. (S. Wang, H. Yao, S. Sato and K. Kimura, J. Am. Chem. Soc., 126 (2004) 7438).
Figure 17. TEM images taken at each step during the preparation of superlattice, From [B. L. V. Prasad, S. I. Stoeva, C. M. Sorensen and K. J. Klabunde, Chem. Mater., 15 (2003) 935.].