

Synopsis

Chapter I. This chapter briefly discusses different aspects of nanoscience and nanotechnology. The exhibition of characteristic property of the nanoparticles has been accounted from electronic structural point of view. Different synthetic strategies and mode of stabilizations has also been presented in detail. Some selected applications of such materials have been elucidated relevant to the following chapters of the thesis.

Chapter II. In this chapter, the synthesis of selenium nanoparticles has been reported involving a wet chemical reduction technique. The catalytic activity of the particles has been substantiated from the photodecolorization of two cationic dyes, methylene blue and dimethylmethylene blue under UV. Detailed kinetic study for the decolorization reaction has been performed to investigate the effect of selenium nanoparticles on the rate of reaction.

Chapter III. Herein we report a solution phase photochemical approach to synthesize a new metal-semiconductor nanocomposite, AuSe nanoalloy. The optical properties of the nanocomposites have been substantiated through their interaction with a fluorescent probe, eosin in aqueous solution. The spectroscopic investigation of dye-metal-semiconductor assembly has been examined from the characteristic emission profile of the dye.

Chapter IV. This chapter discusses a three step procedure for the synthesis of ultra-thin silver nanoshell on anionic polystyrene bead from specific silver precursor silver amine complex, $[\text{Ag}(\text{NH}_3)_2]^+$. The silver coated resin particles were exploited as a solid substrate for surface enhanced Raman scattering study using crystal violet as a Raman probe.

Chapter V. A convenient route to synthesize $Au_{\text{core}} - Pd_{\text{shell}}$ bimetallic nanoparticles in toluene has been reported in this chapter. The present chapter also reports a suitable synthetic protocol for the reproducible generation of corresponding monometallic organosol with modest stability. The particles were characterized both in solution and solid phase to ensure their morphology.

Chapter VI. In this chapter a simple and reproducible technique for the synthesis of hexadecylamine stabilized silver organosol has been reported. The nanoparticles were employed to examine the altered optical properties in different solvent systems and ligands by accounting the changes in localized surface plasmon resonance (LSPR) spectrum. The quantitative alteration of the LSPR spectrum involving encapsulated nanoparticles in a dielectric ligand shell has been rationalized from Mie theory. The affinity of the synthesized silver nanoparticles with amine molecules has been accounted taking HSAB principle into consideration. Finally, the particles were found to be a substrate for surface enhanced Raman scattering (SERS) study in non-aqueous medium, while crystal violet (CV) was used as a Raman probe.