**Tata Institute of Fundamental Research**
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

# Colloquium

## Designing retrosynthetic strategies for the preparation of metal, metal sulphide and bimetallic sulphide nanocrystals

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Recently, we demonstrated that metal thiolates, which exist as lamellar assemblies in the neat state, can be disassembled into individual molecular sheets simply by dilution in apolar organic solvents and these can form ultrathin metallic or metal sulphide layers on substrates upon heat treatment. Interestingly, metal thiolates have all the ingredients (the inorganic metal or metal chalcogenide complex as core and organic molecule as shell) inbuilt in their structure, which are essentially required for the preparation of monolayer protected metal and metal sulphide nanocrystals. Therefore, we investigated them as possible precursors for the preparation of monolayer protected metal and metal sulphide nanocrystals (NCs). We followed two strategies for the same. In the first one the 2D metal thiolates were used as single source precursors for the synthesis of semiconducting metal sulphide nanocrystals via “solvo thermal–decomposition" in solution by either just heating the metal thiolates at high temperatures in a solvent or reacting them with a novel sulphur source octyl ammonium octyl dithiocarbamate ($C_8$DTCA). We also extended this approach to prepare a large variety of uniform-sized semiconducting nanocrystals of metal sulphides including PbS, CdS, ZnS, MnS, $Ag_2S$ and CuS by grinding these metal thiolates with $C_8$DTCA through a solventless solid state mechano-chemical grinding process. Apart from this, silver (Ag NCs) and ultra small gold nanocrystals (Au NCs) have also been prepared using the same solventless green approach, by the simple and convenient solid state grinding of the corresponding metal thiolate with sodium borohydride. In another recent extension we showed that bimetallic thiolates are excellent precursors for the synthesis of pure phase bimetallic sulphide/selenide NCs. The details of these synthetic procedures and the formation mechanism of the metal sulphide nanocrystals will be delineated during this talk.

***Wednesday, July 5th 2023***

***4:00 PM (Tea / Coffee 03.45 PM)***

***Auditorium, TIFR-H***