

ABSTRACT

Self-assembly of organic-inorganic hybrid solids is primarily dictated by metal-ligand interactions. The nature of metal ions and ligands involved in the self-assembly directs the formation of a myriad of hybrid solids ranging from discrete metal complexes to extended three dimensional metal organic frameworks. The present thesis explores the nature of reaction conditions such as temperature, pH, nature of reacting molecular units and effect of solvent to investigate the formation of various hybrid solids. The reaction parameters as stated above affect the nature of molecular units participating in the self-assembly leading to different solids.

This thesis explores the formation of different types of hybrid solids based on cobalt, copper and molybdenum by varying the organic moieties and other reaction conditions, which in turn affect the properties of the hybrid solids.

Chapter I provides a detailed review of various types of hybrid solids reported in literature, their classification and application of these hybrid solids in fields such as magnetism, catalysis, antimicrobial activity and luminescence.

Chapter II primarily discusses the interaction of transition metal ions namely cobalt and chromium with molybdenum precursors in the presence of organic ligands such as pyrazole and 2-aminopyrazine. The interaction of the moieties results in the formation of organically templated Anderson cluster based solids.

Subtle changes in the reaction conditions resulted in the formation of a new pseudopolymorph of cobalt namely $[\text{Co}(2\text{-Hampz})_2\text{Cl}_4]$ and therefore, the properties of this new pseudopolymorph with the reported one has been discussed in Chapter III. The

nature of supramolecular interactions, magnetic moments and antibacterial activities of the two pseudopolymorphs has been extensively studied in Chapter III.

In Chapter III it was observed that the direct reaction of cobalt chloride with the ligand resulted in the formation of discrete complex of cobalt. Therefore, in Chapter IV, instead of cobalt chloride, copper chloride was reacted with isomeric aminopyridines which resulted in isomeric solids. The solids were found to exhibit chromotropism. A detailed investigation of intermolecular interactions has also been carried out using Hirshfeld surface analyses and associated 2-D finger print plots.

The use of long chain amines particularly surfactants has been explored in literature for the synthesis of organically templated hybrid solids. Therefore, in Chapter V, the molybdenum precursors were treated in the presence of cationic surfactants in acidic medium to form organically templated phosphomolybdates. The solids synthesized were found to be highly effective in removal of methylene blue, a cationic dye, from aqueous medium.

Long chain amines when replaced with heterocyclic compound pyrrole in the presence of ammonium persulphate resulted in the formation of composite material based on phosphomolybdates which has been discussed in Chapter VI.