**Ph.D in Materials and Inorganic Chemistry**

 Novel guest- host compounds, based on single crystal vermiculite, were synthesized by diffusive techniques through a new hydrogen vermiculite. Single crystals were chosen because of the ease of characterization.

 An investigation of the ion transport properties of these single crystals was done to determine the mechanism of conductivity including the predominant charge carrier. Measurements of the ionic conductivity using impedance spectroscopy and X - ray lattice parameters of the ion- exchanged samples strongly suggest that the native cations and not protons are the major current carries. Single crystals of hydrogen vermiculite were synthesized at room temperature by ion exchange from sodium - vermiculite using 1 molar acetic acid for one week. Subsequent ion exchange with other cations was found to be much enhanced.

Thus transition metals were exchanged in about a week in contrast to the need of several months using previous methods. The ionic conductivity of hydrogen vermiculite was measured and shown to be much lower than that of many other monovalent cations in the same host lattice. Its enthalpy of motion is also much lower.. These marked differences suggest that protonic species do not play a significant role in charge tranport in these layered materials. These materials were characterized by X-ray powder diffraction, thermogravimetric analysis and acid- base titration.

 Hydrogen - vermiculite was found to react with organic bases, like methylamine, ethylamine, n-butylamine, urea, 1,10 phenanthroline, and 1,10 phenanthroline ferrous sulfate complex, to undergo ion exchange with metal cations like sodium, zinc, copper (II) ions and polymerization reactions could be performed in the galleries of the structure like pyrrole and aniline. Its behavior was compared with that of powdered montmorillonite . Polyaniline vermiculite was prepared and characterized from hydrogen - vermiculite using Cu ions as the oxidation center for the polymerization reaction. Also polypyrrole was prepared and electronic conductivity was measured for both polymers. Benzene was intercalated in vermiculite as a complex of copper. Pillared vermiculties were also prepared by reaction with pillaring agent like aluminum chlorohydrate having different ratios of hydroxyl to aluminum content.