PREFACE

The pyrite structure disulphides of 3d metals from FeS\textsubscript{2} to ZnS\textsubscript{2} have been studied thoroughly during the past few years. The interest in these compounds is based on the fact that they are well suited for experimental investigations of the effects of correlations between electrons in narrow bands. The rapid development of spin valve based magnetic read heads and the emergence of spintronics has thrown up a need for new half metallic ferromagnets for spin injection as well as the need for a better understanding of the underlying materials. Issues in half metallic Co\textsubscript{1-x}Fe\textsubscript{x}S\textsubscript{2} led to the considerable renewed efforts to understand this material. However most of the studies have been reported on bulk counterpart of Co\textsubscript{1-x}Fe\textsubscript{x}S\textsubscript{2}. There is interest in detailed investigations on Co\textsubscript{1-x}Fe\textsubscript{x}S\textsubscript{2} with fine particle size. It must be mentioned here that initially, we had planned to investigate both the Fe and Ni doped CoS\textsubscript{2} nano-crystalline systems, under this thesis. However due to constraint of time and owing to the limitations of availability of experimental facilities, we could not take up the work on Ni doped CoS\textsubscript{2} system.

This thesis presents work on investigations of magnetic and high pressure electric transport behavior of some Fe doped CoS\textsubscript{2} pyrites. Effects of (i) the substitution of Fe at Co site and (ii) Particle size have been examined on Co\textsubscript{1-x}Fe\textsubscript{x}S\textsubscript{2} system. The samples have been synthesized using chemical one step solution method. Powder X-ray diffraction technique has been used for characterizing the samples for confirmation of single phase and structural uniformity. Energy dispersive X-ray spectroscopy (EDAX) and Transmission electron microscopy (TEM) have been performed for determining exact composition and particle size distribution. For studying magnetic behaviour, temperature and field dependent dc measurements have been made on SQUID in the temperature range 5K-300K in the presence of fields ranging from 0 to 8T. High Pressure Resistivity Measurements have been carried out at room
temperature for pressures up to 8 Gpa, to see the pressure induced transitions in samples.

The Thesis is divided into six chapters. First three chapters present a broad introduction to the field of pyrites including spintronics materials and to the experimental techniques used for preparation of materials and their characterization. The chapter IV, V and VI presents author’s own work. The chapter IV gives the detailed description about the synthesis and structural characterization of nano $\text{Co}_{1-x}\text{Fe}_x\text{S}_2$ samples for ($0 \leq x \leq 1$). Chapter V describes the magnetic properties at low temperature and chapter VI gives the description about electric transport properties under high pressure. Finally salient features of the work are summarized under a separate section.

Most of the experimental work was carried out with facilities at the Department of Physics, University of Rajasthan, Jaipur. Magnetic measurements in high magnetic fields and at liquid helium temperatures have been made at Tata Institute of Fundamental Research, Mumbai. High Pressure Resistivity measurements were performed at National Geophysical Research Institute Hyderabad.

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