CHAPTER-V

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Ferrites are technologically important materials. They are widly used in electrical, telecommunication and microwave applications. They posses magnetic as well as electrical properties. Because of their twin requirments,the synthesis of ferrite has become crucial. The new methods of preparation have improved the ferrite properties.To obtain high density and good chemical homogenity,the chemical route methods are useful.The Mg ferrite is technologically important because of its high resistivity. To improve the physical properties of this ferrite we have under taken the following work.

This dissertition comprises five chapters. In chapter 1 , brief review of the ferrite properties and its applications are given.The spinel stucture is discussed.At the end of this chapter orientation of the present work is included.

Chapter-II is divided in to two sections. Section A is devoted to methods of preparation and actual preparation of ferrites by co-precipitation method.Section B is devoted to X-ray diffration stuides. The samples Cu-Zn , Mg-Zn and Cu-Mg mixed ferrites are prepared by co-precipitation method.The optimum conditions are kept to obtain good chemically homogeneous ferrites. It is also tried to obtain the mixed ferrites by proportionate mixing of end members ($MgFe_2O_4$+ $ZnFe_2O_4$).The pellets made from these powders are sintered at two different temperatures 600°c and 900°c

In section B the introduction about the X-ray methods and the relavent formulae are given. The diffraction patterns are obtained by using phillips X-ray diffractometer with CuK_α radiation.These patterns reveals the single phase spinel structure for the samples sintered at 600°c and 900° c .However the full formation of ferrite is not obserrved in the precipitated powder at room temperature. The sharp and well defined lined Xray diffration pattern is obtained only for the samples treated at 900°c .The partical size is calculated by line profile method .It is observed that the particle size increases with higher sintering temperature . it is also noted that the grain growth is more in Zn conntaining ferrites. The lattice constants increase with Zn and this is related to ionic radii of substituting cations.

Chapter -III is mainly devoted to magnetisation(Ms) and A.C susceptibility studies. Maganetic properties of the ferrites are briefly reviewed.Experimental details with necessary formulae are given . The magnetisation behaviour in these ferrites is discussed on the basis of Neel's two sub-lattice model .In Mg-Cu ferrite system the magnetisation increase with Cu. In case of Mg-Zn ferrite system the magnetisation increases upto 0.3 Zn and decreases with further addition of Zn. The decrease in magntisation is due to canted spin arrangement in these materials. it is also observed that the magnetisation is higher for 900°c sintered samples than that of the samples sintered at 600°c. This may be due to change in the microstructure and density of the sample.

The normalized a.c. susceptibility curves are useful in distinguishing the domain states of the materials. In ferrites,there are three types of domain states, multi domain,single domain and super para magnetic. In case of $Mg_{.7} Zn_{.3} Fe_2O_4$, it is observed from the shapes of Xac - T curve that the as it is sample shows SP type of behaviour, sintered at 600°c show SD type of behaviour and sintered at 900°c show MD Type of behaviour .

For Mg - Cu system mixed states of SD + MD are observed whereas in $CuFe_2O_4$ only MDstate is observed. From these observation and with X-ray diffraction study, it is conculded that the grain growth is enhanced at higher sintering temperatures. It is also noted from these plots the canting effect is observed in higher Zn containing samples.

Chapter IV is devoted to electrical properties of ferrites. The DC resistivity and threrm o emf are measured in the temperature range 300°k to curie temp. The resistivity obeys the relation given by Arrehenius. Two regions in log ρ Vs 1/T are observed The first region is the range of 300°k to 450°k .The conduction in the first region is attributed to impurities i. e. extrinsic type and second to polaron hopping mechanism.

The conduction process in these ferrites is explained on the basis of verwey mechanism. The thermo emf measurement shows p-type behaviour for $CuFe_2O_4$ and $Cu_{.7}\ Zn_{.3}\ Fe_2O_4$ The remaining samples of Cu- Mg,Cu-Zn and Mg-Zn series shows n -type behaviour. The variation of thermo emf with temp. indicates the variation of thermo emf with temp. indcates the conduction process taking place due to the presence of acceptor and donor centres with diffrent relative predominance. The Cu^{2+} - Cu^{1+}pair acts as p type carrier and Fe^{3+} - Fe^{2+} pair acts as n type carrier. It is also noted that the resistivity is large in copper containing ferrites and the maximum resistivity is obtained with 0.3 Cu of Mg-Cu system and 0.4 Cu of Cu-Zn system.

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