CHAPTER- V

SUMMARY AND CONCLUSIONS

References.

SUMMARY AND CONCLUSIONS

The soft ferrites have aroused considerable interest owing to their magnetic, electronic, microwave and computor applications. In many electronic applications ferrits with low coercive force and narrow hystersis loop are required for minimising eddy currents and hystersis losses. It is well known that, the properties of spinel ferrites are structure sensitive, therefore, tailor-making of ferrite is possible to suit for the particular application. The properties of ferrites are also influenced by addition of foreign oxides. The rare earth oxides play an important role in superconductivity phenomenon. Therefore, it was thought worth while to undertake the studies on doping of these oxides in mixed ferrites.

Magnesium ferrites exhibit high resistivity and low magnetic and dielectric loss. Its derivatives have wide applications in microwave technology. Zinc ferrite shows the normal spinel structure and is a well known semiconductor. Zinc substituted mixed ferrites have been studied extensively however, doped rare earth oxides in mixed ferrites have been paid little attention. Therefore it was thought worthwhole to undertake the studies on effect of doping of ZrO_2 in $Zn_xMg_{1-x}Fe_2O_4$ ferrite system. The samples of $Zn_xMg_{1-x}Fe_2O_4$ (where x = 0, 0.2, 0.4, 0.6, 0.8, 1.01 and the same system doped with 0.01 mol. wt. % ZrO_2 were prepared by standard ceramic technique, and the following investigations were undertaken.

1) Crystal structure characterisation by X-ray difraction studies to investigate the structural changes, due to doping.

2) D.C. electrical resistivity (ρ). Curie temperature measurements (Tc) and study of variation of Seebeck coefficient (α) with temperature to investigate the effect of doping on the electrical behaviour.

3) To investigate the effect of doping on magnetic behaviour by studying the hystersis effects with composition.

The contents of this dissertation are divided into five chapters. The first chapter deals with historical background, theoretical developments, different theories of ferrimagnetism and electromagnetic properties of ferrites. The applications of ferrites and orientation of the present work is given at the end of the chapter.

In chapter second various methods of preparation of ferrites are described in brief along with the method of preparation used for the present study The samples were prepared by standard ceramic method. For crystal structure characterisation, X-ray diffraction technique was used. The X-ray diffractograms of all the samples were obtained from I.I.T. Bombay. From the analysis of X-ray diffractograms it was observed that the diffractograms show well defined peaks with no ambigious reflections. This confirms the formation of single phase compounds.

It was found that the lattice parameter 'a' remains almost unaffected by addition of 0.01 mol. wt. % ZrO_2 in mixed Zn-Mg ferrite system. This result is in good agreement with Ram Narayan et. al.[1] However, it was found that there is considerable change in percentage porosity of doped samples. This is attributed to the filling of pores by interstices of Zr^{4+} ions.

In chapter three studies on d.c. electrical resistivity, Curie temperature measurements and thermoelectric power measurements are reported. The graphs of log (ρ) versus 1/T were plotted and values of characteristic temperature (Th), Curie temperature 'Tc' and the values of activation energy ΔE in ferrites and para regions were determined. The Curie temperatures were measured by using Lorria and Sinha[2] modified method. The variation of Seebeck coefficient (α) with temperature is also reported. From the values of activation energy (ΔE) in ferri and para regions and variation of (α) with temperature, it has been concluded that doping of 0.01 mol wt.% ZrO_2 leads to n type conductivity, by reducing some of the Fe^{3+} to Fe^{2+}, giving excess Fe^{2+} ions. The nature of the graph of log (ρ) versus 1/T is explained on the basis of canted spin arrangement and is confirmed by studies on magnetisation.

In chapter four, studies on magnetisation of doped Zn-Mg system are reported. Values of Ms, n_β, and α_{yk} also have reported. The observed reduction in saturation magnetisation (Ms) and values of n_β in doped samples is attributed to increase of α_{yk} angles and decrease in values of Curie temperatures of doped samples[3]. It has also been reported that magnesium ferrites obeys Neels[4] two sublattice model while all remaining samples do not obey the same. This is explained on the basis of changes in α_{yk} angles. The values of α_{yk} angles also confirms the existance of triangular spins in the doped Zn-Mg mixed ferrites as predicted.

References

1) Ram Narayan; R.B. Tripathi, and B.K. DAs J. Mater sci. 18, 1267(1983) and also part I of this paper.

2) K.K.Loria, A.P.B. Sinha, Ind. J. Pure and applied physics; 1, 215(1963)

3) Deshpande S.A. M. Phil. dissertation Chapter IV Shivaji University (1987)

4) Neel L. Anna de Physique 3, 137(1948).