LIST OF CONTENTS

- Contents i
- Acknowledgement v
- Synopsis vi
- List of Figures xii
- List of Tables xvii
- List of Abbreviations xix

CHAPTER – 1  INTRODUCTION TO FERRITES

1.1 Introduction 1
1.2 Types of Magnetic Materials 1
  1.2.1 Soft Ferrites 1
  1.2.2 Hard Ferrite 3
1.3 Structural Classification of Ferrites 4
  1.3.1 Hexagonal Ferrites 5
  1.3.2 Garnet Ferrites 5
  1.3.3 Ortho Ferrites 6
  1.3.4 Spinel Ferrites 6
1.4 Introduction to Spinel Ferrite 7
  1.4.1 Crystal Structure and I onic Charge Balance 8
  1.4.2 Cation Distribution in Spinel Ferrites 11
  1.4.3 Crystal Field Splitting of Energy Levels and Jahn – Teller Effect 12
  1.4.4 Magnetic Properties of Spinel Ferrites 15
    1.4.4.1 Exchange interactions 16
  1.4.5 Magnetic Ordering in Spinel Ferrites 22
    1.4.5.1 Neel’s theory of antiferromagnetism and ferrimagnetism 23
    1.4.5.2 Yafet – Kittel theory of ferrimagnetism 25
References 28
CHAPTER – 2 LITERATURE REVIEW AND OBJECTIVE

2.1 Preamble 30
2.2 Spinel Compounds 31
2.3 Review of Literature 33
2.4 Aim and Objective of the Work 43
References 45

CHAPTER – 3 MATERIAL PREPARATION AND CHARACTERIZATION TECHNIQUES

3.1 Preamble 50
3.2 Solid State Reaction Technique 51
  3.2.1 Selecting Raw Materials and Mixing 51
  3.2.2 Calcination 53
  3.2.3 Milling 55
  3.2.4 Pressing 56
  3.2.5 Sintering 58
3.3 Characterization of Materials 59
  3.3.1 Structural and Microstructural Studies 60
    3.3.1.1 X – ray diffraction 60
    3.3.1.2 Scanning electron microscopy (SEM) 63
    3.3.1.3 Energy dispersive analysis of X – rays (EDAX) 67
  3.3.2 Magnetic Measurements 69
  3.3.3 Spectroscopy Measurements 72
    3.3.3.1 Fourier transform infra red spectroscopy 72
    3.3.3.2 Electron paramagnetic resonance spectroscopy 77
References 84
CHAPTER – 4 PREPARATION AND STRUCTURAL CHARACTERIZATION OF PURE AND DYSPROSIUM SUBSTITUTED MAGNESIUM FERRITE

4.1 Preamble 85
4.2 Preparation of Materials 85
4.3 Characterization Technique 89
   4.3.1 X–ray Diffraction Analysis 89
   4.3.2 Scanning Electron Microscopy 95
   4.3.3 Energy Dispersive X–ray Analysis 97
4.4 Conclusions 101
References 103

CHAPTER – 5 MAGNETIC AND SPECTROSCOPIC PROPERTIES OF PURE AND DYSPROSIUM SUBSTITUTED MAGNESIUM FERRITE

5.1 Preamble 105
5.2 Results and Discussions 106
   5.2.1 Preparation of Materials 106
   5.2.2 Magnetic Properties 107
   5.2.3 Spectroscopic Characteristics 118
      5.2.3.1 Fourier transform infrared spectroscopy (FT–IR) 118
      5.2.3.2 Electron paramagnetic resonance (EPR) 128
5.3 Conclusions 135
References 136

CHAPTER – 6 PREPARATION AND STRUCTURAL CHARACTERIZATION OF PURE AND CALCIUM SUBSTITUTED MAGNESIUM FERRITE
6.1 Preamble 139
6.2 Results and Discussions 139
  6.2.1 Synthesis of Ca Substituted Magnesium Ferrite 139
  6.2.2 X – ray Diffraction 140
  6.2.3 Scanning Electron Microscopy 147
  6.2.4 Energy Dispersive X – ray Analysis (EDAX) 149
6.3 Conclusions 153
   References 155

CHAPTER – 7 MAGNETIC AND SPECTROSCOPIC PROPERTIES OF PURE AND CALCIUM SUBSTITUTED MAGNESIUM FERRITE

7.1 Preamble 157
7.2 Results and Discussions 158
  7.2.1 Preparation of Materials 158
  7.2.2 Magnetic Properties 158
  7.2.3 Spectroscopic Properties 168
    7.2.3.1 Fourier transform infrared spectroscopy (FT – IR) 168
    7.2.3.2 Electron paramagnetic resonance (EPR) 175
7.3 Conclusions 181
   References 183

CHAPTER – 8 EPILOGUE AND FUTURE SCOPE

8.1 Epilogue 186
  8.1.1 Substitution Effect of Dy$^{3+}$ ion on MgFe$_2$O$_4$ 187
  8.1.2 Substitution Effect of Ca$^{2+}$ ion on MgFe$_2$O$_4$ 190
8.2 Future Scope 193