

CONTENTS

| | PAGE NO |
|---|----------------|
| <i>List of Figures</i> | xii – xvii |
| <i>List of Tables</i> | xviii – xx |
| <i>List of Abbreviations</i> | xxi – xxiii |
| <i>Preface</i> | xxiv – xxvi |
| | |
| CHAPTER 1 | 01–10 |
| INTRODUCTION | |
| 1.1 Introduction | 01 |
| 1.1.1 Drawback of rare earth permanent magnet | 03 |
| 1.2 M-type hexaferrite | 04 |
| 1.2.1 Crystal structure and cation distribution of strontium hexaferrite | 05 |
| 1.2.2 Properties of strontium hexaferrites | 07 |
| 1.3 Theme of the work | 09 |
| 1.4 Organization of the thesis | 10 |
| | |
| CHAPTER 2 | 11–30 |
| LITERATURE REVIEW | |
| 2.1 Introduction | 11 |
| 2.2 Synthesis of hexaferrites | 11 |
| 2.3 Effect of non-rare earth ions substitution | 14 |
| 2.4 Effect of rare earth ions substitution | 22 |
| 2.5 Summary of literature review | 27 |
| 2.6 Objectives of the work | 29 |
| | |
| CHAPTER 3 | 31–49 |
| EXPERIMENTAL PROCEDURE | |
| 3.1 Synthesis of hexagonal ferrite powder | 31 |
| 3.1.1 Sol-gel auto combustion process | 31 |
| 3.2 Dried gel and as burnt powder characterization | 33 |
| 3.2.1 DTA/TGA analysis | 33 |
| 3.2.2 Fourier transform infrared (FTIR) spectroscopy | 34 |
| 3.2.3 X-ray diffraction analysis | 34 |

| | | |
|---|--|--------|
| 3.3 | Pelletization process of calcined powder | 37 |
| 3.3.1 | Pellet fabrication process | 37 |
| 3.3.2 | Sintering process | 38 |
| 3.4 | Characterization of hexaferrite pellets | 38 |
| 3.4.1 | Density measurement | 39 |
| 3.4.2 | Scanning electron microscopy (SEM) analysis | 39 |
| 3.4.3 | Structural refinement analysis | 40 |
| 3.4.4 | Magnetic property measurement system (MPMS) analysis | 43 |
| 3.4.5 | Impedance measurement | 49 |
| CHAPTER 4 | | 50–67 |
| OPTIMIZATION OF THE SYNTHESIS PROCESS IN $\text{SrAl}_4\text{Fe}_8\text{O}_{19}$ HEXAFERRITE SYNTHESIS | | |
| 4.1 | Introduction | 50 |
| 4.2 | Results and Discussion | 51 |
| 4.3 | Summary | 66 |
| CHAPTER 5 | | 68–84 |
| STUDY THE EFFECT OF Co^{+2} SUBSTITUTION FOR Fe^{+3} ON ELECTRO-MAGNETIC PROPERTIES OF THE OPTIMIZED $\text{SrAl}_4\text{Fe}_8\text{O}_{19}$ HEXAFERRITE | | |
| 5.1 | Introduction | 68 |
| 5.2 | Results and Discussion | 68 |
| 5.3 | Summary | 84 |
| CHAPTER 6 | | 85–107 |
| ANALYZE THE EFFECT OF Cr^{+3} AND Sn^{+4} SUBSTITUTION FOR Fe^{+3} ON ELECTRO-MAGNETIC PROPERTIES OF THE OPTIMIZED $\text{SrAl}_4\text{Fe}_8\text{O}_{19}$ HEXAFERRITE | | |
| 6.1 | Introduction | 85 |
| 6.2 | Results and Discussion | 86 |
| 6.3 | Summary | 107 |

| | |
|--|---------|
| CHAPTER 7 | 109–128 |
| STUDY THE INFLUENCE OF Y ⁺³ SUBSTITUTION FOR Fe ⁺³ ON ELECTRO-MAGNETIC PROPERTIES OF THE OPTIMIZED SrAl ₄ Fe ₈ O ₁₉ HEXAFERRITE | |
| 7.1 Introduction | 109 |
| 7.2 Results and Discussion | 110 |
| 7.3 Summary | 128 |
| CHAPTER 8 | 129–148 |
| STUDY THE EFFECT OF La ⁺³ AND Sm ⁺³ SUBSTITUTION FOR Fe ⁺³ ON ELECTRO-MAGNETIC PROPERTIES OF THE OPTIMIZED SrAl ₄ Fe ₈ O ₁₉ HEXAFERRITE | |
| 8.1 Introduction | 129 |
| 8.2 Results and Discussion | 129 |
| 8.3 Summary | 148 |
| CHAPTER 9 | 149–153 |
| CONCLUSIONS AND FUTURE SCOPE | |
| 9.1 Conclusions | 149 |
| 9.2 Future scope | 152 |
| References | 154–174 |
| List of Publications | 175-178 |