

Table of Contents

Certificate	iii
Declaration by the Candidate	v
Copyright Transfer Certificate	vii
Acknowledgements	xi
Table of Contents	xiii
List of Figures	xvii
List of Tables	xxi
List of Abbreviations and Symbols	xxiii
Preface	xxv
Chapter 1: Introduction and Literature Survey	1-30
1.1 Introduction	1
1.2 Overview of Magnetic Parameters	3
1.3 Strontium Hexaferrite Magnet	8
1.4 Criteria for Development of Permanent Magnet	10
1.5 Literature Survey on Synthesis Techniques for SrM	11
1.5.1 Solid-state Reaction Process	12
1.5.2 Hydrothermal Process	13
1.5.3 Co-precipitation Process	14
1.5.4 Sol-gel Process	15
1.5.5 Sol-gel Auto-combustion method	16
1.6 Literature Survey on Substitutional Efficacy of Non-REEs in SrM	17
1.7 Scope and Objective of the Present Work	29
Chapter 2: Experimental Techniques	31-47
2.1 Sample Preparation	31
2.1.1 Solid-state Reaction Route (Traditional Ceramic Method)	31
2.1.2 Sol-gel Auto-combustion Process	33
2.1.3 Heat Treatment Process	35
2.2 Characterization Techniques	36
2.2.1 Differential Thermal Analyzer & Thermo-gravimetric (DTA-TG)	36
2.2.2 X-ray Diffraction (XRD)	37
2.2.3 Fourier Transform Infrared Spectroscopy (FTIR)	39
2.2.4 Scanning Electron Microscopy (SEM)	41
2.2.5 Bulk Density and Porosity	43
2.2.6 Superconducting Quantum Interference Device Magnetometer	43
2.2.7 Impedance Analyzer	46
Chapter 3: Co-Cr Substituted SrFe_{12-x-y}Co_xCr_yO₁₉ Series	49-63
3.1 Introduction	49
3.2 Results and Discussion	49
3.2.1 TG/DTA Analysis	49
3.2.2 Structural Properties	50
3.2.3 Spectroscopic Properties	52

3.2.4	Densification and Microstructural Properties	54
3.2.5	Magnetic Properties	55
3.2.6	Dielectric Properties	59
3.2.7	Electrical Properties	62
3.3	Conclusions	63
Chapter 4: Cr-Zn Substituted Sr_{1-x}Cr_xFe_{12-x}Zn_xO₁₉ Series		65-79
4.1	Introduction	65
4.2	Results and Discussion	65
4.2.1	Structural Properties	65
4.2.2	Spectroscopic Properties	67
4.2.3	Densification and Microstructural Properties	69
4.2.4	Magnetic Properties	71
4.2.5	Dielectric Properties	75
4.2.6	Electrical Properties	77
4.3	Conclusions	78
Chapter 5: Ni-Al Substituted SrFe_{12-x-y}Ni_xAl_yO₁₉ Series		81-97
5.1	Introduction	81
5.2	Results and Discussion	82
5.2.1	Structural Properties	82
5.2.2	Spectroscopic Properties	84
5.2.3	Densification and Microstructural Properties	86
5.2.4	Magnetic Properties	88
5.2.5	Dielectric Properties	91
5.2.6	Electrical Properties	95
5.3	Conclusions	96
Chapter 6: Bi₂O₃ Doped SrFe₈Al₄O₁₉ Series		99-116
6.1	Introduction	99
6.2	Results and Discussion	100
6.2.1	Analysis of SrFe ₈ Al ₄ O ₁₉ Raw Powder	100
6.2.2	Analysis of SrFe ₈ Al ₄ O ₁₉ Calcined Powder	101
6.2.3	Analysis of SrFe ₈ Al ₄ O _{19-x} Bi ₂ O ₃ (0 ≤ x ≤ 5 wt%) Sintered Pellets	102
6.2.3.1	Structural Properties	102
6.2.3.2	Densification and Microstructural Properties	103
6.2.3.3	Magnetic Properties	106
6.2.3.4	Dielectric Properties	110
6.2.3.5	Electrical Properties	113
6.3	Conclusions	116
Chapter 7: Al-Zn Substituted SrFe_{8-x}Al₄Zn_xO₁₉ Series		117-132
7.1	Introduction	117
7.2	Results and Discussion	118

7.2.1 Structural Properties	118
7.2.2 Spectroscopic Properties	119
7.2.3 Densification and Microstructural Properties	121
7.2.4 Magnetic Properties	123
7.2.5 Dielectric Properties	127
7.2.6 Electrical Properties	131
7.3 Conclusions	132
Chapter 8: Progress in Energy Density	133-140
8.1 Introduction	133
8.2 Calculation of Energy Density	133
8.3 Energy density and Curie Temperature	134
8.3.1 A Composition of SrFe ₈ Al ₄ O ₁₉ _3 wt% Bi ₂ O ₃ , (1050°C)	134
8.3.2 A Composition of SrFe _{8.985} Ni _{0.015} Al ₃ O ₁₉	136
8.3.3 A Composition of SrFe _{7.8} Al ₄ Zn _{0.2} O ₁₉	138
8.4 Conclusions	139
Chapter 9: Summary and Future Scope	141-145
9.1 Summary	141
9.2 Future Scope	144
References	147-161
List of Publications and Patents	163
Attended International Conferences	165