

	Page No.
Title of Thesis	i
Certificate	ii
Declaration by the Candidate & Certificate by the Supervisor/co-supervisor	iii
Copyright Transfer Certificate	iv
Dedication	v
Acknowledgement	vi-vii
Contents	viii- xiv
List of Figures	xv- xix
List of Tables	xx
List of Abbreviations	xxi-xxii
Preface	xxiii-xxvii
CHAPTER – 1	1-50
Introduction	
1.1. Introduction of Perovskite	1
1.2. Perovskite substitution	3
1.2.1. Isovalent substitution	4
1.2.2. Heterovalent substitution	4
(a) Acceptors substitutions	5
(b) Donors substitutions	5
1.2.3. Valence compensated substitution	5
1.3. ABO ₃ type high dielectric constant Perovskites	6
1.3.1. Calcium Titanate (CaTiO ₃)	6

1.3.2. Strontium Titanate (SrTiO_3)	8
1.3.3. Barium Titanate (BaTiO_3)	11
1.4. Complex Perovskite	15
1.4.1. $\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ (CCTO)	15
1.4.2. $\text{Bi}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ (BCTO)	17
1.4.3. $\text{Y}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ (YCTO)	19
1.5. Application of Perovskite	19
1.6. Composite Materials	20
1.6.1. Natural composites	20
1.6.2. Premature composites	21
1.6.3. Constructing composites	21
1.6.4. Nanocomposite	22
1.6.5. Ceramic matrices nanocomposite	24
1.6.6. Application of composites	25
1.7. Ceramic Dielectrics	26
1.7.1. Dielectric Behaviour	26
(a) Basic concept of dielectric capacitor	26
1.8. Polarization	30
1.8.1. Types of polarization:	31
(a) Electronic polarizations:	31
(b) Ionic polarization:	31
(c) Dipolar polarization:	31
(d) Space charge polarization:	31
1.9. Dielectric constant	33

1.10. Dielectric loss	33
1.11. Basic Principles of Impedance Spectroscopy	36
1.12. Conductivity	40
1.13. Magnetic Properties	40
1.13.1. Magnetism	42
(a) Electron magnetic moment	42
(b) Spin magnetic moment	42
1.13.2. Diamagnetism	44
1.13.3. Paramagnetism	45
1.13.4. Ferromagnetism	45
1.13.5. Magnetic Domain	45
1.13.6. Antiferromagnetism	46
1.13.7. Ferrimagnetism	47
1.13.8. Superparamagnetism	47
1.14. Aim of study	49
CHAPTER – 2	51-64
Synthesis and Characterization Techniques	
2.1. Experimental	51
2.2. Material used	52
2.2.1 Chemicals	52
2.3. Preparation of materials	53
2.3.1. Preparation of metal nitrate solution	53
2.4. Synthesis methods	53

2.4.1. Semi wet route	53
2.4.2. Solid State Route	54
2.4.2. Calcination Process	56
2.4.3 Sintering Process	56
2.5. Characterization techniques for synthesized ceramic materials:	56
2.5.1. Phase and Crystal Structure Analysis:	56
2.5.3. Scanning Electron Microscopy (SEM) Analysis	59
2.5.4. Energy Dispersive X-ray Analysis (EDX)	60
2.5.5. Transmission Electron Microscopy (TEM) Analysis	60
2.5.6. Atomic force microscopy (AFM)	61
2.5.7. Superconducting quantum interference device (SQUID)	62
2.5.8. Electric and Dielectric Measurement:	62
2.5.9. Impedance and Conductivity	64
CHAPTER – 3	65-80
Studies of the $0.9\text{BaTiO}_3\text{-}0.1\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ (BTC) Composite	
3.1. Introduction	65
3.2. Experimental	66
3.2.1. Synthesis	66
3.2.2. Characterization	67
3.3. Results and discussion	68
3.3.1. X-ray diffraction studies	68
3.3.2. Microstructural studies	70
3.3.3. Dielectric studies	74

3.3.4. Conductivity studies	78
3.4. Conclusion	80
CHAPTER – 4	81-94
Studies of the $0.1\text{BaTiO}_3 - 0.9\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ (CC-BT) Composite	
4.1. Introduction	81
4.2. Experimental	82
4.2.1. Synthesis	82
4.2.2. Characterization	84
4.3. Results and Discussion	84
4.3.1. X-ray diffraction studies	84
4.3.2. Microstructural studies	86
4.3.3. Dielectric Studies	89
4.3.4. Impedance studies	92
4.4. Conclusion	94
CHAPTER – 5	95-109
Studies of the $0.5\text{BaTiO}_3 - 0.5\text{Bi}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}$ (BT-BCT 5) Composite	
5.1. Introduction	95
5.2. Experimental	96
5.2.1. Synthesis	96
5.2.2. Characterization	98
5.3. Results and Discussion	99
5.3.1. X-ray diffraction studies	99

5.3.2. Microstructural studies	100
5.3.3. Dielectric studies	104
5.4. Conclusion	109
CHAPTER – 6	110-129
Studies of the $0.6\text{Bi}_{2/3}\text{Cu}_3\text{Ti}_4\text{O}_{12}-0.4\text{BaTiO}_3$ (BC-BT) Composite	
6.1. Introduction	110
6.2. Experimental	111
6.2.1. Synthesis of materials	111
6.2.2. Structural and microstructural characterization	113
6.2.3. Dielectric and electrical measurements	113
6.3. Results and Discussion	114
6.3.1. X-ray diffraction studies	114
6.3.2. Microstructural studies	115
6.3.3. Magnetic measurements	120
6.3.4. Dielectric studies	122
6.3.5. Conductivity and impedance studies	125
6.4. Conclusion	128
CHAPTER - 7	130-133
Summary of work and suggestions for future work	
7.1. Summary	130
7.2. Suggestions for future work	132

References	134-154
List of Publications	155-157