

CONTENTS		Page No.
LIST OF FIGURES.....		xvii
LIST OF TABLES.....		xxiii
LIST OF SYMBOLS & ABBREVIATIONS.....		xxv
PREFACE.....		xxvii
Chapter-I	Introduction and Literature Review	1-54
1.1	Introduction.....	1
1.2	Ceramics in perovskite structure.....	3
1.3	Fundamentals of dielectric capacitor.....	5
1.4	Frequency dependent electric polarization.....	13
1.5	Different types of Energy storage dielectric materials.....	14
1.5.1	Linear Dielectrics.....	14
1.5.2	Nonlinear Dielectrics.....	15
1.6	Ferroelectricity in PVDF polymer.....	18
1.7	Dielectric breakdown strength of dielectric material.....	20
1.8	Methods for determination of energy storage density in dielectric Capacitor.....	22
1.9	Interface effect in Polymer nanocomposites.....	25
1.10	Methods to improve the energy storage property of nonlinear dielectric polymers.....	27
1.10.1	Modification of defects.....	28
1.10.2	Blending polymers.....	28
1.10.3	Grafting Polymers.....	29
1.10.4	Polymer based nanocomposites.....	30
1.10.4.1	Polymer based nanocomposites with conducting nanofiller.....	31
1.10.4.2	Polymer based nanocomposites with nonconducting filler.....	37
1.11	Challenges in enhancing the energy storage capacity of polymer- ceramic nanocomposites.....	42
1.12	Effects of Surface Modification of Nanofillers in polymer Nanocomposites.....	45
1.13	Application of PVDF based nanocomposite film.....	51
1.14	Motivation of the thesis.....	53

1.15	Objectives of the present research work.....	53
Chapter-II	Experimental Methods and Characterization Techniques.....	55-83
2.1	Introduction.....	55
2.2	Materials.....	56
2.2.1	Materials used for BST/PVDF composites.....	56
2.2.2	Materials used for BZ/PVDF composite films.....	56
2.2.3	Materials used for BZT/PVDF composite films.....	56
2.3	Synthesis Methods.....	57
2.3.1	Synthesis of nanofiller.....	57
2.3.1.1	Sol gel combustion technique.....	57
2.3.1.2	High Energy ball milling process.....	58
2.3.2	Hydroxylation process of nanoparticles.....	60
2.3.3	Synthesis of PVDF based polymer nanocomposites.....	60
2.3.3.1	Cold Sintering technique.....	61
2.3.3.2	Solution Casting Method.....	63
2.4	Characterization techniques.....	64
2.4.1	X-ray diffraction (XRD) pattern.....	64
2.4.2	Fourier transform infrared spectroscopy (FTIR).....	66
2.4.3	Thermogravimetric Analysis (TGA).....	68
2.4.4	Differential Scanning Calorimetry (DSC).....	70
2.4.5	Field Emission Scanning Electron Microscopy (FESEM).....	71
2.4.6	Impedance Spectroscopy.....	73
2.4.7	P-E hysteresis loop Analysis.....	75
2.4.8	Breakdown strength test set up.....	76
2.4.9	Atomic Force Microscopy.....	79
2.4.10	X-ray Photoelectron Spectroscopy.....	81
2.5	Conclusion.....	83
Chapter-III	Energy Storage Properties of Cold Sintered Ba_{0.7}Sr_{0.3}TiO₃/PVDF Polymer Ceramic Nanocomposites.....	85-107
3.1	Introduction.....	85
3.2	Synthesis of Ba _{0.7} Sr _{0.3} TiO ₃ /PVDF nanocomposites.....	88
3.3	Results and discussion.....	90

3.3.1	Structural Analysis.....	90
3.3.2	Density Measurement.....	92
3.3.3	Thermal Analysis.....	94
3.3.4	Microstructural Analysis.....	95
3.3.5	Dielectric Measurement.....	96
3.3.6	P-E hysteresis Analysis.....	101
3.3.7	Weibull Analysis.....	104
3.4	Conclusion.....	106
Chapter IV	BaZrO₃ /Poly (Vinylidene difluoride) Ceramic Nanocomposite Films with Improved Dielectric and Energy Storage Properties.....	109-132
4.1	Introduction.....	109
4.2	Synthesis of BZ/PVDF composite film.....	110
4.3	Results and discussion.....	113
4.3.1	X-ray Diffraction Analysis.....	114
4.3.2	FTIR Analysis.....	115
4.3.3	Thermal analysis using TGA and DSC.....	116
4.3.4	Microstructural Analysis.....	118
4.3.5	X-ray photoelectron spectroscopy Analysis.....	120
4.3.6	Atomic Force Microscopy Analysis.....	122
4.3.7	Dielectric properties.....	124
4.3.8	P-E hysteresis loop Analysis.....	127
4.3.9	Weibull Analysis.....	130
4.4	Conclusion.....	132
Chapter V	BaZr_{0.4}Ti_{0.6}O₃/Poly (Vinylidene fluoride) Composite Films with Improved Dielectric and Energy Storage Properties.....	133-154
5.1	Introduction.....	133
5.2	Synthesis of BZT/PVDF composite film.....	135
5.3	Results and Discussion.....	138
5.3.1	X-ray Diffraction Analysis.....	139
5.3.2	FTIR Analysis.....	140
5.3.3	Thermal analysis using TGA and DSC.....	141

5.3.4	Microstructural Analysis.....	143
5.3.5	Atomic Force Microscopy Analysis.....	145
5.3.6	Dielectric properties.....	147
5.3.7	P-E hysteresis loop analysis.....	150
5.3.8	Study of breakdown strength using Weibull Analysis.....	151
5.4	Conclusion.....	153
Chapter-VI	Summary and Future Scope	155-160
6.1	Summary.....	155
6.2	Future scope.....	158
References.....		161-181
List of Publications.....		183
List of Conferences/Workshops Attended.....		185-186