Contents

		Page No.
	Acknowledgements	**I**
	Abstract	**III**
Chapter 1	**Introduction**	**1-45**
1.1	Introduction to solid electrolytes	1
1.2	Classification of various solid electrolytes	3
1.2.1	Classification depending on type of ion conducting species	3
1.2.2	Classification depending on type of host material	7
1.3	Glass as a solid electrolyte	14
1.4	α–AgI as a model solid electrolyte	16
1.5	α–AgI based solid electrolytes	20
1.6	Glass as an effective medium to stabilize α-AgI at room temperature	21
1.7	A Review of AgI based silver ion conducting glass materials	27
1.8	Applications of ion conducting glasses	34
1.9	Motivation	34
1.10	Present work	36
	References	
Chapter 2	**Theoretical details**	**49-82**
2.1	Introduction	49
2.2	General features of superionic conduction in glasses	49
2.2.1	Cation and anion conducting glasses	49
2.2.2	Effect of temperature on ionic conductivity	50
2.2.3.	The AC conductivity spectrum	51
2.2.4	Near constant loss effects	52
2.3	Theoretical models of superionic conduction in glasses	53
2.3.1	Basic theory of conductivity	53
2.3.2	The Anderson-Stuart model	54
2.3.3	The weak electrolyte model	56

2.3.4 Cluster bypass model 57
2.3.5 Random site model 58
2.3.6 The diffusion pathway model 59
2.3.7 Jump and relaxation pathways 60
2.3.8 The concept of mismatch and relaxation 60
2.4 Impedance spectroscopy and its various formalisms 62
2.4.1 Mathematical Foundations of Impedance Spectroscopy 63
2.4.2 Complex impedance formalism 66
2.4.3 Complex Conductivity Formalism 69
2.4.4 Complex Dielectric Formalism 71
2.4.5 Complex Modulus Formalism 74
2.4.6 Electrical relaxations and the Decoupling index 78
References

Chapter 3 Experimental Details 85-101
3.1 Introduction 85
3.2 Preparation of glass samples 85
3.3 Experimental techniques 86
3.3.1 Density measurements 87
3.3.2 Powder x-ray diffraction 87
3.3.3 Differential scanning calorimetry 89
3.3.4 Fourier transform – infrared spectroscopy 93
3.3.5 Impedance spectroscopy 95
3.3.6 Ionic transport number measurement 95
3.3.7 Solid state battery preparation 98
References

Chapter 4 Characterization Results 103-130
4.1 Density And Molar Volume 103
4.2 X-ray Diffraction studies. 105
4.3 Differential Scanning Calorimetry Studies 108
4.4 Fourier Transform infrared Spectroscopy analysis 116
4.5 Ionic transport number 126
References

Chapter 5 **Transport Properties** **133-225**

5.1 Introduction 133

5.2 Complex impedance analysis 136

5.3 DC conductivity 146

5.4 Frequency dependent conductivity 158

5.5 Frequency dependent dielectric permittivity 181

5.6 Modulus function analysis 201

References

Chapter 6 **Battery Applications & Results** **229-250**

6.1 Introduction 229

6.2 Experimental 234

6.2.1 Cell Fabrication 234

6.2.2 Cell characterization and other studies 237

6.3 Result and discussion 238

6.3.1 Open circuit voltage of cell 238

6.3.2 Polarization studies 238

6.3.3 Discharge studies 244

6.4 Conclusion 248

References

Chapter 7 **Conclusion & Future Prospects of the Work** 253

List of Publications