

## CONTENTS

| CHAPTER | TITLE   | PAGE NO -- |
|---------|---|------------|
| I       | <b>FERROELECTRICS</b>   |            |
| 1.1     | Introduction  | 8          |
| 1.2     | Ferroelectric Materials and<br>their Characteristic Properties.                                       | 11         |
| 1.3     | Dielectric Properties and Polarization  | 15         |
|         | a) Dielectric Properties  | 15         |
|         | b) Polarizability   | 16         |
| 1.4     | Classification of Ferroelectrics  | 19         |
| 1.5     | Spontaneous Polarization  | 22         |
| 1.6     | Ferroelectric Domains   | 24         |
| 1.7     | Literature Survey and Orientation<br>of Present Work.   | 25         |
| II      | <b>SYNTHETIC AND EXPERIMENTAL PROCEDURE</b>   |            |
| 2.1     | Sample Preparation and Standardization<br>of Procedure for Synthesis                                  | 32         |
| 2.1.1   | The Solid Solutions and<br>the Solid State Reaction   | 32         |
| 2.1.2   | Significance of Melting Points of<br>the Constituents Oxides and the<br>Proposed Sintering Schedules. | 33         |
| 2.2     | Sample Mount and Procedure for Measurement  | 40         |
| 2.2.1   | The Sample Mount.   | 40         |
| 2.2.2   | Measurement of Dielectric Constant  | 43         |
| 2.2.3   | Measurement of Conductivity   | 44         |
| 2.2.4   | Measurement of Thermopower  | 46         |

|       |   |     |
|-------|---|-----|
| III   | <b>XRD ANALYSIS AND TOLERANCE FACTOR:</b>                                   |     |
| 3.1   | The Structure of Perovskite Type<br>Ferroelectrics                          | 49  |
| 3.2   | The Structure of BaTiO <sub>3</sub> in<br>Tetragonal Phase                  | 50  |
| 3.3   | Method of Determination of<br>Parameters 'a' and 'c'                        | 51  |
| 3.4   | Tolerance Factor.   | 52  |
| 3.5   | The Structural Investigation  | 55  |
| IV    | <b>DIELECTRIC PERMITTIVITY</b>  |     |
| 4.1   | Introduction and Literature Survey  | 66  |
| 4.2   | Result and Discussion   | 70  |
| 4.2.1 | The SbMn System.  | 70  |
| 4.2.2 | The SbCo System.  | 83  |
| V     | <b>D.C. ELECTRICAL CONDUCTIVITY AND THERMOELECTRIC POWER.</b>               |     |
| 5.1   | Introduction  | 91  |
| 5.2   | Theoretical Models for the Electron<br>Transport Properties.                | 95  |
| 5.2.1 | The Potential Barrier Effect on Resistivity.                                | 95  |
| 5.2.2 | A Qualitative Model for Electron<br>Transport in Ceramic BaTiO <sub>3</sub> | 98  |
| 5.3   | Result and Discussion   | 100 |
| 5.3.1 | Log $\rho$ Behaviour of SbMn System.  | 100 |
| 5.3.2 | Log $\rho$ Behaviour of SbCo System   | 102 |
| 5.3.3 | Thermoelectric Power of SbMn and SbCo System                                | 102 |
|       | <b>RESUME</b>   | 128 |
|       | <b>REFERENCES</b>   | 130 |