**LIST OF FIGURES**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Figure No. with caption</th>
<th>Page no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fig 1.1 Vein diagram of classification of materials</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Fig. 1.2 Classification of crystal structure</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Fig. 1.3 Schematic illustration of temperature variation of polarization for first order and second order ferroelectric phase transition.</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Fig. 1.4 Typical ABO3 structure</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Fig. 1.5 A typical hysteresis loop illustrating the coercive field $E_c$, spontaneous polarization $P_s$, and remnant polarization $P_r$.</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Fig. 1.6 Typical hysteresis loop illustrating coercive force, remnant magnetization etc.</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Fig. 1.7(a,b) Correlation between different ferroic properties</td>
<td>13</td>
</tr>
<tr>
<td>8</td>
<td>Fig. 1.8 Multiferroic perovskites with ferroelectrically, shifts of electrically active $d^0$ ions (brown) from the centres of oxygen (pink plaquettes) lead to polarization (along brown arrow), coexisting with magnetic order (green arrows)</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td>Fig. 1.9 BiFeO$_3$ Multiferroics with ordering of lone pairs (yellow lobes)</td>
<td>14</td>
</tr>
<tr>
<td>10</td>
<td>Fig. 1.10 Mechanism of generation of polarization in YMnO$_3$</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>Fig. 1.11 Type-II Multiferroics - Sinusoidal spin density wave</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>Fig. 1.12 Cycloid spiral structures with wave vector $\hat{Q}$</td>
<td>16</td>
</tr>
<tr>
<td>13</td>
<td>Fig. 1.13 Type-II Multiferroics with collinear magnetic structures - Spins broken inversion symmetry</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>Fig. 1.14 Perovskite crystal structure of BiFeO$_3$: (a) rhombohedral and (b) rhombohedral units and hexagonal unit cell. Figure adopted from</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td>Fig. 1.15 Hexagonal representation of spin structure of BiFeO$_3$</td>
<td>19</td>
</tr>
<tr>
<td>16</td>
<td>Fig. 1.16 Long range magnetic order: incommensurate spin cycloid.</td>
<td>20</td>
</tr>
<tr>
<td>17</td>
<td>Fig. 1.17 Three structures: (a) rhombohedral structure (b) orthorhombic structure and (c) cubic structure</td>
<td>21</td>
</tr>
<tr>
<td>18</td>
<td>Fig. 1.18 NaTaO$_3$ with (a) respective cell parameters and space group in monoclinic crystalsystem (b) the perovskite structure</td>
<td>23</td>
</tr>
<tr>
<td>19</td>
<td>Fig. 1.19 (a) Crystal structure of KTaO$_3$ (b) View along the [111] direction of the Ta atoms alone</td>
<td>24</td>
</tr>
<tr>
<td>20</td>
<td>Fig. 2.1 Flow chart for the preparation of ceramics samples by a solid-state reaction technique</td>
<td>38</td>
</tr>
<tr>
<td>21</td>
<td>Fig. 2.2 General feature of power diffractometer</td>
<td>42</td>
</tr>
<tr>
<td>22</td>
<td>Fig. 2.3 Electron/specimen interactions in SEM setup</td>
<td>45</td>
</tr>
<tr>
<td>23</td>
<td>Fig. 2.4 Schematic diagram of Scanning electron microscope</td>
<td>46</td>
</tr>
</tbody>
</table>
24. Fig. 2.5 The vector resolution of ac current in a capacitor

25. Fig. 2.6 PSM-1735, LCR 4NL

26. Fig. 2.7 Laboratory fabricated Sample holder

27. Fig. 2.8 Representation of cell impedance (Z) on a vector diagram/complex plane

28. Fig. 2.9 Relationship between microstructure and electrical properties in complex impedance plane

29. Fig. 2.10 An electrical equivalent circuit in complex impedance plane.

30. Fig. 2.11 (a) High voltage test fixture, (b) High Temperature Test Fixture (c) high voltage

31. Fig. 3.1 Comparison of room temperature XRD pattern of (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ samples and BiFeO$_3$ (inset)

32. Fig. 3.2 Comparison of room temperature XRD pattern of (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ sample and BiFeO$_3$ (inset)

33. Fig. 3.3 Comparison of room temperature XRD pattern of (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ sample and BiFeO$_3$ (inset)

34. Fig. 3.4 SEM micrograph of (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system
   (a) x=0.0, (b) x=0.1, (c) x=0.2, (d) x=0.3, (e) x=0.4, (f) x=0.5

35. Fig. 3.5 SEM micrograph of (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system
   (a) x=0.0, (b) x=0.1, (c) x=0.2, (d) x=0.3, (e) x=0.4, (f) x=0.5

36. Fig. 3.6 SEM micrograph of (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system
   (a) x=0.0, (b) x=0.1, (c) x=0.2, (d) x=0.3, (e) x=0.4, (f) x=0.5

37. Fig. 4.1 (a) Variation of dielectric constant ($\varepsilon_r$) with frequency at room temperature of BiFeO$_3$
   (b) Variation of dielectric loss (tan$\delta$) with frequency at room temperature of BiFeO$_3$

38. Fig. 4.2 Variation of (a) dielectric constant and (b) loss as a function of frequency of (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ with x=0.1, 0.2, 0.3, 0.4, 0.5 at room temperature.

39. Fig. 4.3 Variation of (a) dielectric constant and (b) loss as a function of frequency of (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ with x=0.1, 0.2, 0.3, 0.4, 0.5 at room temperature.

40. Fig. 4.4 Variation of (a) dielectric constant and (b) loss as a function of frequency of (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ with x=0.1, 0.2, 0.3, 0.4, 0.5 at room temperature.

41. Fig. 4.5 Variation of tan$\delta$ with temperature at different frequencies and $\varepsilon_r$ with temperature at different frequencies (insert) of BiFeO$_3$.

42. Fig. 4.6 Variation of $\varepsilon_r$ with temperature at different frequency for (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ (a) x=0.1, (b) x=0.2, (c) x=0.3, (d) x=0.4, (e) x=0.5
   (f) Comparison of $\varepsilon_r$ with temperature for different concentrations of (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system at a particular frequency.

43. Fig. 4.7 Variation of tan$\delta$ with temperature at different frequency for (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$
   (a) x=0.1, (b) x=0.2, (c) x=0.3, (d) x=0.4, (e) x=0.5
   (f) Comparison of tan$\delta$ with temperature for different concentrations of (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system at a particular frequency.
44. Fig. 4.8 Variation of $\varepsilon_r$ with temperature at different frequency for $(\text{Bi}_{1-x}\text{Na}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ (a) $x=0.1$, (b) $x=0.2$, (c) $x=0.3$, (d) $x=0.4$, (e) $x=0.5$, (f) Comparison of $\varepsilon_r$ with temperature for different concentrations of $(\text{Bi}_{1-x}\text{Na}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ system at a particular frequency.

45. Fig. 4.9 Variation of tan$\delta$ with temperature at different frequency for $(\text{Bi}_{1-x}\text{Na}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ (a) $x=0.1$, (b) $x=0.2$, (c) $x=0.3$, (d) $x=0.4$, (e) $x=0.5$, (f) Comparison of tan$\delta$ with temperature for different concentrations of $(\text{Bi}_{1-x}\text{Na}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ system at a particular frequency.

46. Fig. 4.10 Variation of $\varepsilon_r$ with temperature at different frequency for $(\text{Bi}_{1-x}\text{K}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ (a) $x=0.1$, (b) $x=0.2$, (c) $x=0.3$, (d) $x=0.4$, (e) $x=0.5$, (f) Comparison of $\varepsilon_r$ with temperature for different concentrations of $(\text{Bi}_{1-x}\text{K}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ system at a particular frequency.

47. Fig. 4.11 Variation of tan$\delta$ with temperature at different frequency for $(\text{Bi}_{1-x}\text{K}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ (a) $x=0.1$, (b) $x=0.2$, (c) $x=0.3$, (d) $x=0.4$, (e) $x=0.5$, (f) Comparison of tan$\delta$ with temperature for different concentrations of $(\text{Bi}_{1-x}\text{K}_x)\text{Fe}_{1-x}\text{Ta}_x\text{O}_3$ system at a particular frequency.

48. Fig. 4.12 Room temperature P-E loop of $(\text{Bi}_{1-x}\text{Li}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$.

49. Fig. 4.13 Room temperature P-E loop of $(\text{Bi}_{1-x}\text{Na}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$.

50. Fig. 4.14 Room temperature P-E loop of $(\text{Bi}_{1-x}\text{K}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$.

51. Fig. 5.1 Complex impedance spectra ($Z'$ versus $Z''$) of $(\text{Bi}_{1-x}\text{Li}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ System (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$ at selective temperatures, with the respective circuit symbol.

52. Fig. 5.2 Complex impedance spectra ($Z'$ versus $Z''$) of $(\text{Bi}_{1-x}\text{Na}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ System (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$ at selective temperatures, with the respective circuit symbol.

53. Fig. 5.3 Complex impedance spectra ($Z'$ versus $Z''$) of $(\text{Bi}_{1-x}\text{K}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ System (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$ at selective temperatures, with the respective circuit symbol.

54. Fig. 5.4 (a) Equivalent circuit without grain boundary contribution (b) with grain boundary contribution.

55. Fig. 5.5 Variation of real part of impedance with frequency of $(\text{Bi}_{1-x}\text{Li}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ system (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$ at some selected temperatures.

56. Fig. 5.6 Variation of real part of impedance with frequency of $(\text{Bi}_{1-x}\text{Na}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ system (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$ at some selected temperatures.

57. Fig. 5.7 Variation of real part of impedance with frequency of $(\text{Bi}_{1-x}\text{K}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ system (a) $x=0.0$, (b) $x=0.1$, (c) $x=0.2$, (d) $x=0.3$, (e) $x=0.4$, (f) $x=0.5$ at some selected temperatures.

58. Fig. 5.8 Variation of imaginary part of impedance with frequency of $(\text{Bi}_{1-x}\text{Li}_x)(\text{Fe}_{1-x}\text{Ta}_x)\text{O}_3$ system
system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

59. Fig. 5.9 Variation of imaginary part of impedance with frequency of (Bi1-xNa)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

60. Fig. 5.10 Variation of imaginary part of impedance with frequency of (Bi1-xK)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

61. Fig. 5.11 Variation of dc (bulk) conductivity with inverse of absolute temperature of (a) BiFeO3 (x=0.0) (b)(Bi1-xLi)x(Fe1-xTa)yO3 system (c)(Bi1-xNa)x(Fe1-xTa)yO3 system (d)(Bi1-xK)x(Fe1-xTa)yO3 system for x= 0.1, 0.2 ,0.3 ,0.4 ,0.5 at a certain temperature range (300°C-400°C).

62. Fig. 5.12 Variation of dc (gb) conductivity with inverse of absolute temperature of (a) (Bi1-xNa)x(Fe1-xTa)yO3 system for x= 0.2 ,0.3 ,0.4 (b)(Bi1-xK)x(Fe1-xTa)yO3 system for x=0.1, 0.2 ,0.3 ,0.4 at a certain temperature range (300°C-400°C).

63. Fig. 5.13 Shows the complex modulus plot of (Bi1-xLi)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 (Bi1-xNa)x(Fe1-xTa)yO3 system (g)x=0.1, (h)x=0.2, (i)x=0.3, (j)x=0.4, (k)x=0.5 and (Bi1-xK)x(Fe1-xTa)yO3 systems (l)x=0.1, (m)x=0.2, (n)x=0.3, (o)x=0.4, (p)x=0.5

64. Fig. 5.14 Variation of real part of electric modulus (M') with frequency of (Bi1-xLi)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperature.

65. Fig. 5.15 Variation of real part of electric modulus (M') with frequency of (Bi1-xNa)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

66. Fig. 5.16 Variation of real part of electric modulus (M') with frequency of (Bi1-xK)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

67. Fig. 5.17 Variation of imaginary part of electric modulus (M'') with frequency of (Bi1-xLi)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

68. Fig. 5.18 Variation of imaginary part of electric modulus (M'') with frequency of (Bi1-xNa)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

69. Fig. 5.19 Variation of imaginary part of electric modulus (M'') with frequency of (Bi1-xK)x(Fe1-xTa)yO3 system (a)x=0.0, (b)x=0.1,(c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 at some selected temperatures.

70. Fig. 5.20 Variation of relaxation time with inverse of temperature for Z" of (a)(Bi1-xLi)x(Fe1-xTa)yO3 (b)(Bi1-xNa)x(Fe1-xTa)yO3 (c)(Bi1-xK)x(Fe1-xTa)yO3 for x=0.0, 0.1, 0.2 ,0.3 ,0.4 ,0.5.

71. Fig. 5.21 Variation of relaxation time with inverse of temperature for M" of (a) (Bi1-xLi)x(Fe1-xTa)yO3 (b) (Bi1-xNa)x(Fe1-xTa)yO3 (c)(Bi1-xK)x(Fe1-xTa)yO3 for x=0.0, 0.1, 0.2 ,0.3 ,0.4 ,0.5.
72. Fig. 6.1 Variations of $\sigma_{ac}$ with inverse of absolute temperature (10$^{3}$/T) at different frequencies for (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system
(a)x=0.0, (b)x=0.1, (c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 130
73. Fig. 6.2 Variations of $\sigma_{ac}$ with inverse of absolute temperature (10$^{3}$/T) at different frequencies for (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system
(a)x=0.0, (b)x=0.1, (c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 132
74. Fig. 6.3 Variations of $\sigma_{ac}$ with inverse of absolute temperature (10$^{3}$/T) at different frequencies for (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system
(a)x=0.0, (b)x=0.1, (c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5 134
75. Fig. 6.4 Variation of ac conductivity as a function of frequency for (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system (a)x=0.0, (b)x=0.1, (c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5. 137
76. Fig. 6.5 Variation of ac conductivity as a function of frequency for (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system (a)x=0.0, (b)x=0.1, (c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5. 138
77. Fig. 6.6 Variation of ac conductivity as a function of frequency for (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system (a)x=0.0, (b)x=0.1, (c)x=0.2, (d)x=0.3, (e)x=0.4, (f)x=0.5. 139
78. Fig. 6.7 Variation of current density (J) with applied field (E) at temperature 300°C for (a) BiFeO$_3$ (x=0.0) (b) (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system (c) (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system (d) (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system. 141
79. Fig. 6.8 Variation of $\sigma_{dc}$ with inverse of temperature for (Bi$_{1-x}$Li$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system. 143
80. Fig. 6.9 Variation of $\sigma_{dc}$ with inverse of temperature for (Bi$_{1-x}$Na$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system. 144
81. Fig. 6.10 Variation of $\sigma_{dc}$ with inverse of temperature for (Bi$_{1-x}$K$_x$)(Fe$_{1-x}$Ta$_x$)O$_3$ system. 145

LIST OF TABLES

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Table No. with caption</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Table 2.1 Calcination and sintering temperature with respective duration of time of different samples</td>
<td>38</td>
</tr>
<tr>
<td>2.</td>
<td>Table 3.1 Comparison of observed (obs.) and calculated (calc.) d values (in Å) of (Bi$_{1-x}$Li$<em>x$)(Fe$</em>{1-x}$Ta$_x$)O$_3$ system (a) x=0.0, (b) x=0.1, (c) x=0.2, (d) x=0.3, (e) x=0.4, (f) x=0.5 samples with relative intensity I/I$_0$.</td>
<td>60</td>
</tr>
<tr>
<td>3.</td>
<td>Table 3.2 Comparison of lattice parameters a and c (Å) with estimated standard deviation (in parenthesis), unit cell volume (Å$^3$) and average particle size (Pnm) of (Bi$_{1-x}$Li$<em>x$)(Fe$</em>{1-x}$Ta$_x$)O$_3$ system.</td>
<td>61</td>
</tr>
<tr>
<td>4.</td>
<td>Table 3.3 Comparison of observed (obs.) and calculated (calc.) d values (in Å) of (Bi$_{1-x}$Na$<em>x$)(Fe$</em>{1-x}$Ta$_x$)O$_3$ system (a) x=0.0, (b) x=0.1, (c) x=0.2, (d) x=0.3, (e) x=0.4, (f) x=0.5 samples with relative intensity I/I$_0$.</td>
<td>63</td>
</tr>
<tr>
<td>5.</td>
<td>Table 3.4 Comparison of lattice parameters a and c (Å) with estimated standard deviation (in parenthesis), unit cell volume (Å$^3$) and average particle size (Pnm) of (Bi$_{1-x}$Na$<em>x$)(Fe$</em>{1-x}$Ta$_x$)O$_3$ system.</td>
<td>63</td>
</tr>
</tbody>
</table>
6. **Table 3.5** Comparison of observed (obs.) and calculated (calc.) d values (in Å) of (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 (a) x=0.0, (b) x=0.1, (c) x=0.2, (d) x=0.3, (e) x=0.4, (f) x=0.5 samples with relative intensity I/I_0. 65

7. **Table 3.6** Comparison of lattice parameters a and c (Å) with estimated standard deviation (in parenthesis), unit cell volume (Å³) and average particle size (Pnm) of (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 system. 66

8. **Table 4.1** Comparison of different parameters obtained from P-E loop of (Bi_{1-x}Li_x)(Fe_{1-x}Ta_x)O_3 system. 84

9. **Table 4.2** Comparison of different parameters obtained from P-E loop of (Bi_{1-x}Na_x)(Fe_{1-x}Ta_x)O_3 system. 83

10. **Table 4.3** Comparison of different parameters obtained from P-E loop of (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 system. 86

11. **Table 4.4** Comparison of different parameters obtained from P-E loop of (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 system. 87

12. **Table 5.1** Summary of the values obtained from the electrical parameters corresponding to the equivalent circuit model used in the fitting processes of the measured data at different temperatures for all (Bi_{1-x}Li_x)(Fe_{1-x}Ta_x)O_3 system. 97

13. **Table 5.2** Summary of the values obtained from the electrical parameters corresponding to the equivalent circuit model used in the fitting processes of the measured data at different temperatures for all (Bi_{1-x}Na_x)(Fe_{1-x}Ta_x)O_3 system. 98

14. **Table 5.3** Summary of the values obtained from the electrical parameters corresponding to the equivalent circuit model used in the fitting processes of the measured data at different temperatures for all (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 system. 99

15. **Table 5.4** Comparison of values of activation energy calculated from the temperature dependence relaxation time (τ_z and τ_m) plots derived from both impedance and modulus spectra and dc conductivity plot both for bulk and grain boundary for all the samples. 124

16. **Table 6.1** Activation energy values of Arrehenious ac conductivity plots for the (Bi_{1-x}Li_x)(Fe_{1-x}Ta_x)O_3 samples. 130

17. **Table 6.2** Activation energy values of Arrehenious ac conductivity plots for the (Bi_{1-x}Na_x)(Fe_{1-x}Ta_x)O_3 samples. 132

18. **Table 6.3** Activation energy values of Arrehenious ac conductivity plots for the (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 samples. 134

19. **Table 6.4** Variation of activation energy E_a (eV) of (Bi_{1-x}Li_x)(Fe_{1-x}Ta_x)O_3 system calculated from J-E plot. 142

20. **Table 6.5** Variation of activation energy E_a (eV) of (Bi_{1-x}Na_x)(Fe_{1-x}Ta_x)O_3 system calculated from J-E plot. 143

21. **Table 6.6** Variation of activation energy E_a (eV) of (Bi_{1-x}K_x)(Fe_{1-x}Ta_x)O_3 system calculated from J-E plot. 144