

*Supplementary information*

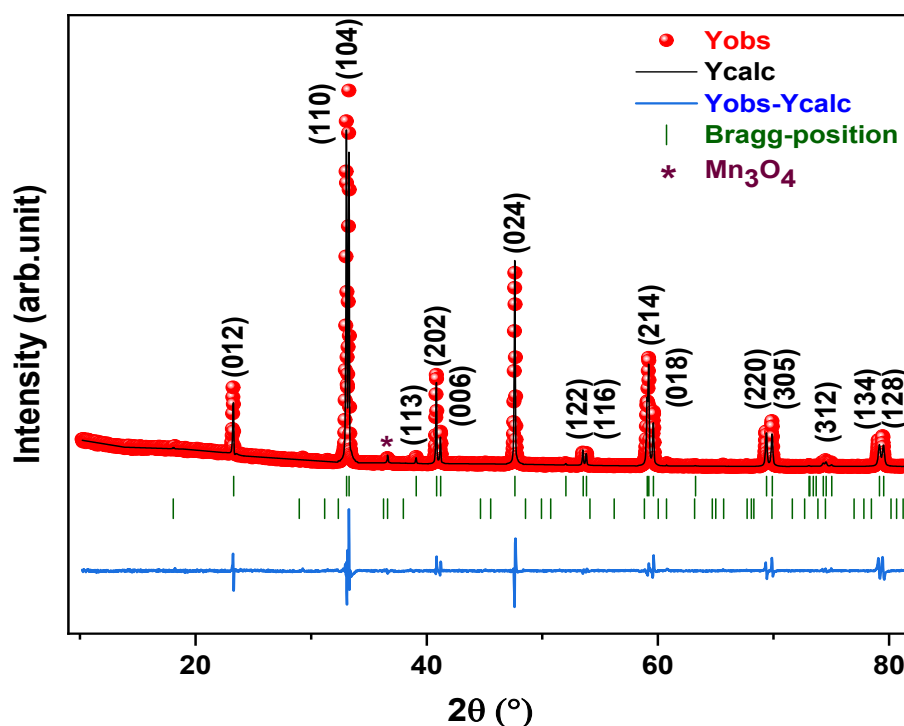
**Structural, morphological, magnetic and electrical properties of  $\text{La}_{0.8}\text{Na}_{0.2-x}\square_x\text{MnO}_3$  ( $0.00 \leq x \leq 0.15$ ) manganites**

M. Wali<sup>(a)</sup>, W. Hizi<sup>(b),\*</sup>, R. Dhahri<sup>(a)</sup>, H. Rahmouni<sup>(b)</sup>, K. Khirouni<sup>(c)</sup> and E. Dhahri<sup>(a)</sup>.

<sup>(a)</sup>Laboratoire de Physique Appliquée, Faculté des Sciences de Sfax, Université de Sfax, B.P.1171, 3000, Sfax, Tunisia

<sup>(b)</sup>Laboratoire de recherche Matériaux Avancés et Nanotechnologies, Institut Supérieur des Sciences Appliquées et de Technologie de Kasserine, Université de Kairouan, BP 471, Kasserine 1200, Tunisia

<sup>(c)</sup>Laboratoire de Physique des Matériaux et des Nanomatériaux appliquée à l'Environnement, Faculté des Sciences de Gabès cité Erriadh, Université de Gabès, 6079 Gabès, Tunisia



**Fig. SI1.** XRD patterns of  $\text{La}_{0.8}\text{Na}_{0.2-x}\square_x\text{MnO}_3$  system ( $x=0.00$ ).

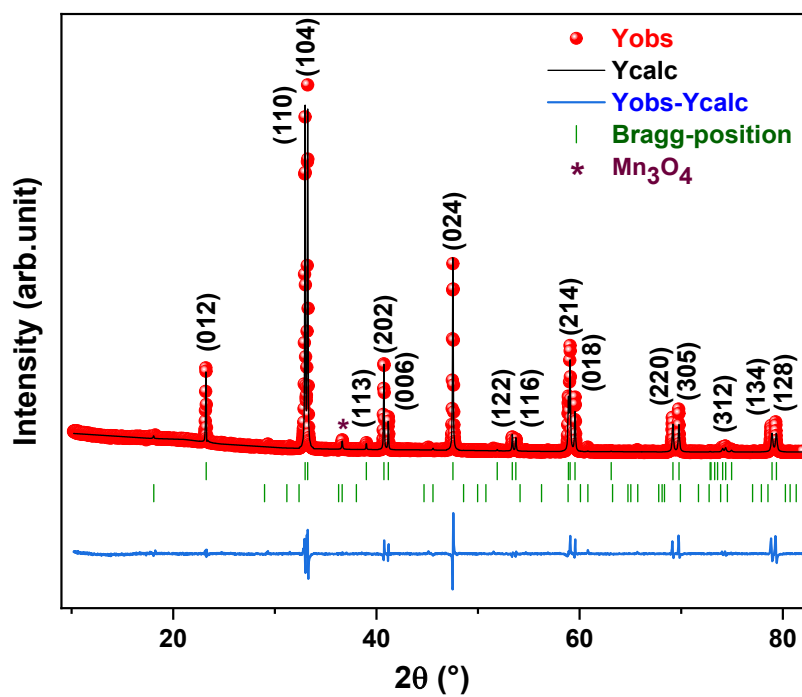


Fig.SI2. XRD patterns of  $\text{La}_{0.8}\text{Na}_{0.2-x}\square_x\text{MnO}_3$  system ( $x=0.05$ ).

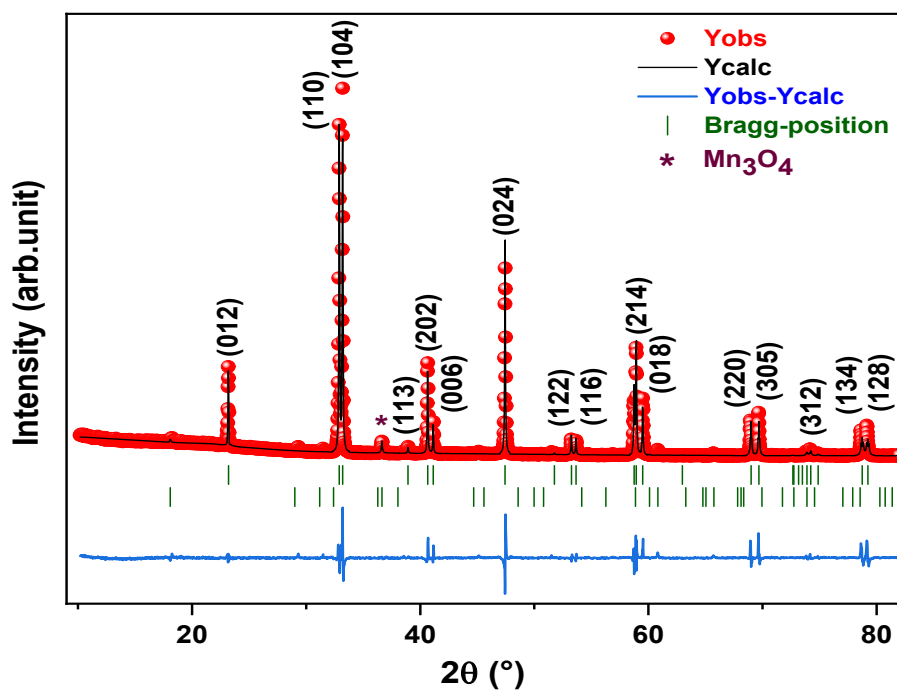


Fig.SI3. XRD patterns of  $\text{La}_{0.8}\text{Na}_{0.2-x}\square_x\text{MnO}_3$  system ( $x=0.10$ )

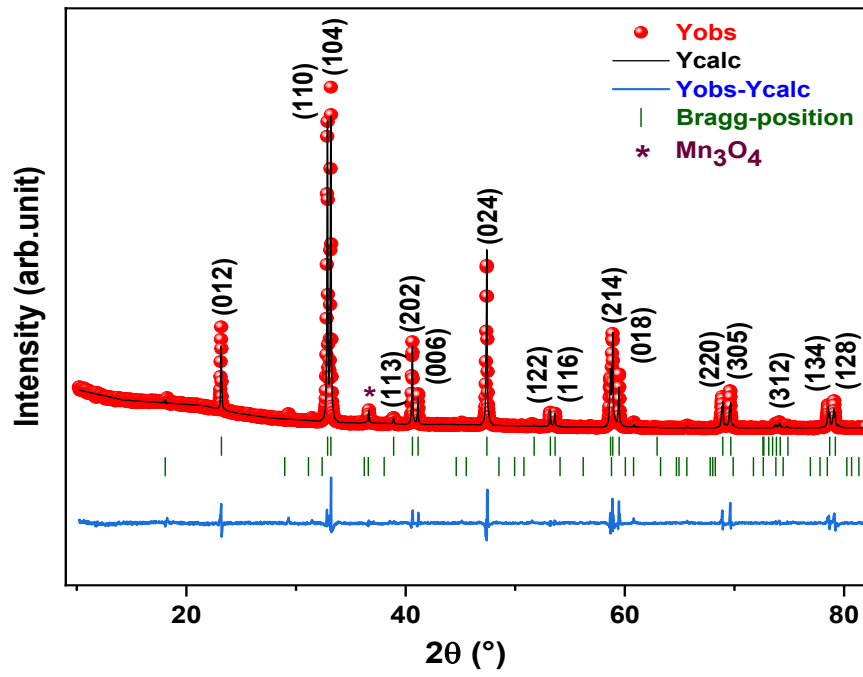


Fig.SI4. XRD patterns of  $\text{La}_{0.8}\text{Na}_{0.2-x}\square_x\text{MnO}_3$  system ( $x=0.15$ )

**Table.SI5.a.** Results of Rietveld refinements, determined from XRD patterns recorded at room temperature for  $\text{La}_{0.8}\text{Na}_{0.2-x}\square_x\text{MnO}_3$  compounds ( $0.00 \leq x \leq 0.15$ )

| Compound                  | $\text{La}_{0.8}\text{Na}_{0.2}\text{MnO}_3$ | $\text{La}_{0.8}\text{Na}_{0.15}\text{MnO}_3$ | $\text{La}_{0.8}\text{Na}_{0.1}\text{MnO}_3$ | $\text{La}_{0.8}\text{Na}_{0.05}\text{MnO}_3$ |
|---------------------------|----------------------------------------------|-----------------------------------------------|----------------------------------------------|-----------------------------------------------|
| Structure type            | Rhombohedral                                 | Rhombohedral                                  | Rhombohedral                                 | Rhombohedral                                  |
| Space group               | $R\bar{3}c$                                  | $R\bar{3}c$                                   | $R\bar{3}c$                                  | $R\bar{3}c$                                   |
| <b>Lattice parameters</b> |                                              |                                               |                                              |                                               |
| a (Å)                     | 5.4123(6)                                    | 5.4276(8)                                     | 5.4400(6)                                    | 5.4441(2)                                     |
| c (Å)                     | 13.1351(9)                                   | 13.1462(3)                                    | 13.1549(3)                                   | 13.1550(8)                                    |
| V (Å <sup>3</sup> )       | 55.538                                       | 55.8998                                       | 56.1928                                      | 56.2766                                       |
| <b>Atomic position</b>    |                                              |                                               |                                              |                                               |
| <b>La</b>                 |                                              |                                               |                                              |                                               |
| x                         | 0                                            | 0                                             | 0                                            | 0                                             |
| y                         | 0                                            | 0                                             | 0                                            | 0                                             |
| z                         | 0.25                                         | 0.25                                          | 0.25                                         | 0.25                                          |
| Occ (La)                  | 0.2698                                       | 0.27206                                       | 0.27292                                      | 0.27045                                       |
| <b>Mn</b>                 |                                              |                                               |                                              |                                               |
| x                         | 0                                            | 0                                             | 0                                            | 0                                             |
| y                         | 0                                            | 0                                             | 0                                            | 0                                             |
| z                         | 0                                            | 0                                             | 0                                            | 0                                             |
| Occ (Mn)                  | 0.3185                                       | 0.31275                                       | 0.30972                                      | 0.30036                                       |
| <b>O</b>                  |                                              |                                               |                                              |                                               |
| x                         | 0.54657                                      | 0.54726                                       | 0.54896                                      | 0.54811                                       |
| y                         | 0                                            | 0                                             | 0                                            | 0                                             |
| z                         | 0.25                                         | 0.25                                          | 0.25                                         | 0.25                                          |
| Occ (O)                   | 0.96509                                      | 1.01934                                       | 0.98488                                      | 0.96872                                       |
| <b>Na</b>                 |                                              |                                               |                                              |                                               |
| x                         | 0                                            | 0                                             | 0                                            | 0                                             |
| y                         | 0                                            | 0                                             | 0                                            | 0                                             |
| z                         | 0.25                                         | 0.25                                          | 0.25                                         | 0.25                                          |
| Occ (Na)                  | 0.03479                                      | 0.04732                                       | 0.04263                                      | 0.04497                                       |

**Table.SI5.b.** Results of Rietveld refinements, determined from XRD patterns recorded at room temperature for Mn<sub>3</sub>O<sub>4</sub> secondary phase.

| <b>Compound</b>                             | <b>La<sub>0.8</sub>Na<sub>0.2</sub>MnO<sub>3</sub></b> | <b>La<sub>0.8</sub>Na<sub>0.15</sub>MnO<sub>3</sub></b> | <b>La<sub>0.8</sub>Na<sub>0.1</sub>MnO<sub>3</sub></b> | <b>La<sub>0.8</sub>Na<sub>0.05</sub>MnO<sub>3</sub></b> |
|---------------------------------------------|--------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------|
| <b>Secondary phase</b>                      | Mn <sub>3</sub> O <sub>4</sub>                         | Mn <sub>3</sub> O <sub>4</sub>                          | Mn <sub>3</sub> O <sub>4</sub>                         | Mn <sub>3</sub> O <sub>4</sub>                          |
| <b>Structure type</b>                       | Tetragonal                                             | Tetragonal                                              | Tetragonal                                             | Tetragonal                                              |
| <b>Space group</b>                          | I 41/a m d                                             | I 41/a m d                                              | I 41/a m d                                             | I 41/a m d                                              |
| <b>Lattice parameters (secondary phase)</b> |                                                        |                                                         |                                                        |                                                         |
| <b>a (Å)</b>                                | 5.7346(1)                                              | 5.7317(6)                                               | 5.7314(5)                                              | 5.7393(8)                                               |
| <b>c (Å)</b>                                | 9.4678(6)                                              | 9.4586(8)                                               | 9.4535(2)                                              | 9.4551(2)                                               |
| <b>V (Å<sup>3</sup>)</b>                    | 311.359                                                | 310.747                                                 | 310.544                                                | 311.457                                                 |
| <b>Atomic position</b>                      |                                                        |                                                         |                                                        |                                                         |
| <b>Mn1</b>                                  |                                                        |                                                         |                                                        |                                                         |
| <b>x</b>                                    | 0                                                      | 0                                                       | 0                                                      | 0                                                       |
| <b>y</b>                                    | 0                                                      | 0                                                       | 0                                                      | 0                                                       |
| <b>z</b>                                    | 0                                                      | 0                                                       | 0                                                      | 0                                                       |
| <b>Occ (Mn1)</b>                            | 0.32191                                                | 0.27086                                                 | 0.35968                                                | 0.28991                                                 |
| <b>Mn2</b>                                  |                                                        |                                                         |                                                        |                                                         |
| <b>x</b>                                    | 0                                                      | 0                                                       | 0                                                      | 0                                                       |
| <b>y</b>                                    | 0.25                                                   | 0.25                                                    | 0.25                                                   | 0.25                                                    |
| <b>z</b>                                    | 0.625                                                  | 0.625                                                   | 0.625                                                  | 0.625                                                   |
| <b>Occ (Mn2)</b>                            | 0.04589                                                | 0.26812                                                 | 0.09478                                                | 0.20662                                                 |
| <b>O</b>                                    |                                                        |                                                         |                                                        |                                                         |
| <b>x</b>                                    | 0                                                      | 0                                                       | 0                                                      | 0                                                       |
| <b>y</b>                                    | 2.24221                                                | 0.21384                                                 | 0.22292                                                | 0.02229                                                 |
| <b>z</b>                                    | 0.22517                                                | 0.52382                                                 | 0.38402                                                | 0.38458                                                 |
| <b>Occ (O)</b>                              | 0.29545                                                | 0.45481                                                 | 0.34746                                                | 0.32421                                                 |