

Ilham BEZZA<sup>1</sup>, Maximilian Kaus<sup>2</sup>, Ralf Heinzmann<sup>2</sup>, Kristian Nikolowski<sup>3,4</sup>, Helmut Ehrenberg<sup>3,4</sup>, Sylvio Indris<sup>2,4</sup>, Horst Hahn<sup>2,4</sup>, **Ismael SAADOUNE<sup>1</sup>**

<sup>1</sup>Laboratoire de Chimie des Matériaux et de l'Environnement, Université Cadi Ayyad, Avenue A. Khattabi, BP 549 Marrakech, Morocco; e-mails: [isaadoune@uca.ma](mailto:isaadoune@uca.ma)

[ilhambezza@yahoo.com](mailto:ilhambezza@yahoo.com)

<sup>2</sup>Karlsruhe Institute of Technology, Institute of Nanotechnology, Hermann-von-Helmholtz Platz 1, 76344 Eggenstein-Leopoldshafen, Karlsruhe, Germany

<sup>3</sup>Karlsruhe Institute of Technology, Institute of Applied Materials, Hermann-von-Helmholtz Platz 1, 76344 Eggenstein-Leopoldshafen, Karlsruhe, Germany

<sup>4</sup>Helmholtz Institute Ulm for Electrochemical Energy Storage, Albert-Einstein-Allee 11, 89069 Ulm, Germany

## Abstract

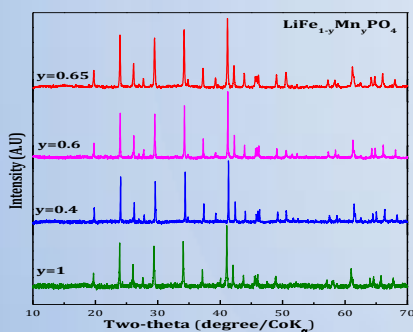
LiFe<sub>1-y</sub>Mn<sub>y</sub>PO<sub>4</sub> olivines were synthesised by the combustion method. The samples were investigated using a several techniques: XRD, <sup>57</sup>Fe Mössbauer, <sup>7</sup>Li NMR. Electrochemical cycling of LiFe<sub>1-y</sub>Mn<sub>y</sub>PO<sub>4</sub> phosphates showed that the capacity decreases with increased amount of Mn.

## Experimental

LiFe<sub>1-y</sub>Mn<sub>y</sub>PO<sub>4</sub> was synthesised by the combustion method. The precursors were used in the nitrate form while the phosphoric acid H<sub>3</sub>PO<sub>4</sub> was used as phosphate source and the sucrose was the fuel and the carbon source. The sample was calcined at 800°C for 12h.

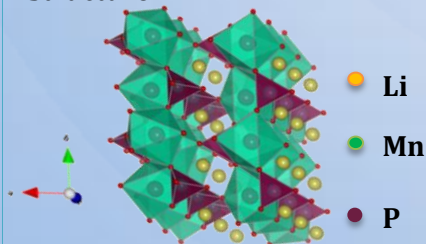
## Characterization

### XRD spectra:



LiFe<sub>1-y</sub>Mn<sub>y</sub>PO<sub>4</sub> crystallized in the orthorhombic system with the Pnma space group.

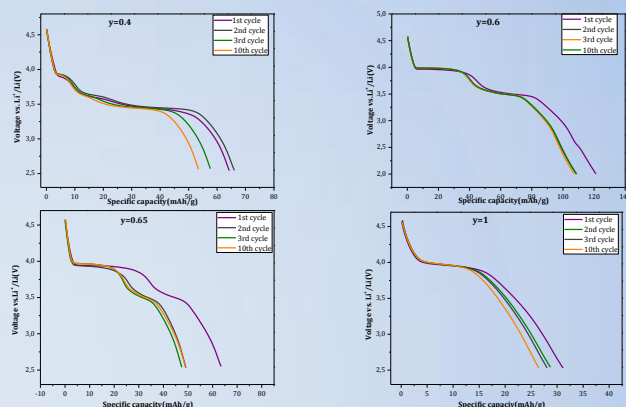
### Structure



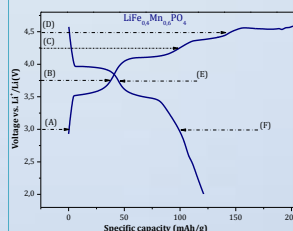
## Conclusion

LiFe<sub>1-y</sub>Mn<sub>y</sub>PO<sub>4</sub> phosphates, synthesised by the combustion method, crystallized in the orthorhombic system with an open structure. The Mossbauer spectroscopy confirmed that the as prepared materials contain Fe<sup>2+</sup> ions that are completely oxidized to Fe<sup>3+</sup> during the charge of the Li//LiFe<sub>1-y</sub>Mn<sub>y</sub>PO<sub>4</sub> battery. The electrochemical cycling showed that the specific capacity decrease with increased Mn content.

## Electrochemical properties



## Mössbauer spectroscopy study

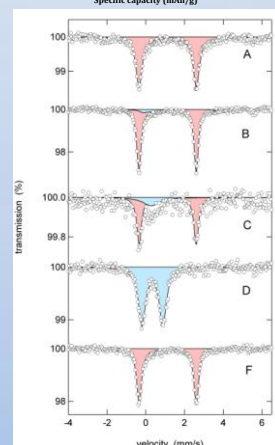


- <sup>57</sup>Fe Mössbauer spectra of LiFe<sub>0.4</sub>Mn<sub>0.6</sub>PO<sub>4</sub> were collected at different delithiation states.

- The parameters (IS, QS) confirm the presence of Fe<sup>2+</sup> in state A. the broad doublet successively disappears and a new, narrow doublet is formed (Fe<sup>3+</sup>).

- The spectrum shows that the Fe<sup>2+</sup> ions have been oxidized completely to Fe<sup>3+</sup>.

- The NMR spectra (not shown here) confirm the presence of two phase domains even when Fe is substituted by Mn



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