Workshop: Electrochemistry from Sensing to Energy Conversion and Storage

Preparation and Characterization of Electrode Materials in Lithium Batteries

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INTRODUCTION

The lithium batteries are electrochemical systems based on the use of intercalation compounds supported on porous structures. Different materials are used as cathodes: for example, mixed oxides of transition metals ($LiMO_2$, where M: Mn, Co and / or Ni), and carbons materials (commercial carbon and Sungite carbon) are used as anodes.

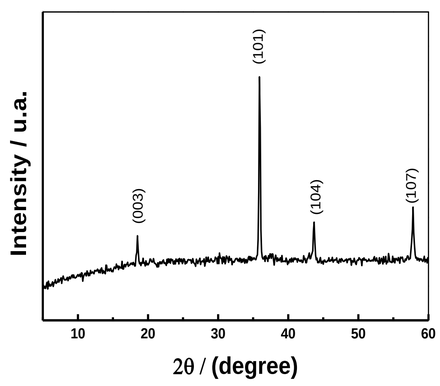
The preparation of anodes and cathodes materials are presented. Optical techniques (as DRX, SEM and TEM) are used to characterize the prepared material. The electrochemical performance are studied by electrochemical techniques: charge-discharge cycles, galvanostatic discharge at different currents and cyclic voltammetry.

MATERIAL PREPARATION

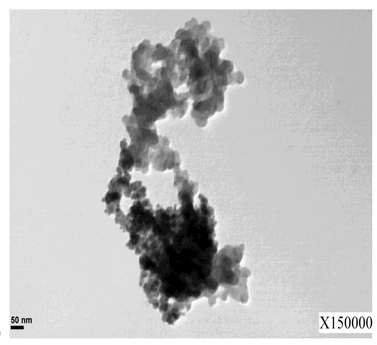
Hydrothermal synthesis (180 ºC- 4 h)

The suspension were filtered and washed. Precipitate + Li(OH) are combusted (oxygen atmosphere 900ºC).

XRD AND TEM CHARACTERIZATION

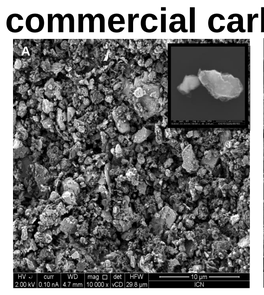


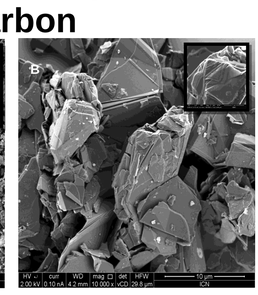
XRD patterns of $Li[Ni_{1/3}Co_{1/3}Mn_{1/3}]O_2$

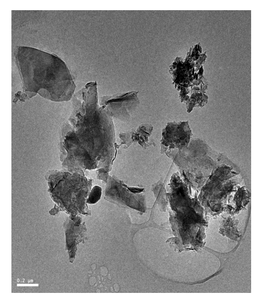


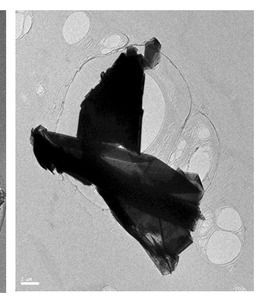
TEM

SEM and TEM - Sungite and commercial carbon

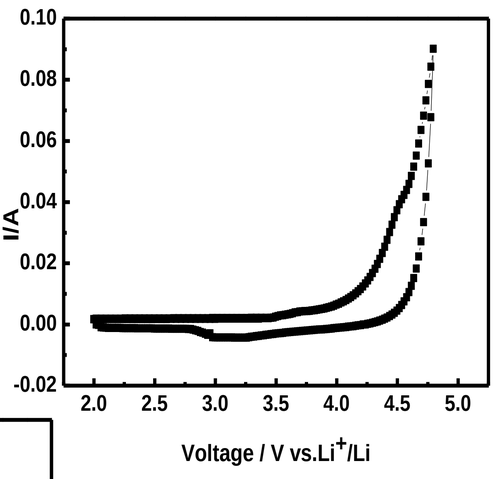


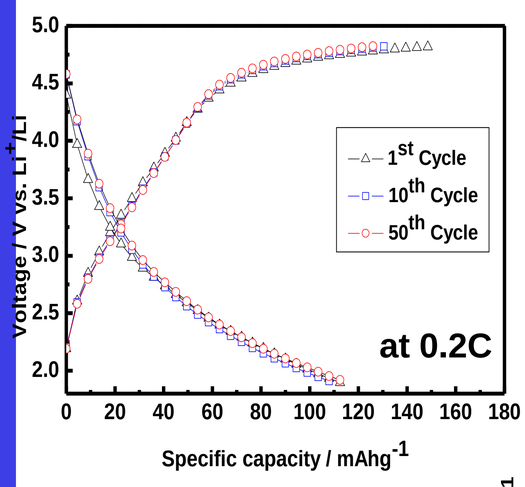


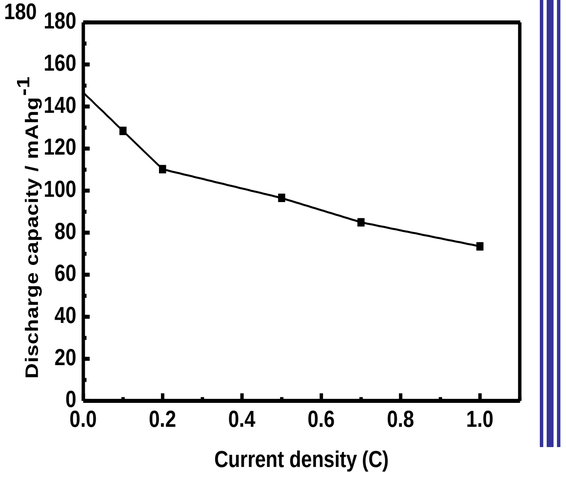




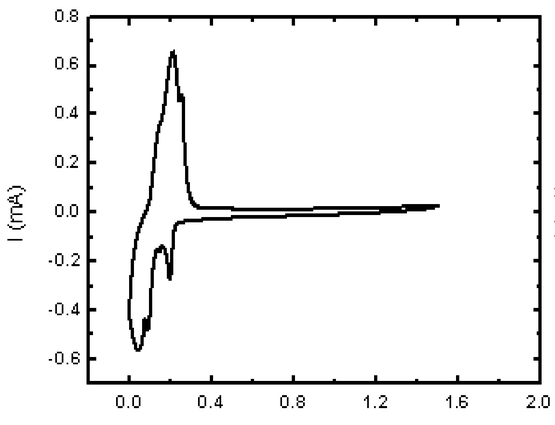
ELECTROCHEMCIAL RESULTS

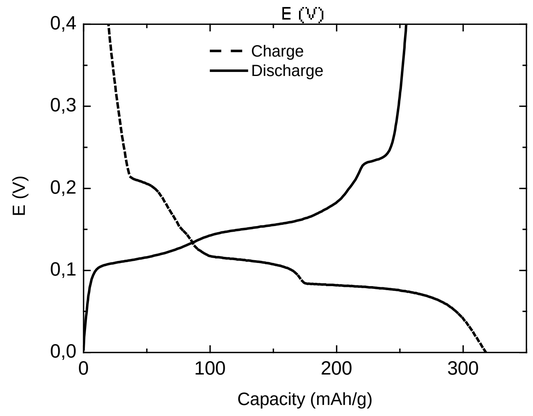




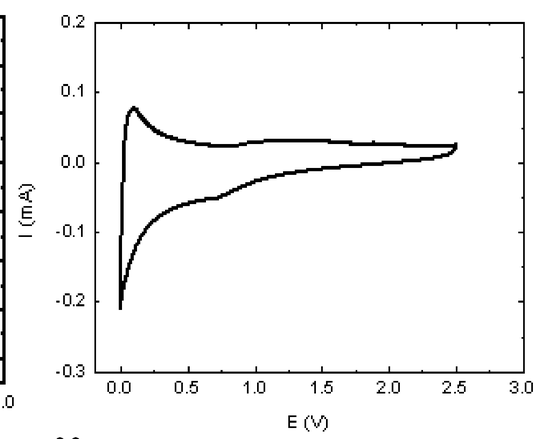


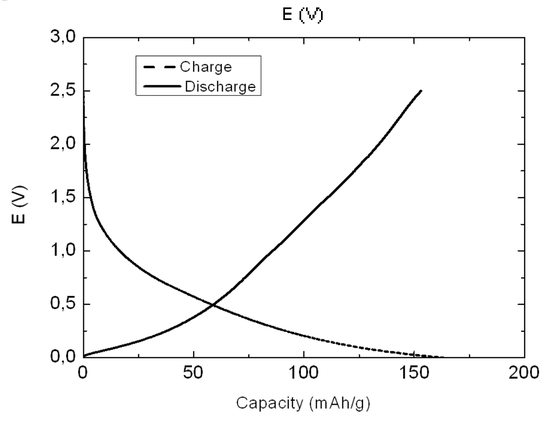
Sungite carbon

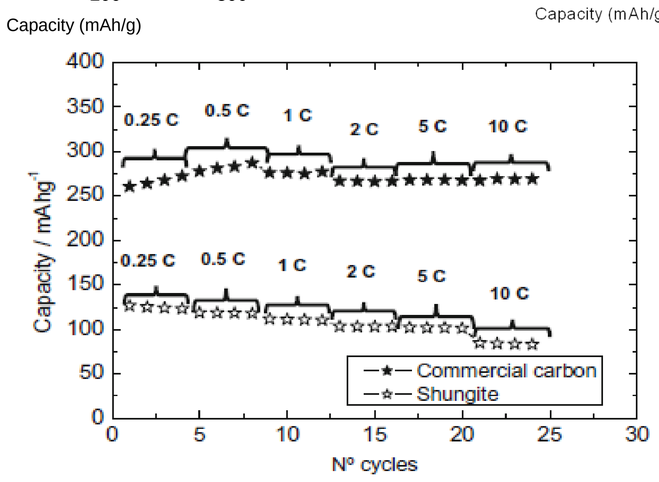




Commercial carbon







CONCLUSIONS

✓ $Li[Ni_{1/3}Co_{1/3}Mn_{1/3}]O_2$ are synthesized by hydrothermal route that is a simple, low cost and low temperatures process. This method allows to prepare highly homogeneous electrode materials. $Li[Ni_{1/3}Co_{1/3}Mn_{1/3}]O_2$ products show good electrochemical performance: stability to cycling and 110 $mAhg^{-1}$ discharge capacity.

✓ The commercial carbon presents higher electrochemical performance than Sungite carbon (280 $mAhg^{-1}$ vs 120 $mAhg^{-1}$)