LITHIUM INSERTION INTO RAMSDELLITE $LI_2TI_3O_7$

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Introduction

Lithium-ion batteries have been emerging as power sources for modern electronics because they have high working voltage, high energy density, and good cyclability [1, 2]. In these batteries, numerous effort have been made to find alternative anode materials to replace graphite in Li-ion batteries. Notably, lithium titanium oxides due to an average voltage around 1.5V, such as the spinel phase $Li_4Ti_5O_{12}$ [3, 4] or the ramsdellite phase $Li_2Ti_3O_7$ [5, 6] have been proposed.

We have already reported the synthesis of a mixed lithium titanium spinel $Li_4Ti_5O_{12}$ obtained via a sol-gel process in non aqueous media [4]. In this paper, we report the main electrochemical features achieved for the ramsdellite $Li_2Ti_3O_7$ synthesized via a sol-gel process.

Experimental

The precursor solution for $Li_2Ti_3O_7$ was a mixture of 0,033 mole of titanium alkoxide, $Ti(OiPr)_4$ and 0.0264 mol of lithium acetate dihydrate ($LiOAc.2H_2O$). Hydrolysis, generated in situ by the dissolution of the hydrated lithium salt, followed by polymerisation occurs and a white monolithic gel is obtained after 1H. After calcination of the gel at 1050°C during 24H and quenching, the sample was characterized by X-ray diffraction.

Results and discussion

The powder X-ray diffaction data of the sample is shown in Fig.1. All the diffraction peaks are indexed using an orthorombic cell with the following parameters a = 5.045 Å, b = 9.542 Å and c = 2.943 Å corresponding to the ramsdellite structure $Li_2Ti_3O_7$.

Fig.2 displays the chronopotentiometric behaviour of $Li_2Ti_3O_7$ at constant current density between 3V-1V in 1M $LiClO_4$/PC. At C/20, two insertion process appear. The first step involves a faradaic yield of 0.6 Faraday per mole with a decrease in potential from 2.9V up to 1.5V. The second step with a lower slope located around 1.4V corresponds to the accomodation of 1.1 additional lithium ion. During cycling experiments performed at discharge charge rate of C/20, a stabilization of the specific capacity around 120 $Ah.kg^{-1}$ occurs after the 35^{TH} cycle (Fig.3).

Reference

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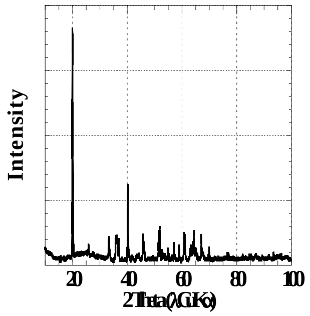

Fig.1 : Powder X-ray diffraction pattern of $Li_2Ti_3O_7$ obtained at 1050°C/24H after quenching.

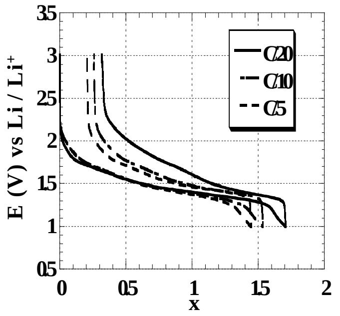

Fig.2 : Chronopotentiometric behaviour of $Li_2Ti_3O_7$ in 1M $LiClO_4$/PC.

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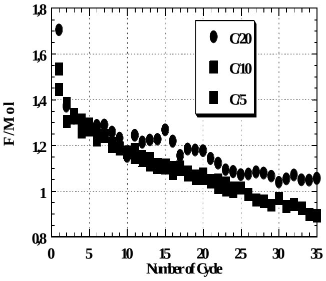

Fig 3 : Evolution of the faradaic yield as a function of the number of cycles for differents discharge-charge rates.