



Contribution ID: 15

Type: not specified

Particle size and shape dependence of the ionic diffusivity in LiMnPO₄ cathode for lithium ion batteries

Tuesday 4 November 2014 12:00 (1h 15m)

Advanced lithium ion batteries require higher safety, lower cost, longer durability and lower toxicity to apply larger applications [1].

LiMnPO₄ can be an alternative cathode material due to its stable structure, low material cost, lower toxicity, high theoretical capacity (170 mAh/g), high operating voltage (4.1 V vs. Li) and good capacity retention. However, it suffers from poor electronic and ionic conductivity [2, 3]. Its poor ionic conductivity can be overcome by employing nano-particles in order to shorten Li-ion path lengths [4, 5]. Enhancement in electron transport is achieved by carbon coated nanocomposite cathode material [6, 7]. Most high-performing LiMnPO₄ materials were so far achieved by adding a large amount of carbon (15–30 wt%) in order to increase the electronic conductivity [8,9]. Recently, we reported < 30 nm sized nano-LiMnPO₄ reached 97 % of theoretical capacity with 10 wt% of carbon additive in total in the electrodes [10]. We investigated further to study the favorable direction for lithium ions in different shapes of nano-LiMnPO₄ and the desired composite structure to improve the electrochemical properties.

Since olivine LiMnPO₄ materials have one preferred direction of lithium ion diffusion in the lattice, we synthesized various shapes and sizes of nano-LiMnPO₄ (Fig. 1). Chemically exfoliated graphene from graphite flake was applied to nano-LiMnPO₄, forming a thin coating on the surface of the active material (Fig. 2).

Afterwards, we determined the lithium ion diffusion coefficients in terms of shapes and sizes of LiMnPO₄ nanomaterials using an electrochemical technique of cyclic voltammetry (Table. 1).

Author: Dr KWON, Nam Hee (University of Fribourg, Chemistry department, Fribourg, Switzerland)

Co-authors: Dr FABIO, Edele (University of Fribourg, Chemistry department); YIN, Hui (University of Fribourg, Chemistry department); Prof. FROMM, Katharina (University of Fribourg, Chemistry department); VAVROVA, Tatiana (University of Fribourg, Chemistry department)

Presenters: Prof. FROMM, Katharina (University of Fribourg, Chemistry department); Dr KWON, Nam Hee (University of Fribourg, Chemistry department, Fribourg, Switzerland)

Session Classification: Meet and Eat, Poster session