Nanostructured $Li_4Ti_5O_{12}$ spinel as an anode for three-dimensional Li-ion battery.

Marketa Zukalova, Jan Prochazka and Ladislav Kavan

J. Heyrovský Institute of Physical Chemistry, v.v.i. Academy of Sciences of the Czech Republic
Dolejskova 3, CZ-18223 Prague 8, Czech Republic
marketa.zukalova@jh-inst.cas.cz

Nanocrystalline spinel prepared by sol-gel process exhibits excellent activity towards Li-insertion at high charging rates; smaller Li diffusion coefficients of nanoparticles are compensated by increase in active electrode area[1]. The optimum performance is achieved for nanocrystalline spinel with surface area between 20 and 100 m^2/g. These materials can be charged/discharged nearly to the nominal capacity of $Li_4Ti_5O_{12}$ (175 mAh/g) independently of the charging rate at the mentioned conditions.

Phase pure $Li_4Ti_5O_{12}$ nanofibres were prepared by electrospinning. They exhibited charge capacity of ~100 mAh/g at 2C, but this value decreased significantly at higher charging rates.

The electrochemical performance of nanosized $Li_4Ti_5O_{12}$ with optimized structure was studied both in the form of thick layer electrode incorporated in Al container and in complete experimental cell containing the above mentioned electrode, separator and Li sheet as a counter electrode. The electrochemical behavior of systems was examined by means of cyclic voltammetry of Li insertion, galvanostatic chronopotentiometry and chronoamperometry. The experimental cell exhibited very good stability even with the spinel electrode as thick as 7.5 mm. Introduced 3D concept represents promising fit for high capacity rechargeable microbatteries.

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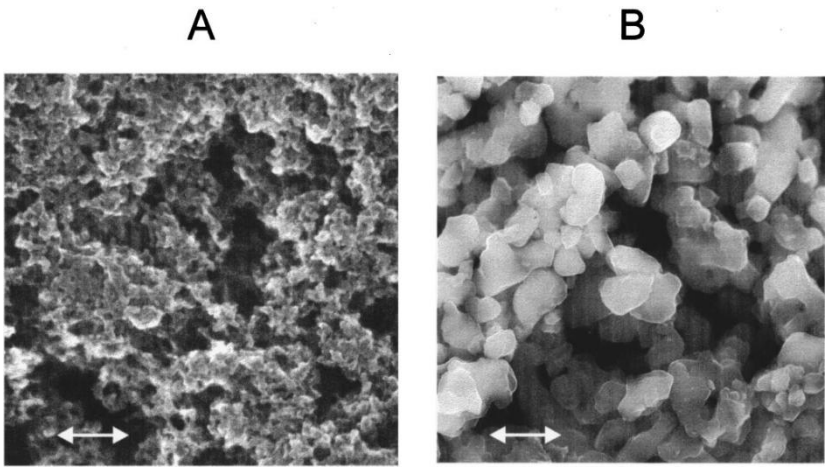
Figure 1:



Sample A: Classical solid state synthesis

Sample B: Nanocrystalline $Li_4Ti_5O_{12}$ made by sol-gel process: hydrolysis of ethanolic solution of Li and Ti alkoxides

References

1) Kavan,L.; Prochazka,J.; Spitler,T.M.; Kalbac,M.; Zukalova,M.; Drezen,T.; Grätzel,M. *J.Electrochem.Soc.* **2003**, *150*, A1000-A1007