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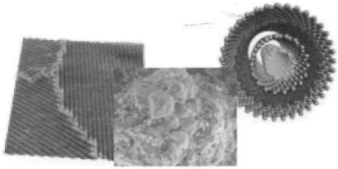

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BOOK OF ABSTRACTS

web-site: http://www.phys.univ.kiev.ua/material/conference

P1.17. MESOPOROUS SILICA AS ELECTRODE MATERIAL FOR LITHIUM POWER SOURCES

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The possibility of use of the ordered mesoporous SBA-16 silica as an electrode material was studied in this work. Synthesis of the SBA-16 silica was carried out with application of tetraethoxysilane (TEOS) as a silica precursor, and Pluronic F127 – polyethyleneoxide-polypropyleneoxide-polyethyleneoxide triblock polymer ($PEO_{106}PPO_{70}PEO_{106}$) as a template. For this purpose 4.5 g of Pluronic F127 was previously dissolved in 19.5 ml of 38 % hydrochloric acid and 16.5 g of *n*-butyl alcohol was added. After mixing for 1 h 22.5 ml TEOS was added to solution, mixture was stirred for 24 h at 45°C and then was placed in thermostat at 100°C for 48 h. Molar ratios of components were following:

$$TEOS : F127 : BuOH : H_2O : HCl = 315 : 1 : 566 : 37735 : 565.$$

The synthesized sample was filtered, washed by distilled water and dried up at 100°C for 5 h. To remove an organic template the obtained composite was calcinated for 5 h at 550°C. Silica specific surface area determined by the BET method was 810 m^2/g. According to data of transmission electron microscopy the synthesized silica has well-ordered and regularly located pores with the average diameter of 5 nm.

The discharge capacity of mesoporous silica was 180 mA·h/g at the first cycle. However, after charging of element it was 9 mA·h/g only, and the value of the irreversible capacity exceeded 95 %. The main reason of such behaviour of the electrochemical system can be connected with irreversible absorption of lithium ions on the surface of cathode material with the simultaneous formation of the superficial layer with the ionic type of conductivity. It should be noted that coulomb efficiency is near to 1 at growth of number of charge/discharge cycles (~ 200). Thus, a charge / discharge capacity does not exceed 1 mA·h/g.

The use of impedance spectroscopy method gave possibility to explore the kinetic peculiarities of passing electrochemical processes in the Li / 1 M $LiBF_4$ γ-butirolactone / SiO_2 system. It was selected the equivalent scheme, which allows to model satisfactorily the impedance spectrum in all explored frequency range. Physical interpretation was offered for every element of the scheme. The dependences of equivalent scheme parameters on equilibrium potential (composition) of Li_xSiO_2-electrode have been received.