THERMODYNAMIC OF INTERCALATION OF NANOSIZED TiO_2 WITH STRUCTURAL DEFECTS

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The problem of increasing of energy-conversion efficiency of mass and volume unit of material is of urgent importance in the field of power sources manufacturing. To dissolve the mentioned problem we used nanosized TiO_2 to increase the efficiency of Lithium current forming.

The nanosized titanium dioxide marked as TiO_2-N was synthesized by pyrogenic method from $TiCl_4$. This powder and TiO_2-M (Merck) were used in experiments. The X-ray structure studies were carried out with using DRON-3 X-ray diffractometer ($Cu_{K\alpha}$ – radiation, $\lambda = 1.5418$ Å; monochromatized by LiF single crystal). The powder size was characterized by small-angle scattering method and electron microscopy. The electrochemical behavior of the investigated materials was characterized by impedance spectroscopy in a frequency range $10^{-2} \div 10^{5}$ Hz using AUTOLAB instrument (ECOCHEMIE) electrochemical interface controlled by a computer. The electrodes were formed by mixing 85 wt.% active material, 10 wt.% acetylene black and 5 wt.% PTFE as binder. The electrolyte was 1M $LiBF_4$ solution in γ-butyrolactone. The experiments were carried out in a three electrode glass cell. Nickel foil was used as a counter electrode, and silver chloride electrode as the reference electrode.

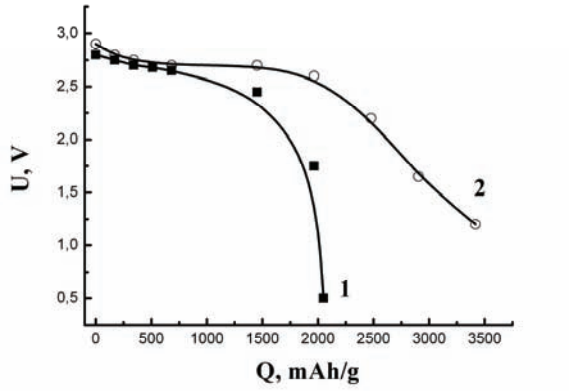

Figure 1. Discharge curves of elements with cathodes with TiO_2-M – 1, and TiO_2-N – 2.

The change of macrosized by nanosized TiO_2 powder leads to specific capacity increasing. As it was determined the reason of such behavior lays in size effect and modification of energetic topology of impurity system. The thermodynamic parameters of intercalation reaction agree well with investigated physical properties of ceramic samples.