

## Modification of Titania-Based Nanoparticles for Anode Materials of Li Ion Battery

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**Objective:** The present poster contribution aims at optimization of electrochemical properties of titania (N doped anatase  $\text{TiO}_2 / \text{N}$ ) and Li-Ti ternary oxides ( $\text{Li}_4\text{Ti}_5\text{O}_{12}$ , LTO) with respect to their performance as anode materials in Li-ion battery by using mechanochemical effects.

**Experimentals:** The mixture of anatase with 10 mass% urea was co-milled with a small amount of ethanol in a planetary mill, dried and subsequently calcined in air up to 450 °C for 1 h to obtain  $\text{TiO}_2 / \text{N}$ . LTO was prepared from stoichiometric mixture of anatase and  $\text{LiOCOCH}_3$  (15 mass% ethanolic solution) was co-milled in a planetary mill, dried and calcined under argon up to 680 °C [1]. Product characterization and electrochemical properties are described in [1].

**Results and Discussion:** Cyclic voltammograms of the N-doped anatase, calcined at 450 °C at different scan rates are given in Fig. 1. Charge capacity was  $196 \text{ mAh} \cdot \text{g}^{-1}$ , slightly higher than the theoretical capacity of anatase,  $170 \text{ mAh} \cdot \text{g}^{-1}$ , presumably due to the coexisting second phase,  $\text{TiO}_2(\text{B})$ , because of mechanochemical phase transformation [2]. Cyclic voltammetry of Li insertion into LTO was given in [1]. Its performance and charge capacity was better than commercially available LTO, despite relatively small specific surface area,  $1.4 \text{ m}^2 \cdot \text{g}^{-1}$ . We are now paying efforts to obtain LTO with higher specific surface area.

**Conclusion:** Utilization of mechanochemical effects combined with subsequent optimized heat treatment pave the way to make the preparative methods of LIB anode materials more affordable.

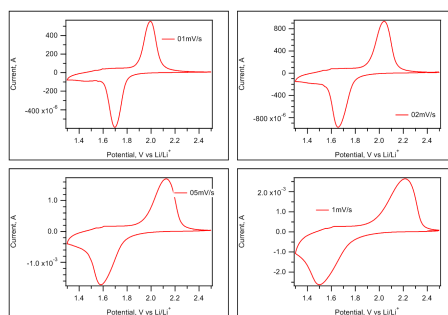


Figure 1: Cyclic voltammograms of the N-doped anatase, calcined at 450 °C at different scan rates.

- [1] Electrochemical Properties of Spinel  $\text{Li}_4\text{Ti}_5\text{O}_{12}$  Nanoparticles Prepared via a Low-Temperature Solid Route, M. Senna, M. Fabián, L. Kavan, M. Zukalová, J. Briancin, E. Turianicová, P. Böttke, M. Wilkening, V. Šepelák, J. Solid State Electrochem. 20 (2016) 2673.
- [2] Mechanochemical Preparation of Nanocrystalline  $\text{TiO}_2$  Powders and their Behavior at High Temperatures, A. Gajović, K. Furić, N. Tomašić, S. Popović, Ž. Skoko, S. Musić, J. Alloys Compds. 398 (2005) 188.