Contribution ID: **11** Type: **Poster**

Pulsed plasma chemical synthesis of carbon-bearing nanocomposites based on silicon and titanium oxides

Monday 19 June 2017 13:30 (1h 30m)

The paper presents the study on the plasma chemical synthesis of nanocomposite carbon-bearing powders based on SiO2 and TiO2 and the analysis of their main characteristics. The nanopowders were synthesized in the plasma chemical reactor using a pulsed electron beam for the low-temperature plasma generation. The experiments on the synthesis of powders were carried out using a TEA-500 pulsed electron accelerator. The main characteristics of the electron beam are as follows: 400-450 keV electron energy, 60 ns half-amplitude pulse duration, up to 200 J pulse energy, and 5 cm beam diameter. The following precursors were used for the production of carbon-bearing composites based on silicon and titanium oxides: SiCl4, TiCl4, O2, and CH4.
The morphology of the synthesized particles was studied using the LEO EVO 50 scanning electron microscope and the JEOL-II-100 transmission electron microscope with an accelerating voltage of 100 kV. To determine a crystal structure of nanopowder, the common technique of X-ray phase analysis was used. The reaction products were analyzed using a DRON-07 diffractometer; the elemental composition was examined using the Oxford ED2000 X-ray fluorescence analyzer. The substances included in the composite nanopowder were identified using Nicolet 5700 FT-IR spectrometer.
The synthesized composites can be applied as composite photocatalysts with a high efficiency and acting in the region of visible light, as well as the composites possessing electrophysical properties required for the manufacture of the improved lithium-ion batteries.

- Work supported by RFBR, project no. 16-38-00055 mol_a.

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Session Classification: Poster session I - Pulsed Power Industrial and Bio-Medical Applications

Track Classification: Pulsed Power Industrial and Bio-Medical Applications