

Final Report of project „AKTION“ 73p6 in period Jan. 1st 2016 to Jun. 30th,2016

Basic information

Start of the Project: July 1st, 2015

Closing of Project: June 30th, 2016

PARTNERS of the project:

TU Wien - principal leader Prof Günther Fafilek

Brno University of Technology (VUT v Brně) - - principal leader Assoc. Prof. Marie Sedlaříková

Visits of people from TU-Wien on Institute of Electrotechnology. FEEC, VUT Brno

Prof. Günther Fafilek

Date: May 17th – 20th. 2016 – 3 nights

Substantiation of the program:

- A. lecture “Thermodynamics of electrochemical reactions”
- B. Discussion of result, preparation of specimens and investigation of their properties
- C. Preparation of a common manuscript for publication in international respectful journal
- D. Negotiation concerning preparation of thin layer systems based on Al₂O₃

Date: June 13th to 16th – 3 nights

Substantiation of the program:

- A. Lecture „Kinetics of el electrochemical reactions“
- B. Discussion of results obtained during the Project
- C. Negotiation of possible prolongation of the cooperation, e.g., by prolongation of the project ACTION

BSc. Gesara Bismashofer

Date: May 9th to 18th – 9 nights

During her stay on VUT, she has paid interest to testing mixed electrolytes differing in concentration of lithium salts. Potential window, conductivity and comparison of their transference numbers was studied with the aim to estimate optimum of solvents and lithium salts for application ion lithium – ion accumulators.

Visits of people from Institute of BUT. FEEC, VUT Brno on TU WIEN

Doc. (Assoc. Prof.) Ing. Marie Sedlaříková, CSc, Ing. Miroslav Zatloukal

Date: March 8th to 11th, 2016

The aim of this visit was to perform preparatory task concerning the visit of Ing, Josef Máca on TU Wien. Further, possibility of using thin layers as electrolytes in accumulator systems utilizing sodium ions. The production of thin layers based on Al₂O₃ by use of magnetron reactive sputtering was discussed. Samples of Si substrates were manufactured at VUT Brno; their quality was checked using electron microscope. As a result of it, the intercalation of Na in manufactured layers will be tested in nearest future.

Preparation of a common manuscript for publication in international respectful journal was suggested during the visit.

In general, the mutual cooperation in investigation of new intercalation systems was evaluated and based on consultations at TU Wien the continuation of the common research for nearest period was recommended.

Ing. Josef Máca

Date of visit: April, 11th to May 5th, 2016

Ionic liquids and their application in lithium ion accumulators was studied experimentally.

The experiments performed at TU Wien also included corrosion on the boundaries ionic liquid and negative electrode.

Summary of achieved results

Within the framework of this project, silicon wafers covered by sputtered thin layers of aluminium in an inert argon atmosphere and in argon atmosphere with added oxygen with the aim of thin layer Al₂O₃ on the surface were manufactured. The aim of the Al₂O₃ layer formation was to increase the electrical conductivity.

These wafers were tested in electrochemical cells. The aim of this series was to judge their possible use as materials for Li-ion and Na-ion accumulators. The layers obtained by sputtering in pure argon achieved better parameters than those sputtered in presence of oxygen - presumably, the oxidation of silicon surface prior to the sputtering is suppressed in absence of oxygen. However, neither layer sputtered without oxygen nor with its addition is not long-time stable in cycling and the layer is damaged.

Společná publikace :T. Kazda 1, P Čudek 1, J. Vondrák 1, M. Sedlaříková 1, J. Tichý 1, M. Slávik, G. Fafílek, Lithium-sulphur batteries based on biological 3D structures, odeslána do časopisu Journal of Solid State Electrochemistry (IF), současné době je po revizi vrácena na drobné úpravy.

Final summary of the Project

1. All items in the approved program have been met
2. Results of investigation of ionic liquids application possibility show their use in electrochemical sources and it is necessary to examine further modification of new systems, including additives, controlling the ionic conductivity, the safety of the new battery systems and their effect on the electrode material. Finally, it is necessary to verify their stability and durability during charging and discharging cycles. This activity is time consuming, but fully possible with superior workplace equipment.
3. Research properties of thin layers of Al₂O₃ is new variant of the utilization of their unique conductive properties, it is appropriate to continue the study, and the preparation technology of the preparation thereof (magnetron sputtering) in various modes and the composition of the working environment. This means to prepare and investigate a larger number of samples, their compatibility with electrode materials and the changes in electrical properties during cycling.

These results of a joint project between the two universities are promising. A benefit is the successful cooperation doctoral students will be mutually profitable.

For these reasons we are interested in the **project ACTION extension for next period.**

