Dedicated to mark the centenary of Acad. Evgeni Budevski's birth

Sofia Electrochemical Days SED'22

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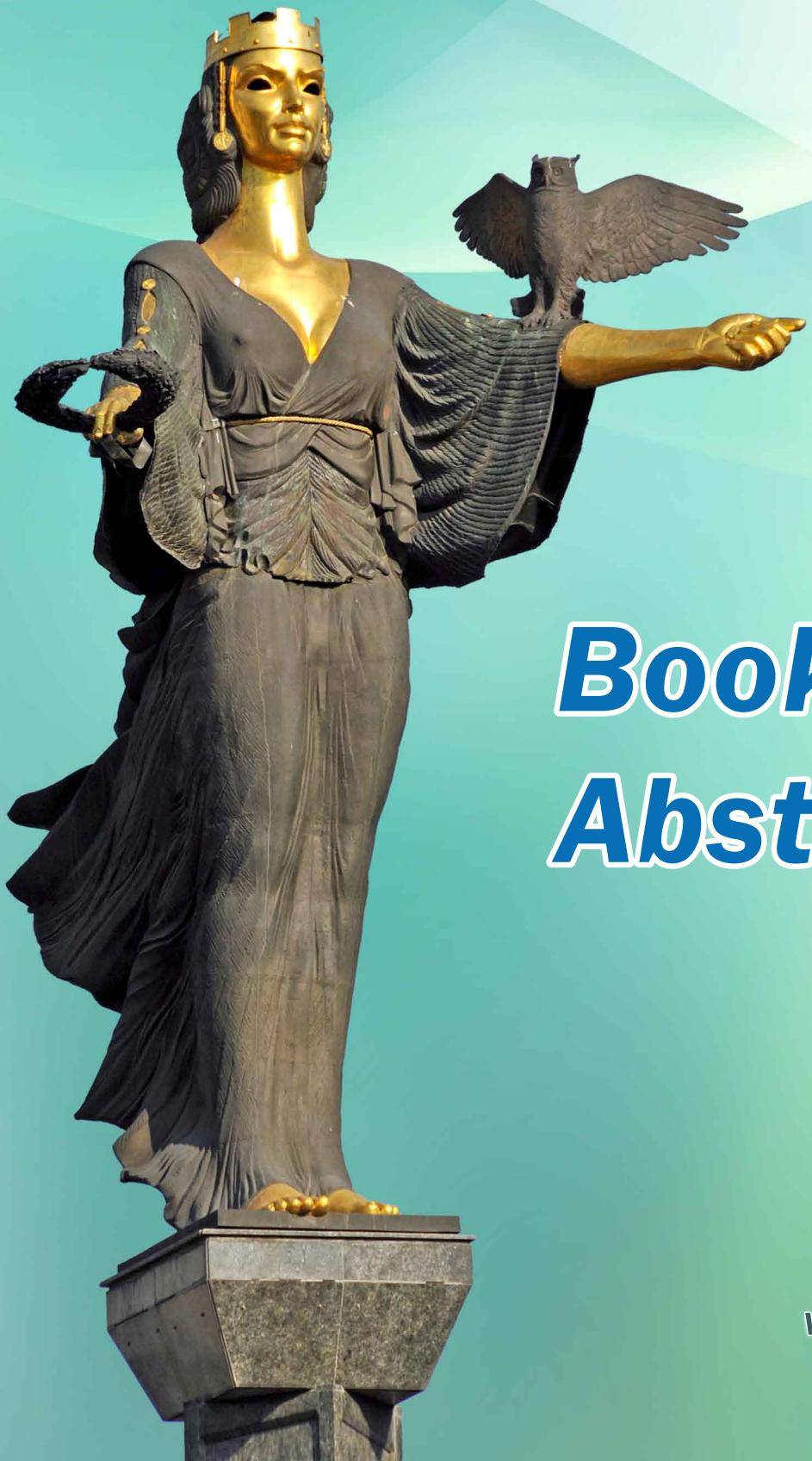

Book of Abstracts

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POSTER SESSION I (May, 12 2020, 18:10)

PI 1	**Krum Banov**: Composite electrodes based on $LiMn_2O_4$ with enhanced features for fast charge-discharge LIB
PI 2	**Krum Banov**: High capacity anodes based on nanostructured silicon for fast charge-discharge LIB
PI 3	**Veselin Zhelev**: Titanium doped perovskite as a novel anode for lithium ion battery
PI 4	**Simeon Stankov**: Electrochemical intercalation abilities of Cu_2SnS_3 in aprotic lithium system
PI 5	**Ana Arenillas**: Silicon-xerogel composites as anode materials for lithium ion batteries
PI 6	**Valentin Terziev**: Microstructure and electrochemical investigation of gas diffusion electrodes (GDEs) with bimetallic catalytic composition for metal hydride air batteries
PI 7	**Borislav Abrashev**: Investigation on the mechanical stability and electrochemical properties of the Zn electrode for rechargeable zinc- air batteries
PI 8	**Borislav Abrashev**: Zinc-air battery technology developments at IEES- BAS - five decades accumulated experience
PI 9	**Ilian Popov**: Advanced bi-functional catalysts for lead-air system
PI 10	**Albena Aleksandrova**: Application of porous sacrificial agent in negative electrode of lead battery
PI 11	**Svetlana Veleva**: Ni, Mn-composites as electrode materials for hybrid supercapacitors with polymer electrolyte
PI 12	**Borislava Mladenova**: Preparation of manganese oxides as electrode materials in energy storage systems
PI 13	**Jordan Iliev**: Research of traction drive systems powered by electrochemical energy sources
PI 14	**Boriana Karamanova**: Electrochemical behavior of carbon materials obtained by burning biofuels
PI 15	**Marin Pandev**: Hydrogen economy – perspectives, applications and market opportunities
PI 16	**Tsvetomila Parvanova-Mancheva**: The influence of membranes on the production of hydrogen in microbial electrolytic cells
PI 17	**Dzhamal Uzun**: Optimization of the electrooxidation of aqueous sodium sulfite in electrolysis cells using functional nanocarbon materials
PI 18	**Nevelin Borisov**: Thin Pt films as catalysts for electrochemical hydrogen compression
PI 19	**Katerina Maksimova-Dimitrova**: Alkaline water electrolysis using non-noble oxide supported catalysts
PI 20	**Ivelina Tsacheva**: Design and electrochemical study of phosphorus- containing materials for hydrogen production from seawater
PI 21	**MariyaPimpilova**: Investigation of the Catalytic Activity of Immobilized Catalase (*Penicilium Chrysogenum 245*) Using an Electrochemical Peroxide Sensor

Ni, Mn-Composites as Electrode Materials for Hybrid Supercapacitors with Polymer Electrolyte

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With increasing attention to energy and environmental issues, hybrid supercapacitors with polymer electrolytes are highly valued as a new type of energy storage device. The key problem with them is to maintain high ionic conductivity, as well as good electrolyte-electrode contact. By changing the chemistry of polymer electrolyte, their ionic conductivity and stability can be easily adjusted. New and promising classes of electrode materials for supercapacitors are binary and ternary Ni-Mn oxides / hydroxides, as their properties are directly related to the synergistic effect of Ni and Mn ions. Phosphate compounds are an alternative due to their high stability, but their capacitive operation in alkaline environments is still far from desirable. The challenge, therefore, is to investigate and improve the capacitive characteristics of phosphates in non-aqueous electrolytes. The present study aims to investigate the capacitive properties of Ni-Mn phosphates with olivine ($LiNi_{0.5}Mn_{0.5}PO_4$) and maricite structure ($NaNi_{0.5}Mn_{0.5}PO_4$) as electrode materials in supercapacitors with polymer electrolyte and compare their properties with Ni-Mn oxides.

Pyrrolidinium based poly(ionic liquid) (PIL) was obtained applying a multi-step procedure. Initially, a diallyl amine hydrochloride monomer was synthesized, followed by its polymerization and subsequent functionalization. The obtained PIL with different additives was used as an electrolyte in supercapacitor systems. For the synthesis of $LiNi_{0.5}Mn_{0.5}PO_4$ and $NaNi_{0.5}Mn_{0.5}PO_4$ a phosphate-formate precursor method was adopted. The mixed Ni-Mn oxides were obtained by thermal decomposition of mixed Ni-Mn carbonates at 400ºC, the latter being prepared by co-precipitation from the nitrate salts with $KHCO_3$ in a flow of CO_2.

The electrochemical performance of the composite electrodes was examined in hybrid supercapacitor cells working in PIL electrolyte and activated carbon as a negative electrode. The capacitor cells were subjected to cyclic voltammetry measurements, galvanostatic charge-discharge and long-term tests. The obtained results show that further optimization of the composition of the composite phosphate electrode is needed in order to achieve a higher discharge capacitance and efficiency in the polymer electrolyte.

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