

40 Years of Experience and Excellence

Established in 1967 under the name “Central Laboratory of Electrochemical Power Sources” (CLEPS), nowadays the Institute of Electrochemistry and Energy Systems (IEES) successfully unites the traditions of the Bulgarian Stranski-Kaishev Physical Chemistry School with the general policy of BAS for integration with the European Research Area.

The early years of CLEPS are highlighted by significant RTD achievements - to name a few: introduction of technologies for the production of zinc-air elements, improved lead-acid batteries, lithium elements, the world's first electric car powered by zinc-air batteries. Along with such applied research technological developments, extensive basic research was carried out and, soon enough, CLEPS gained prominent reputation and a position of prestige in the international scientific society – during the 1980s CLEPS was the only Bulgarian coordinator in the cooperation between the Central and Eastern European academies of sciences.

Currently, the Institute's main scientific activities resonate with EC's priorities for sustainable high quality of life, development of a knowledge based society, environmental protection and electrochemical energy sources development and advances. Hydrogen energy emerges as one of the new research trends at IEES. It is orientated towards novel approaches for hydrogen production and storage, metal-hydrides and fuel cells. The activities concerning Li-batteries follow the advanced ideas for synthesis of highly efficient, low cost intercalation compounds and nanostructured composite materials for primary and Li-ion batteries. In the field of lead-acid batteries the work is focussed on the development of new materials and new technologies for the production of battery plates with performance answering the requirements for hybrid electric vehicles and photovoltaic system applications. The development of Zn-air cells is based on the combination of fundamental studies, professional knowledge and advanced technologies. An original idea for environmentally friendly cells is realized on Mg-air cells with a seawater electrolyte. Research and development of electrochemical information systems (biosensors and enzyme electrodes) finding application in medicine and ecology is in progress. Isotropic and anisotropic metal and intermetal nanoparticles, nanowires, nanorods and nanochains containing hydrogen, boron or nitrogen, with tailored quantum-influenced properties, are synthesized by the boronhydride method. They find application as catalysts and electrocatalysts, as well as in electrochemical energy sources. The development and application of advanced methods for investigation and testing of energy sources (heavy pulse testing, non-stationary methods, original Differential Coulometry Spectroscopy) is a durable practice. The advanced technique of Differential Impedance Analysis is carefully approbated, disseminated and finalized by publishing an original monography. A new research priority is the development and implementation of e-Science instruments for efficient collaboration and virtual research, especially in the field of Electrochemical Impedance Spectroscopy.

The Institute has a long-term tradition in intensive international collaboration with other scientific institutions and companies. The number of contractors and partners from Europe, USA, Canada, Japan, China, in the last 10 years is more than 300. One of the long-term benefits from the prestigious grant of 5FP Centre of Excellence POEMES (Portable and Emergency Energy Systems) is the editing of "POEMES SERRIES" (two Proceedings and two Monographies for the last 3 years). The collective monography POEMES with 29 authors (18 from Europe, USA, Canada) unites review articles representing the state of the art in the field, combined with own knowledge and experience.

IEES is a host organization of international and national structures: EICIS - European Internet Centre for Impedance Spectroscopy; National Centre for Nanotechnologies, COSENT - regional COoperation of South-east Europe for Nano-Technologies; LABAT - international conference on Lead-Acid Batteries, held every 3rd year; TK64 - Technical Committee for harmonization of the Bulgarian standards for batteries with the European ones; BED - Bulgarian Electrochemical Society. The Institute is a member of the Bulgarian Hydrogen Society, BG GRID Society, and organizer of the Association of the Bulgarian Centres of Excellence - aBEST.

IEES publicity relies on scientists recognized world-wide: *Acad. E. Budevski, Acad. D. Pavlov, Corr. Mem. A. Popov, Prof T. Vitanov, Prof V. Bostanov, Prof Z. Stoynov, Prof. I. Dragieva, Prof D. Vladikova,*

Prof R. Raichev, Associate Professors A. Kaisheva, P. Andreev, G. Papazov, V. Obretenov, K. Petrov, A. Momchilov, B. Banov, T. Rogachev, T. Petkova, S. Vasilev, E. Slavcheva and others.

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