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Modern active materials and electrolytes for lithium-ion batteries

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Lithium-ion batteries (LIBs) made a real revolution in the field of rechargeable batteries for all so called 4C-applications due to the sufficiently higher specific energy, good cycling life, low self-discharge and other advantages. Nevertheless, the following main problems exist, which restrain further LIBs development for the modern transport and other large-scale applications: still insufficiently energy density and especially power density; a high flammability and fire hazard of organic electrolytes; a relatively high price of active materials and electrolytes; toxicity of some solvents like NMP, which commonly used in LIBs technology. KNUTD team works for solving the above-mentioned problems in close cooperation with international partners in framework of FP6, FP7, H2020 EC Programs, USA DOE Programs, as well as a direct bilateral cooperation. KNUTD has some experience in developing, electrochemical investigation and testing of novel materials in half-cells, full cells and small real mockups of LIBs for the following materials groups: *anode materials*, like different carbon-graphite composites with Si, Sn, Al and other promised additives [1-4]; *cathode materials*, like common LiMn_2O_4 , LiFePO_4 , LiCoO_2 , as well as new high-voltage materials $\text{LiNi}_x\text{Mn}_y\text{O}_4$, $\text{LiNi}_x\text{Co}_y\text{Mn}_z\text{O}_2$, etc. [5]; *novel electrolytes* with an effective SEI-forming additives [5], inflammable ionic liquids [6], polymer electrolytes [7], etc.; *aqueous based polymer binders*, like carboxymethylcellulose, etc. [8]. As further perspectives for improving the properties of LIBs it is planned to discuss hybrid lithium-ion capacitors and rechargeable Metal-Oxygen (including Lithium-Oxygen) batteries, based on conducting polymers, inorganic spinels and other non-noble materials as ORR catalysts [9].

References:

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CV: Viacheslav Barsukov. Born 05/06/1948. V. Barsukov received his BSc in Chemical Technology in 1971, PhD in 1974, Dr.Sc. (habilitation) in Electrochemistry in 1985 (Dnepropetrovsk Chemical Technological University) and Professor Degree in Electrochemistry in 1992 (Ukrainian National Academy of Sciences, Kiev). V. Barsukov has been involved as a team leader in more than 30 national and international projects including 15 international projects of INTAS, NATO Science for Peace, CRDF, US DOE, FP6, FP7 and H2020 EC Programs.