NEW POLYMER ELECTROLYTES AND BINDERS FOR LITHIUM POWER SOURCES

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Ener1 develops synthesis methods of new polymer materials and binders for using in lithium power sources. Synthesis of these new materials can be carried out due to the solving some specific tasks for improvement of the complex of operation properties of promising rechargeable lithium batteries.

Synthesis methods of the new film-forming high-molecular compounds for promising plasticized, microporous, solvent-free polymer electrolytes have been developed. In particular, the following synthesis methods have been developed:

- Elastomeric ion-exchange materials (polyammonium, polypyridinium, polymers with $-SO_3H$ group and other).
- Elastomeric polyamines.

Polymer materials of these classes are very promising for solvent-free polymer materials production (electrolytes and membranes) both for lithium batteries and for fuel cells. Synthesized by Ener1 polyamines and polyammonium compounds can be used as modifying additives to the liquid electrolytes based on aprotic solvents for lithium batteries.

New polymer electrolytes provide safety during cycling, are characterized by a high conductivity and stability within a wide range of working potentials, as well as by compatibility with electrode materials and products of electrochemical reactions

The following tasks have been solved at the development of new polymer electrolytes:

- High conductivity at the wide temperature range (~10^{-3}-10^{-4} S/cm).
- Electrochemical stability from 0.5 to 4.6 V against lithium electrode.
- Tolerance of oxidation-reduction products of cathode materials (based on oxides and sulfur-containing cathode materials) and anode materials based on metal lithium.
- Tolerance of electrolyte components to moisture availability.
- Production of the morphology providing uniform distribution of electrochemical processes at electrode/electrolyte interface and preventing possible dendrite formation during cycling.
- Production of the materials with a high complex of physical and mechanical properties.
- Environmental friendly and non-flammable electrolytic systems.

New binder based on elastomeric polypyridinium derivatives with high adhesion to the current collectors was developed. This binder provides other advantages compared to tradition materials of type PVDF and PTFE:

- exhibit excellent electrochemical properties;
- improve low-temperature conductivity.

This binder can be used for electrode applications in Li-ion, Li-metal polymer type batteries and super capacitors.

References:

1. Patent Pending: Nonaqueous Electrolytes Based on Organosilicon Ammonium derivatives for High-Energy Power Sources. US PTO Patent Application No. 10/126,340.
2. Patent Pending: Salts of Alkali Metals of N, N'-Disubstituted Amides of Alkane Iminosulfinic Acid and Nonaqueous Electrolytes on their Basis. US PTO Patent Application No. 10/122,788.

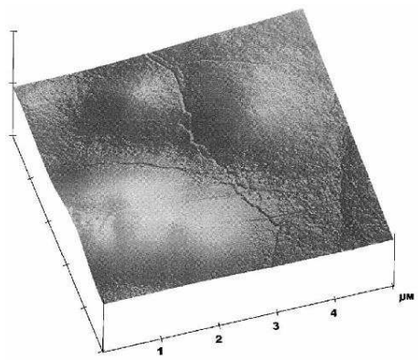

Fig.1 Example of morphology of developed polymer electrolytes.