CONDACTIVE CARBON LAYERS FOR COMPOSITE ELECTRODE IN LITHIUM BATTERIES

(TECHNOLOGY OFFER P-100)

innovation compass

The subject of the offer is direct production of a conductive layer on the hard coal powder (oxides, silicates, phosphates, etc.), designed especially for the layers of electrode for lithium-ion batteries.

Lithium-ion (Li-Ion) batteries are devices for collecting and transmitting electricity with the highest energy storage capacity per weight and volume. Commonly they are used in cell phones, digital cameras and notebooks, but also in the measuring apparatus, electro-tools, telemetry systems, satellite communications, or in a hybrid-powered (HEV) and electric cars (EV).

Battery negative electrode is made of porous carbon or graphite while positive electrode of transition metal oxides (cobalt, manganese or nickel). Conductive carbon layer designed to the electrode layers are usually obtained by pyrolysis of organic compounds or polymers. For this purpose physical mixtures are prepared or organic solvents are used. Previous carbon layers obtained by pyrolysis of organic materials do not show appropriate surface morphology and sufficient high electrical conductivity. Conductive carbon layers used for lithium batteries should have a low surface of contact with electrolyte in order to reduce the SEI layer *(Solid-Electrolite Interphase)*, while strictly adhere to the surface of electrochemically active material. Moreover, they should have a sufficient electrical conductivity, as well should not impede the transport of lithium ions between the electrolyte and active material during charge and discharge processes.

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JAGIELLONIAN UNIVERSITY IN KRAKOW

The subject of the invention is a direct process of the preparation of conductive layers on powdered supports (oxides, silicates, phosphates, metals, etc.), designed especially to obtain the composite electrode for lithium-ion batteries.

Significant advantages of the presented solutions are:

- chemical composition of the mixture, which is a precursor of carbon layers,
- the new use of hydrophilic polymers with N-vinylformamide to receive the carbon layers and films,
- method of to obtaining the nano-carbon layer with a specific surface morphology,
- improvement of the chemical stability of composite cathode materials.

In the comparison to existing solutions the novelty of presented invention is method of carbon precursor marking, which proceeds completely in the water environment and its composition allowing to obtain strictly adherent layer of controlled porous structure. Moreover carbon precursors are nontoxic, which makes the technology more safety and less onerous for the environment. **Appropriately chosen carbon precursor composition allow to obtain expected and required physicochemical properties of the carbon layer** (thickness, tightness, porosity, etc.). In particular, it should be emphasized the possibility of receiving suitable electrical conductivity of the carbon layer (>10^{-3} Scm^{-1}) above the temperature level of 400°C.

C/Al_2O_3, $C/LiMn_2O_4$ and $C/LiMn_2O_{4-y}S_y$ conductive carbon layers have been received and experimentally tested. The carbon content in the composite, its electrical properties, thermal and chemical stability as well as the surface morphology have been determined. Test results have indicated a good properties of the layer and the possibility of their use in both positive and negative electrodes of lithium batteries.

Offered method of conductive carbon layer preparation is the subject of patent application and its is still developed at the Faculty of Chemistry of the Jagiellonian University. **Currently the Centre for Innovation, Technology Transfer and University Development (CITTRU) is looking for companies and institutions interested in the technology development, its testing and application.**

MORE INFORMATION:

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