HIGH-PERFORMANCE ELECTRODIC AND ELECTROLYTIC MATERIALS FOR THE DEVELOPMENT OF NEW GENERATION ENERGY STORAGE SYSTEMS

The increasing energy demand requires the exploitation of clean energy sources and sustainable energy storage systems. Nowadays, lithium-ion batteries are the most efficient devices for the electrochemical storage of energy thanks to their unique properties, such as high specific energy, high efficiency, and durability. However, towards a thorough exploitation of this energy storage systems innovative electrode materials, for both the cathode and the anode, as well as new electrolytic components are required. This research project targets the development of lithium-ion batteries based on new electrodic components, featuring higher energy density, extended lifetime, and higher specific capacity. The aim of the project is therefore the research of new high-performance material for the preparation of anodes, such as materials that work through a conversion reaction mechanism (e.g., Fe_2O_3, CuO) and graphene, as well as the quest of low-cost and environmentally-friendly cathodic materials, such as olivine-type compounds (e.g., $LiFePO_4$, $LiMnPO_4$). Part of the research activity is also dedicated to the development of new electrolytes such as ionic liquids (ILs). Moreover, new-generation charge accumulators are also considered based on the reaction with sulfur and oxygen (e.g., lithium sulfur and lithium-air batteries).

GOALS

Development of new-generation materials for charge accumulators, such as lithium-ion, lithium-air, lithium-sulfur, and sodium-ion batteries and devices with ionic liquids and graphene. Development of batteries for automotive engines, electronic devices, and charge accumulation from photovoltaic plants.

INSTRUMENTS AND METHODS

Argon glove box, high-performance multichannel galvanostatic cyclers, electrochemical impedance spectroscopy (EIS), cyclic voltammetry, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), Nuclear Magnetic Resonance (NMR) spectroscopy.

MAIN SUBJECTS

Electrochemistry, Material science, Sustainable energy

RESEARCH GROUP

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