ENERGY

G

Materials for improving energy storage battery technologies

One of the most relevant issues on energy for our society is how to store electrical energy. In this context, electrochemical based devices have offered worthy solutions based in different solid state ionic processes as well as flow redox procedures. Nevertheless, beyond the standard lithium ion battery technology, there are still rooms for developing alternative materials, electrolytes, membranes as well as new geometries and storage system technologies based on new nanoionic improvements and/or flow cells approaches.

Scope:

Nowadays one of the most relevant issues on energy for our society is how to storage electrical energy such as for steady as mobile applications.

In this context, electrochemical based systems have offered worthy solutions. Nevertheless, beyond the standard lithium ion battery technology, there are still rooms for using alternative materials, electrolytes, membrane as well as new geometries and strategies that must allow enhancing the battery performances. Different ions like sodium or novel strategies like redox flow batteries, RFB, or semi-solid batteries, SSB, or fully organic batteries, FOB, or lithium sulfide, LiSB, or metal air batteries, MAB, etc., become as promising options for the next future need for energy storage.

Likewise, the industrial implementation and the required low cost industrial policy arise many requirements to the materials, the fabrication procedures, packaging and stack control.

All these targets require a deeper knowledge of all involved mechanisms taking place at the electrodes and their surfaces including their simulation and modeling. On the other hand, all chemical reactions happen in the electrolyte and membrane functionality must be understood and used materials and components must be morphological, structural, physic-chemical, optical, electrical and electrochemically characterized in order to optimize the correlation between material properties and battery performances.

Nowadays, special attention is paid to redox flow redox batteries and semi-solid ones, as they have full independence between the energy capacity and power values. Furthermore, these concepts offer option for using advances materials as electrodes avoiding negative effect of SEI formation or improving the electrolyte characteristics changing from aqueous based solutions to fully organics or ionic liquids. Degradation mechanisms analysis and their modelization constitute an essential knowledge for estimating the battery life time and efficiency decay. It is basic to determine the effective cost of the stored kilowatt- hour of electrical energy.

For these cases, the use of a specific catalyst can contribute to enhancement of the battery characteristics. In parallel, stacking of individual cells define the scale up options of different electrochemical approaches as energy storage solution.

Hot topics to be covered by the symposium:

- Materials for anode and cathode battery electrodes;
- Electrolytes;
- Membranes;
- Catalyst;
- Chemical redox;
- Characterization and electrochemical analysis procedures;
- Electrodes degradation mechanisms;
- Aging procedures and test;
- Battery cell and battery system testing and evaluation;
- Electrochemical mechanisms modeling;
- Li and Na based batteries;
- Redox flow batteries;
- Semi-solid batteries;
- Metal-air based batteries;
- Full organic batteries;
- Photo based batteries;
- New approaches beyond Lithium ion technology;
- Replacement of scarce material;

START AT	SUBJECT	NUM.	ADD
16:30	Hydrogenated V2O5 Nanosheets for Superior Lithium Storage Properties	G.TAa.14	★

Authors : Xiang Peng, Paul K. Chu
Affiliations : Department of Physics and Materials Science, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China

Resume : V2O5 is a promising cathode material for lithium ion batteries boasting a large energy density due to its high capacity as well as abundant source and low cost. Hydrogenated transition metal oxides (TMOs) prepared by H2 thermal treatment have attracted increasing attention as electrodes in LIBs and supercapacitors on account of the improved conductivity and kinetics in the electrochemical reactions. In this presentation, we report the design and fabrication of a hydrogenated V2O5 nanosheets with super Li storage properties. The V2O5 nanosheets with most of O(II) vacancies are fabricated by hydrogenating V2O5 nanosheets at a relatively lower temperature of 200 oC, enabling easier and faster Li ion diffusion. In our work, hydrogen atoms first adsorbed at the oxygen sites forming OH and then H-V2O5 with most oxygen vacancies at O(II) sites could be produced beacuse the formation of the oxygen vacancy in O(II) sites by removing the OH group requires less energy than removing oxygen directly. The H-V2O5 with most oxygen vacancies in O(II) sites has improved conductivity, faster diffusion of Li+, and improved structure stability for Li+ intercalation/deintercalation, resulting in higher capacity, rate capability, and improved cycling stability. The hydrogenated V2O5 (H-V2O5) nanosheets deliver an initial discharge capacity as high as 259 mAh g-1 and it remains at 55% when the current density is increased 20 times from 0.1 to 2 A g-1. The H-V2O5 electrode has excellent cycle stability with only 0.05% capacity decay per cycle after stabilization. The effects of oxygen defects on Li+ diffusion and overall electrochemical lithium storage performance are revealed. Our results reveal a simple and effective strategy to improve the capacity, rate capability, and cycling stability of V2O5 materials which have large potential in energy storage and conversion applications.

START AT	SUBJECT	NUM.	ADD
16:30	High-performance colossal permittivity materials of (Nb Er) co-doped TiO2 for large capacitors and high-energy-density storage	G.TAa.15	☆
16:30	Effect of substitution La by Mg on electrochemical and electronic properties in La2-xMgxNi7: a combined experimental and ab init	G.TAa.16	☆
16:30	Solar energy storage system with recycled hydrogen carriers	G.TAa.17	☆
16:30	Electrodeposited Sn-Ni alloy as anode material for 3D Lithium-Sulfur battery	G.TAa.18	☆