A Technology Opportunity of the University of Liège

Sprayable water-based compositions for Li-ion battery electrodes

Electrodes for Li-ion batteries are commonly manufactured by casting a liquid composition onto a metallic current collector. This liquid composition contains an active material, conductive carbon and usually a fluorinated binder dissolved in an organic solvent. Such an approach is not optimal in terms of cost and environmental impact because of the fluorine-based compound itself but also because the later needs the use of toxic and expensive organic solvents when processed during manufacturing and recycling steps.

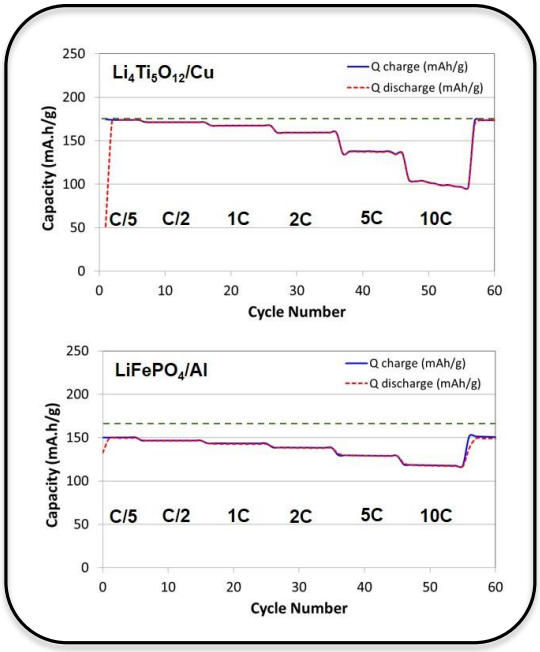
University of Liège has developed water-based compositions for the preparation of Li-ion battery electrodes avoiding the use of fluorine-based compounds and organic solvents. These new compositions are suitable for spray deposition overcoming the disadvantages linked to roller and curtain coating depositions.

Description

This technology relates to a process for preparing electrodes by spraying an aqueous slurry composition using a water-compatible polysaccharide (xanthan gum) in substitution of usual fluorine-based binders.

Anodes made of $Li_4Ti_5O_{12}$ and cathodes made of $LiFePO_4$ and of $LiCoO_2$ prepared by this process show good and similar electrochemical properties to those prepared by a bar-coating process using polyvinylidene fluoride (PVDF) as binder and N-methyl-2-pyrrolidone (NMP) as solvent. Full Li-ion cells including such electrodes work well and display good cycling stability.

Figures on the right show the (dis-)charge capacities in half-cell configuration at several rates for a $Li_4Ti_5O_{12}$/Cu electrode (top) and a $LiFePO_4$/Al electrode (bottom).



Properties

- Good specific capacity and cycling properties
- Similar electrochemical performance compared to PVDF/NMP based coatings
- Improved adhesion on the metal electrode base (no need of surface treatment)

Advantages

- Fluorine-free binder
- Aqueous formulation
- Applicable by spray
- No need of dispersant
- No need of costly solvent recovery system
- Easy recycling of electrode bases

Cost effective and environmental friendly solution

A Technology Opportunity of the University of Liège

Potential Applications

The patented technology is developed towards the manufacture of electrodes for electrochemical storage devices: Li-ion and Na-ion batteries as well as supercapacitors.

Patent Status

WO2017/211555 A1 (Patent application pending)

Research Team

The Nanomaterials, Catalysis, Electrochemistry (NCE) laboratory, which is part of the Research Unit in chemical Engineering, has developed a wide expertise in the conception and set-up of devices linked to chemical engineering based on an integrated approach, from the preparation of materials and their characterization in prototype (continuous) reactors. The first part of the activities concerns the design and preparation of new materials with controlled pore texture at the nanoscale and their scale up/shaping. The second part deals with the building of test benches dedicated to the determination of the materials properties (activity of catalysts, performances of fuel cell assemblies or batteries, mainly) and to the set-up of pilot devices for the production of given materials.

This methodology has been developed and extended to various research domains in order to solve specific problems. Applications are thus numerous: rational synthesis of nanostructured materials, catalysis and electrocatalysis, purification of liquid or gas effluents, heat and electricity conducting materials, materials for electrochemical energy conversion and storage (fuel cells, batteries, supercapacitors), multifunctional films, etc. In particular, since 2009, the electrochemical engineering applications constitute a major axis of the research at NCE, with about 15 researchers involved at the moment. Several large research projects allowed us to acquire state-of-the-art equipment such as electrode manufacture devices and test benches, and to develop a good expertise in the domain of Li-ion batteries and Proton Exchange Membrane fuel cells. The objective of the laboratory is to be able to cover the complete manufacture chain, from raw materials to the final application that can be further integrated in a user system.

https://www.chemeng.uliege.be/cms/c_2275228/fr/chemical-engineering-nanomaterials-catalysis-electrochemistry-nce

Opportunities

Research collaboration and/or license agreement

Contact

Jean-Marc Schumers
jm.schumers@uliege.be
Tel : +32 4 349 85 39

ITF file n° 2015-09

A Technology Opportunity of the University of Liège

Sprayable water-based compositions for Li-ion battery electrodes

- ❑ I am interested in learning more about the general aspects of this technology. Please contact me.

The best time to reach me is: _____

- ❑ I would like an electronic version of this technology.
- ❑ I would like to learn more about the specifics of this technology and would be wiling to complete a Confidential Disclosure Form in order to discuss it further.
- ❑ I am not interested in this technology because: _____

_____

_____

- ❑ I am not interested in this technology but would be interested in learning more about (please specify): _____

_____

Name: _____

Title: _____

Company: _____

Address: _____

_____

Phone: _____ Fax: _____

E-mail: ___ _____

Please send it back to Gesval

info@gesval.be - Fax : + 32 4 349 85 20