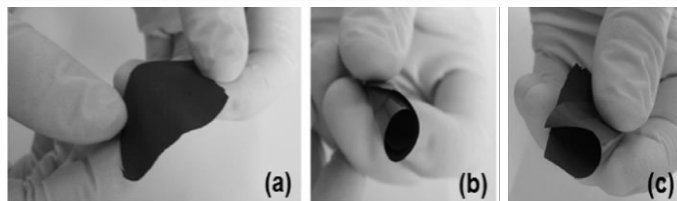


## Flexible thin-films for battery electrodes

With the emergence of portable and flexible electronics there is an increasing need for high-performance flexible batteries which can be implemented in products such as flexible mobile phones & tablets, smart textiles, smart watches and also health monitoring systems.

University of Liège has developed new active film compositions suitable for the preparation of flexible battery electrodes.

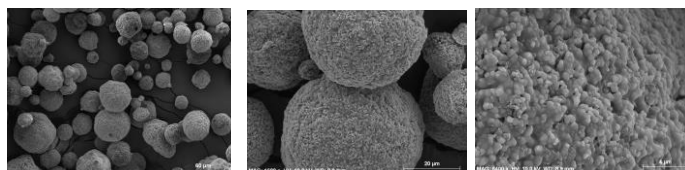


**Figure 1:** Flexible film made of  $\text{Li}_4\text{Ti}_5\text{O}_{12}$ , carbon black, and polymer additives.

### Description

This technology relates to anode and cathode active compositions containing a mixture of partially hydrolysed polyvinyl acetate and a polyalkylene glycol as the binder. Figure 1 shows some pictures illustrating the flexibility of a film suitable for the preparation of Li-ion battery anodes.

Such compositions can be formulated with water or with alcoholic solvents (ethanol, propanol, etc.) and represent thus an environmental friendly alternative to current manufacturing processes in which N-methylpyrrolidinone is generally used. Additionally, formulations with active material, carbon source and binder, can be dried to obtain a ready-to-use powder (Figure 2) that is easily re-dispersible before application.



**Figure 2:** dry composite powder obtained from slurry after drying

### Film Properties

- High flexibility
- Good electrochemical performances (150 mAh/g-1C)
- Excellent homogeneity
- Crack-free
- Thin film thickness (10-25  $\mu\text{m}$ )
- No (nano)powder get out of the film when manipulated-high security

### Advantages

- Flexible film
- Fluorine-free binder
- Aqueous (or alcoholic) formulation
- Applicable by tape casting, roller coating, spray coating
- Easy recycling of electrode bases

### Potential Applications

The patented technology is developed towards the manufacture of flexible electrodes for flexible electrochemical storage devices such as Li-ion, Na-ion and Mg-ion batteries.

### Patent Status

WO2018/141659 A1 (PCT - Patent application pending)  
EP3355384 A1 (EP- Patent application pending)

### Research Team

*GREENMat* group from University of Liège is a research laboratory directed by Prof. Rudi Cloots and specialized in the development and characterization of inorganic materials. The group develops powders, bulk materials or coatings for applications related to energy, environment, health or protective coatings. In its research projects, special attention is paid to the control of microstructure, porosity and interfaces in order to optimize the material properties.

[https://www.greenmat.uliege.be/cms/c\\_3570565/fr/greenmat-portal](https://www.greenmat.uliege.be/cms/c_3570565/fr/greenmat-portal)

### Opportunities

Research collaboration and/or license agreement

### Contact

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ITF file n° 16-10

## Flexible thin-films for 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 willing 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: \_\_\_\_\_

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