High barrier cellulose-based packaging for Li-ion pouch cells

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Abstract

This presentation focuses on the materials and technologies developed within the European project MARS-EV (grant agreement 609201) as well as on the latest developments of CTP, internally and in other selected projects.

The MARS-EV project (http://www.mars-ev.eu/) is a 4-year Large Scale Collaborative Project within the FP7 leading to the development of Li-ion high energy electrode materials and safe electrolyte systems with improved life cycle. Activities include sustainable scale-up synthesis, industrial scale prototype cell assembly, modelling of ageing behaviour and full life cycle assessment.

Within this project, CTP has worked on the development of paper-based materials that exhibit excellent properties while strongly decreasing the environmental impact compared to conventional aluminium foil and polymer based materials. The aim is to use these materials for the packaging of the battery cells that represents about 8 square meters per battery. The specifications include oxygen and water vapour transmission rates close to zero, as well as excellent chemical resistance, heat-sealability, fire resistance and 10 years lifetime.

Major results have been obtained with several strategies to produce multilayer materials allowing a weight reduction of more than 64%.

The above mentioned technologies include:

- Multilayer water-based coating of paper and board with polymers (poly(vinyl alcohol), poly(vinylidene chloride) and poly(lactic acid)), developed from lab to pilot scale,
- Grafting of material surfaces with fatty acids by chromatogeny, a patented process that provides outstanding water and chemical resistance, and
- Stratification of materials using micro-fibrillated cellulose (MFC) as barrier layer as well as a new wet-lamination process providing exceptional oxygen barrier (patent pending).

The presentation describes the strategies used to produce and upscale these structures, and details the results obtained in terms of performance (oxygen transmission rate, water vapour transmission rate, liquid water absorption, resistance to acid and alkaline aqueous solutions).