

Project NanoPoliBat

Project Description NanoPoLiBat

The main objective of this work is to design functional nanomaterials as active materials, binder and separator for a very long life high rating polymer microbattery which can be used in high rate low voltage application. To overcome the current limitations of the components for lithium polymer batteries they should be newly re-designed and fine tuned. Nano-particulate electrode materials, electrode materials modified by surface layers in the nm- range (core-shell materials) and nano-structured composite electrodes and electrolytes-separators offer tremendous chances for realisation of this objective.

As positive electrode active material we select $\text{Li}_4\text{Ti}_5\text{O}_{12}$ (lithiated state: $\text{Li}_7\text{Ti}_5\text{O}_{12}$). This compound synthesised as nano-tubes and nano-fibres is characterised by extremely fast Li^+ -intercalation / de-intercalation and shows excellent capacity retentions even at very high C rates and in a wide temperatures range. It is by far superior compared to common commercialized micro- $\text{Li}_4\text{Ti}_5\text{O}_{12}$. Moreover intelligent composite electrodes require a well-designed spatial distribution of the various components. Simple mixing does not create optimised percolation patterns of conductive additives or other functional components. Self assembling of nano-particles on preconditioned surfaces can be used to create optimised 3-dimensional percolation patterns by use of the "binder-less" Substrate Induced Coagulation (SIC) in nano-thickness. Adequate electronic contacts for high-rate operation of these electrode materials can be made by SIC-coating.

The main project output is the understanding of the nano-material properties related to their synthesis structure and interaction to the metallic current collectors and to the other battery materials like conductive additives. Furthermore the different interfaces will be analysed and studied (electrodes to separator). The battery as demonstrator is the last proof of the developed nano-technology in the applied project.

In Asia and USA a considerable activity is directed towards the development of nano-material for an industrial use in the energy storage field. In order to be competitive with them we set up this network involving several European countries to establish on this future sector a nano-technology from the first material-developing and characterisation until the proof of their industrial viability. The economic yield of this project is the improvement of the infra-structure of nano-technology within the European Union and contributes to secure the European position with respect to future job opportunities.

The selected partners combine nicely basis-oriented work coming from the Universities Graz and Amiens and application-orientated institutes CSIC-ICMAB Barcelona and Fraunhofer Institute with the well-know company VARTA. The partners are situated in several European countries with an excellent infrastructure for working on their tasks.

Related content

- NPB in the brochure "Materials for energy applications"