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Silicon and polyanionic chemistries and architectures of Li-ion cell for high energy battery

The development of highly efficient batteries is a critical need in automotive industry to enable the future success of electric vehicles.

Active material with higher insertion potential in association with a compliant electrolyte is a way to increase Lithium-ion cell energy density and hence electric vehicles autonomy. Moreover, green processes like the aqueous process for positive electrode manufacturing allows significant reduction of battery cost.

This work in the framework of the European SPICY project (EC grant No. 653373) presents results obtained on polyanionic chemistry in association with sulfolane or adiponitrile electrolyte solvent and water soluble binder stable at high voltage. Results at cell level are also presented with 17 Ah cells having the same components but different formats. Modelling, based on electrochemical and thermal properties at particles, electrodes and cell levels are finally presented and allow identification of the optimized cell design in terms of loading and porosity. LiFe0.45Mn0.55PO4/C material has been developed with an energy density increase compared to the reference LiFePO4 polyanionic chemistry while keeping power capability.

This material is highly suitable for Lithium-ion cells dedicated to plug-in hybrid electric vehicle application with strong power needs. In association with this active material, a high potential electrolyte has been developed with sulfolane or adiponitrile solvent.

Future work will focus on the evaluation of these materials in relevant cell for plug-in hybrid electric vehicle application. Evaluations of 17 Ah cells have shown that calendar ageing is not really dependent of the format contrary to life cycling tests where prismatic hard packaging cells show better results than cylindrical hard packaging cells •