

# Powering Electrical Vehicles with Hybrid Electrochemical Energy Storage System

**Although a large variety of electrochemical energy storage systems exist, they are not yet fully capable to withstand the energy and power requirements of road vehicles.**

The purpose of this project has been to demonstrate an integrated electrochemical energy storage system based on the combination of high energy-density Li/S batteries and high power density IL based SC devices.

Li/S technology is a near future battery technology, as it offers very high gravimetric capacity. Therefore, the development of Li/S at industrial scale is under rigorous investigation. On the other hand, ionic liquid-based SCs are ready to make an impact because of their high power rating, wide potential window, thermal stability and very long cycle life. As, Li/S batteries lack in power, we extended our idea to study the dif-

ferent implementations of the hybrid system, in which both battery and SC are connected in parallel directly or with a Buck-Boost DC/DC converter among them aiming to reduce battery stresses in those situations of rough terrain and regenerative braking. Indeed, in these situations, high transient currents are required or sourced by the electric motor.

Precisely, during acceleration the electric motor requires more current than at steady velocity, while in regenerative braking state high transient currents are directed towards the energy storage system and the SC can assist the battery in this recovery operation thanks to its high kinetics. This solution may lead to simplified electronics to manage the interface between the two systems and, however, increased battery life together with a more compact energy storage system •

