

## Center of Competence IIEE, Efficient Energy Systems

### SAM: Super Accumulator Module

#### Motivation

The characteristics of double layer capacitors, also called Supercapacitors (SCAPs) or Ultracapacitors, have been rapidly improving over last few years. This opens more and more fields of application to this technology. So far, chemical energy storages (batteries) have been the standard source of energy in electrical vehicles. The two main disadvantages of batteries are their inability to supply or take up peak currents, and, their limited lifespan due to chemical effects. These two gaps can be compensated by Supercapacitors. A capacitor is able to supply high currents and has cyclability over 500'000.

#### Description

The first aim of the SAM project is the optimal combination of the traditional batteries with innovative Supercapacitor technology to achieve high performance energy storage systems. The percentage of batteries and SCAPs depends on the application profile (cycles per minute, cycles per day, cycles per month). The second goal of the SAM project is a management system for the energy flows. If the short-time storage SCAP is combined with the long-time storage battery, the battery is supposed to deliver the average power while the SCAP covers the power peaks. To achieve this goal, the energy flow has to be controlled. The third aim of the SAM project is an optimal charge equalizing technology for the SCAP to eliminate their restrictions due to their small maximum voltage of 2.5V. In order to obtain high efficiency in an energy system, high voltages and small currents are required. To provide these conditions by means of SCAPs, they have to be connected in series. Due to the tolerances of the capacity and the parasitic parallel resistance of a SCAP, the voltage of several SCAPs in a serial stack can vary and easily exceed the above the rated voltage of 2.5V. The need for a charge equalizing technology is given.

#### Results

The idea of combining batteries (also fuel cells), Supercapacitors and intelligence (management) was patented in 1997. A system-simulation (Simplorer) for all possible applications has been realized. Sixteen different applications with Supercapacitors were studied in detail. The "virtual parallel circuitry" including the external management software for charge equalizing and energy management in SCAP-stacks has been developed and patented in 2000. Solutions for designs of SAMs including mechanical and electrical aspects have been developed.



Projectname  
SAM: Super Accumulator Module

Projectpartners  
- HSLU T&A  
- Maxwell Technologies SA

Contact  
Projectleader  
Vinzenz Härrli  
P: +41 (0)41 349 33 13  
F: +41 (0)41 349 39 60  
vinzenz.haerri@hslu.ch

CC-Leader  
Vinzenz Härrli  
P: +41 (0)41 349 33 13  
F: +41 (0)41 349 39 60  
vinzenz.haerri@hslu.ch  
www.hslu.ch/iiee