Single cell battery management chip

Degree programme: BSc in Electrical Engineering and Information Technology | Specialisation: Industrial Automation and Control
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Industrial partner: Sensichips, Aprilia (LT), Italy

Validation of the cell management unit (CMU) chip by the Italian company Sensichips, capable of monitoring several parameters of a single cell; with EIS technique we get informations about the impedance and thus the state of health of the electrochemical element. Included in the project in parallel are the characterization of LFP (Lithium Iron Phosphate) cells and the implementation of a battery management system (BMS).

Motivation

The price of E-cars is falling steadily, practically matching that of internal combustion cars; this is mainly due to the research and development of increasingly efficient and economical batteries, which represent the biggest cost for the manufacturer.
In this context, Sensichips has produced a CMU (Cell Management Unit) capable of monitoring several parameters of a single cell. The most interesting of these are the results of electrochemical spectroscopy (EIS), which provides important information about the equivalent circuit components of the cell, directly related to its degradation and aging.

Introduction

With the climate chambers in the battery testing laboratory at BFH's Energy storage Research Centre (ESReC), it is possible to compare the data measured with the chip produced by Sensichips. The most important parameters that can be monitored by the latter are as follows:

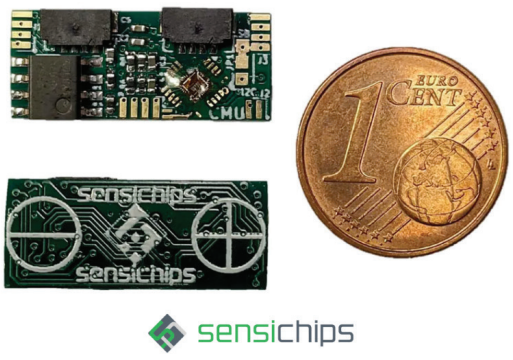
- Cell voltage
- Cell internal impedance with EIS
- Anode, cathode & body temperature
- Environmental temperature & humidity

With EIS technique we get the most important information: the state of health of the battery. In fact, from the impedance values at different frequencies, we can know the equivalent circuit values of the cell, which are strictly dependent on the level of degradation and thus the aging.

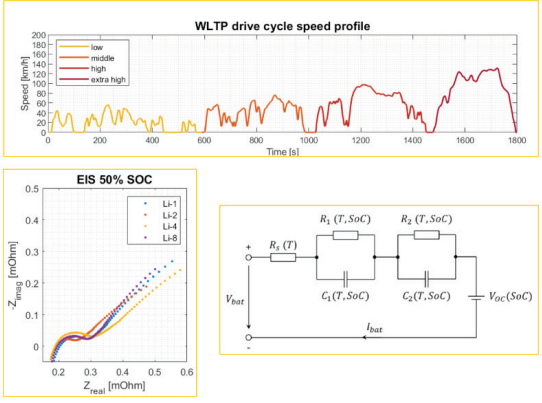
Project goals

1- Validation experiments of the measured parameters
All parameters will be compared with those obtained by our testers in the lab, to know the accuracy and resolution of the chip.
2- Driving cycles simulations
Drive cycles are standard tests that simulate a typical vehicle path. By simulating several of these cycles we can analyze the behavior of the cell.
3- Equivalent circuit model
Through the results of EIS measurements and other appropriate tests, we can model the cell with different components; by doing so, an estimation of the degradation in the future is possible.
4- BMS implementation
The Italian firm's chip can be combined with a battery management system, as the latter is unable to know the impedance and thus the health status of the cell.

Martin Vestermark Caccia



Sensichips' CMU RUN8 chip



WLTP Drive Cycle, EIS & ECM