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SAFELiMOVE – Deliverable Report

<< D7.03 – Battery module performance >>

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Written By	Maider Usabiaga (IKR)	2023-11-30
Checked by	Adrien Mery (REN)	2023-12-06
Reviewed by (if applicable)	Elixabete Ayerbe (CID)	2023-12-12
Approved by	Maria Martinez (CICe)	2023-12-21
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Publishable summary

This deliverable contains a description of the successfully built and tested SAFELiMOVE demo module. It is a 24 V and 3 Ah module that stacks 6 units of the 3Ah SAFELiMOVE cells. It consists of two units: a battery system that contains the cell stack and the BMS slave, and a power unit that contains mainly the BMS master and the PMDU (Power, monitoring and disconnection unit). In the report are summarized the results of the test made to it, containing both the tests to verify the adequate performance of safety issues and protections and specific tests to validate the management and control strategies and specific module based KPIs define in the project.

First of all, a description of the built 24 V and 3 Ah module is done, including its specifications and the electrothermal and mechanical design of the module. The design of the module was tuned to the final characteristic of the upsized SAFELiMOVE cells, taking into account its final capacity, format, pressuring needs and operation temperature and Crates.

Second, a description of the implemented safety control and management strategies is added, describing the specific alarms that have been defined and the algorithm for module disconnection to avoid an unsafe battery operation. All safety alarms and procedures have been validated in lab prior to their implementation in the module.

Third, the developed algorithms are described and validated. The state-of-charge SOC algorithm is based on Coulomb Counting recalibrated by voltage measurements in relaxation periods and weighted according to confidence in estimations. The state-of-health (SOH) algorithm is based on SOH calibration in full and partial discharges and weighted by the minimum SOH. A simple balancing algorithm is also included based on a hysteresis controller. The SOC and SOH algorithm validation is firstly made at simulation level, and then on real SAFELiMOVE cell test level. The obtained algorithm values are mostly under a 5% RMSE error, except in certain situations where cell degradation causes considerable OCV variations and capacity fade.

Finally, the results of the module level tests are presented, which include a capacity and Ri measurement, and the observation of the correct performance of the algorithms and safety controls that has been implemented. Further testing was not possible due to the very fast degradation of some of the cells.

The SAFELiMOVE module successfully reached its targets for module impedance (< 1.5 x cell value) and SOC estimation algorithm (<5% error on 1Ah cells). The objective set for energy density on the contrary was not able to be met, mainly because the shape of the cell was for different reasons non adequate for high energy density design and the module design prioritized in-time and safe demonstration of the SAFELiMOVE cell technology.

Future recommendations point the importance of a minimally adequate cell shape to reach the target energy density values that are desirable and the need to further investigate in fast prototyping materials that are enough light to achieve the energy density targets and at the same time are enough resistant to support the high level of pressure required in the end plates.

Appendix A- Acknowledgement

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Project partners:

#	Partner	Partner Full Name
6	RENAULT SAS	RENAULT SAS
10	CIDETEC	FUNDACION CIDETEC