



Battery testing expertise

Performance and aging evaluations for your electrochemical system

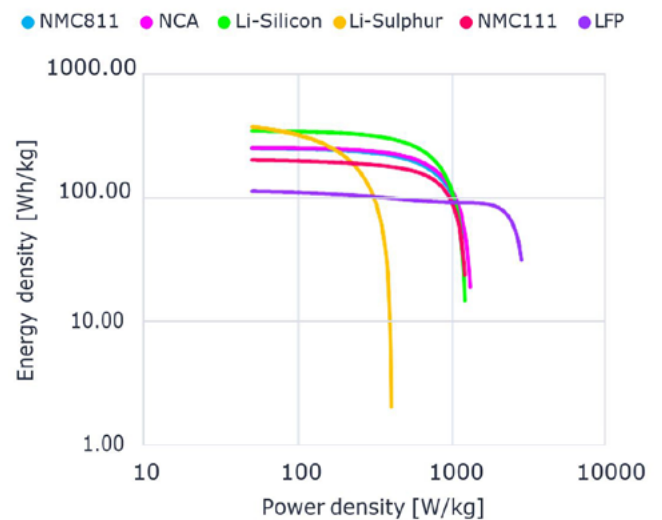
The risk associated to battery degradation and the investment in Battery Energy Storage Systems (BESS) is high despite a continuous reduction of battery cells prices. Standard testing procedures are often not adequate to evaluate the performance of these systems in real operation. At CSEM, we have developed independent testing procedures to characterize the electrochemical cells performances and aging characteristics.

Our testing infrastructure

CSEM is equipped to run tests ranging from coin cells to battery packs. All standard testing protocols are supported (CC, CV, CP, etc.) together with the main testing standards such as: IEC 62660-1, ISO/CD 12405-1/2. Advanced characterization technique such as Electrochemical Impedance Spectroscopy (EIS) are also integrated in our cell testers. All tests run in controlled environmental conditions and a detailed list of all available equipment is provided in the table below.

Performance evaluation

We have developed testing procedures such as efficiency tests, Ragone protocol, OCV/GITT procedures, and EIS mapping (SoC vs. T) which help in mapping and benchmarking performances of different cell technologies. These procedures have been successfully applied to different chemistries including NMC111, NMC532, NMC811, NCA, LFP, Li-Sulphur, Li-Silicon, NiMH. Typical characterization results in the form of Ragone plots are shown in the following figure.



Aging characterization

We have developed aging protocols to evaluate capacity and power fade of electrochemical cells in a systematic way. A statistically relevant number of cells is tested in different cycling conditions: variable Depths of Discharge (DoD), variable currents, and optionally variable temperatures. The equivalent number of cycles is computed for all conditions to map the aging performance of the cells. EIS and OCV/GITT measurements are also available to infer about the main aging processes occurring during cycles.

Battery testers	Brand	#Channels	Max current / ch	Max Voltage / ch
Cell tester	Ivium Octostat30	24	30 mA	10 V
Cell tester	Bio-Logic BCS815	32	15 A	9 V
Cell tester	Arbin LBT21044HC	20	100 A	5 V
Module tester	PEC SBT10050	12	50 A	100 V
Module tester	ITECH IT900	1	150 A	80 V
Pack tester	ITECH IT9000	1	150 A	300 V
Pack tester	Regatron TC.GSS.20.600.400.S	1	40 A	600 V
EIS spectroscopers	Brand	Frequency range	Max current	Max Voltage
EIS spectroscoper	Bio-Logic BCS815	10kHz – 10mHz	15 A	9 V
EIS spectroscoper	Gamry Reference 3000	1MHz – 10µHz	30 A	36 V
Environmental chambers	Brand	Temperature range	Humidity range	Volume
Thermostatic chamber	ESPEC-ARU1100	-45°C – +180°C	-	1100 l
Thermostatic chamber	ACS-DM1200T	-40°C – +180°C	-	1200 l
Climatic chamber	ACS-DM340C	-70°C – +180°C	10% – 98%	340 l