

EUROPEAN COMMISSION

HORIZON 2020 PROGRAMME - TOPIC H2020-LC-BAT-2020
Sodium-Ion and sodium Metal BAtteries for efficient and sustainable
next-generation energy storage

GRANT AGREEMENT No. 963542



SIMBA – Deliverable Report

<< D3.2 – Operational in-situ NMR and SPM /first tests
demonstration >>

Publishable summary

Monitoring structural changes in sodium/sodium ion battery systems during galvanostatic cycling is a challenging task that requires appropriate analytical techniques allowing the detection of structure moieties as a function of the time progress of the cycling process. A powerful technique that allows such analysis is in-situ solid-state NMR spectroscopy which can be applied to analyze local structural changes in alkali metal containing electrochemical cells. To perform such experiments appropriate cells have to be prepared which are stable during the cycling process. Furthermore, special in-situ NMR probes have to be set up that allow the measurement of solid-state NMR spectra under cycling conditions.

The successful preparation of electrochemical cells for in-situ solid-state NMR investigations is presented. For the model compounds LiCl and NaCl, as well as for electrochemical Li|LiPF₆|Li and Na|NaPF₆|Na cells the operational of the two single resonance channel probes (ATMC IN SITU NMR 300 and ATMC IN SITU NMR 600 WB) is shown. The obtained in-situ spectra allow the monitoring of structural changes in these cell systems. To obtain more details these experiments have to be combined with ex-situ NMR investigations that increase resolution.

Single particle measurement (SPM) is a powerful tool to investigate the electrochemical properties of a single particle of active material without considering the effect of the binder and conducting materials. It is employed in the SIMBA project to study the diffusion coefficients of sodium in the electrode, electrolyte and the charge transfer resistances across the electrode/electrolyte interface. The main processes of setting up the SPM device are detailed in this report. Besides, first measurements on a SiOC|LiPF₆|Li cell have been successfully performed to prove the operability of the SPM setup.

Appendix B - Acknowledgement

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Project partners:

#	Partner	Partner Full Name
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2	UU	UPPSALA UNIVERSITET
3	UBham	THE UNIVERSITY OF BIRMINGHAM
4	WMG	THE UNIVERSITY OF WARWICK
5	KIT	KARLSRUHER INSTITUT FUER TECHNOLOGIE
6	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
7	IFE	INSTITUTT FOR ENERGITEKNIKK
8	SAS	USTAV ANORGANICKEJ CHEMIE SLOVENSKA AKADEMIA VIED (Institute of Inorganic Chemistry, Slovak Academy of Sciences)
9	FHG	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
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