

# BENCHMARK, AGEING AND ANTE-MORTEM OF SOTA CYLINDRICAL LITHIUM-ION CELLS



## OVERVIEW

For the **iModBatt** project an extensive market search on high energy cylindrical cells was performed. A set of 8 cells was identified, based mostly on energy density and lifetime. These cells were analyzed in depth through

- ante mortem material characterization,
- electrical and thermal benchmarking,
- cycle life.

The main findings of this investigation regarding ante mortem analysis and cycle life are presented in this work.

## CELL SELECTION AND PROPERTIES

Applying the criteria from above, **3 type 18650 and 5 type 21700 cells** were identified. 21700 cells generally offer higher energy density. 6 cells came from Asia and 2 from Europe. The table gives datasheet values and those obtained by ante mortem analysis.

Models	Energy density (Wh/kg)	Country	Anode*	Cathode*
LG INR18650 MJ1	259,6	Korea	Graphite + 1%wt Si	NCM
LG INR21700 M50	263,0	Korea	Graphite + 1%wt Si	NCM811
Panasonic NCR18650B	248,7	Japan	Graphite	NCA
SAMSUNG INR18650-35E	252,0	Korea	Graphite + 1%wt Si	NCA
SAMSUNG INR21700-48G	250,4	Korea	Graphite + 1%wt Si	NCA
SAMSUNG INR21700-50E	260,9	Korea	Graphite + 1%wt Si	NCA
BMZ/SONY 21700-52EM	267,4	Germany	Graphite	NCA
BMZ/SONY 21700-50EL	257,0	Germany	Graphite	NMC811

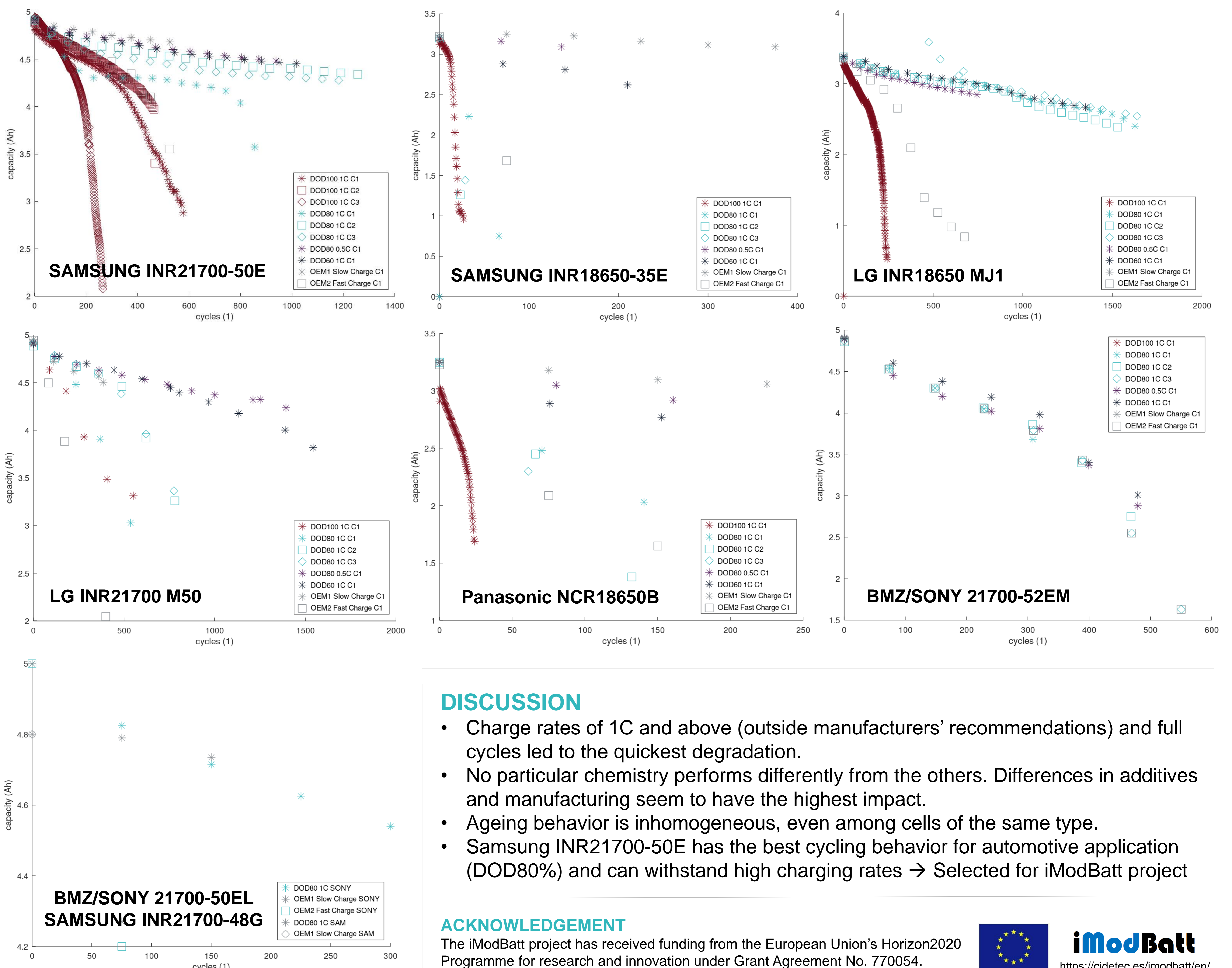
\*combined results from EDX/XRD analysis

## CYCLE LIFE TESTS

The cells were cycled according to requirements of OEMs → **Out of boundary conditions for some cells.**

Different C-rates and DODs were chosen for cycling, and 2 OEM profiles with slow and fast charging were executed.

Cells were cycled with CC/CV for charge and CC for discharge. Every 75 full cycle equivalents a checkup was performed.



## DISCUSSION

- Charge rates of 1C and above (outside manufacturers' recommendations) and full cycles led to the quickest degradation.
- No particular chemistry performs differently from the others. Differences in additives and manufacturing seem to have the highest impact.
- Ageing behavior is inhomogeneous, even among cells of the same type.
- Samsung INR21700-50E has the best cycling behavior for automotive application (DOD80%) and can withstand high charging rates → Selected for iModBatt project

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**iModBatt**  
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