Improvement in Lithium-ion battery testing and characterisation

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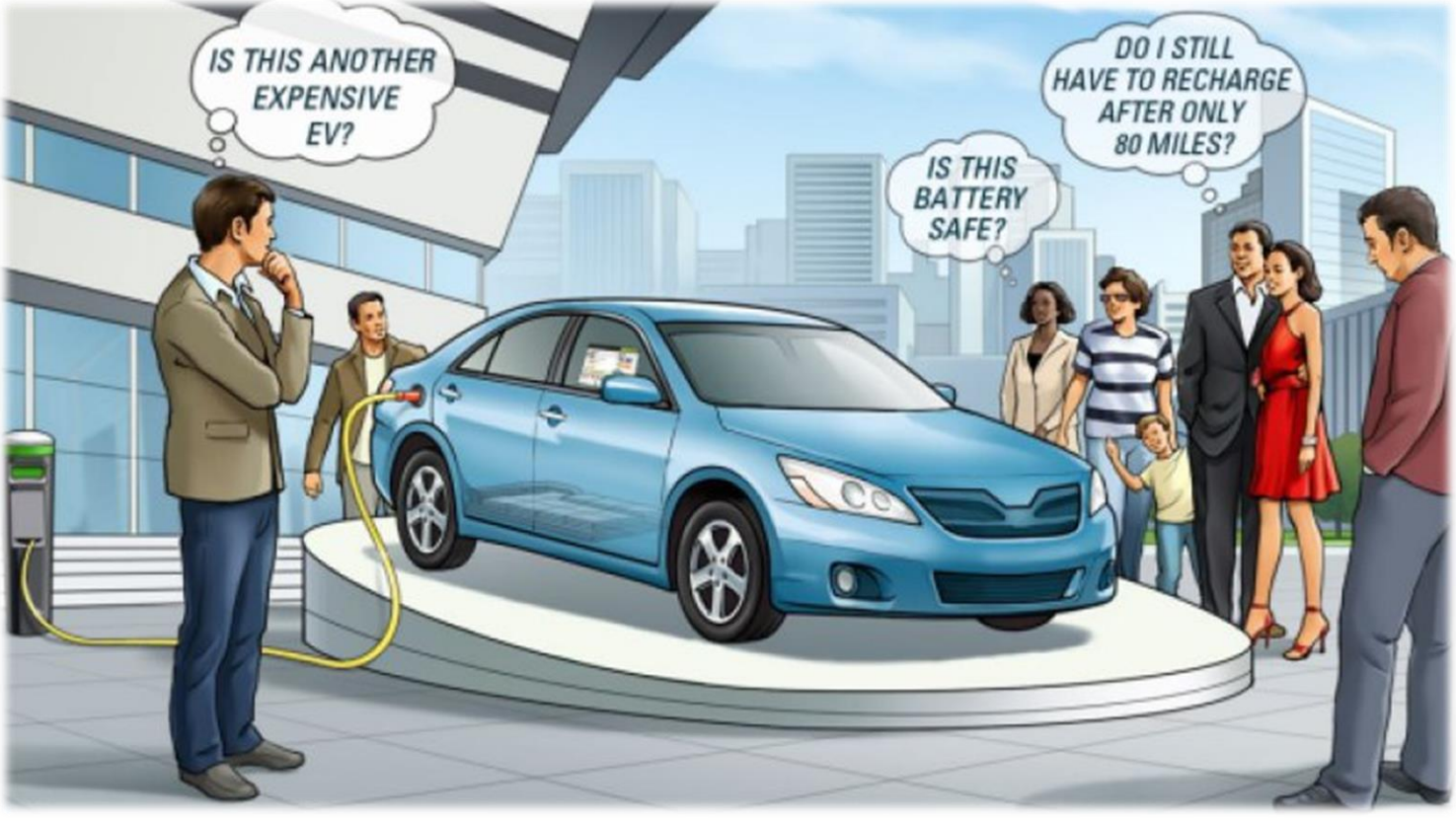
Why battery testing and characterisation is important?



Problem definition

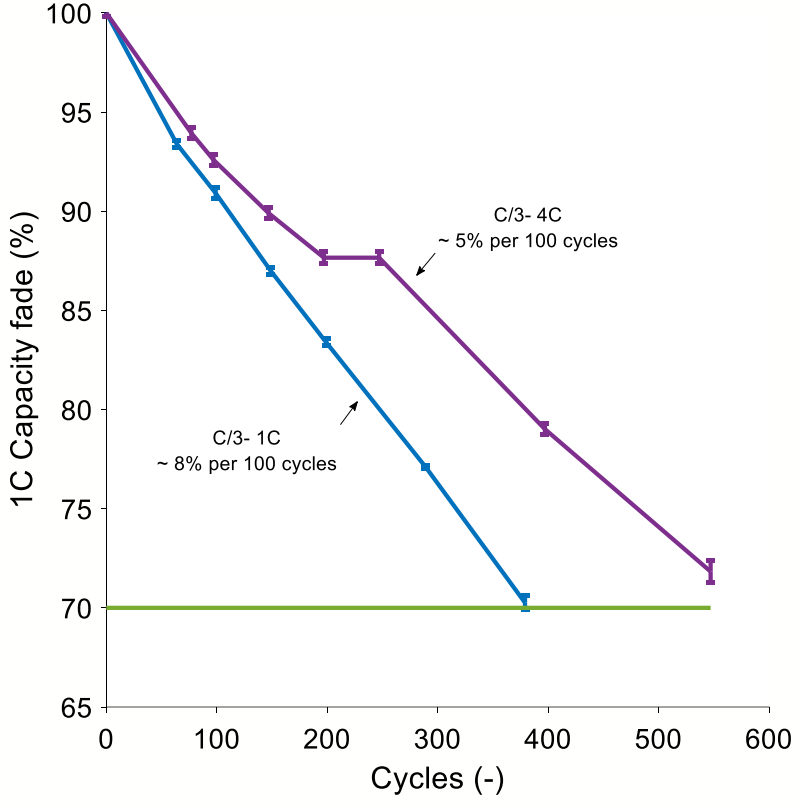
- Various designs and test rigs are used to characterise Li-ion batteries.
- Performing and collecting long-term ageing data is becoming prevalent.
- Contact resistance and temperature control of cells should measured to ensure reliable data sets.
- If not, large data-sets can be compromised and erroneous conclusions may be drawn.

An immersion test rig

Partial immersion test rig

An example

- Partially immersed setup used and results indicated that:
  - Batteries appeared to age rapidly:
  - 5% - 8% per 100 cycles at 25°C
  - 10% - 13% per 100 cycles at 40degC.
  - 1C discharge condition aged more rapidly than the 4C discharge cycling.

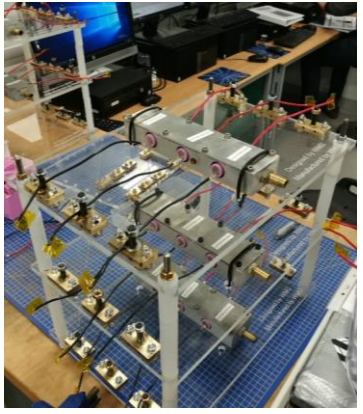


Possible sources of error

- Contact resistances
- Exposure of cell tabs to ambient
- 1C charging in snapshot test

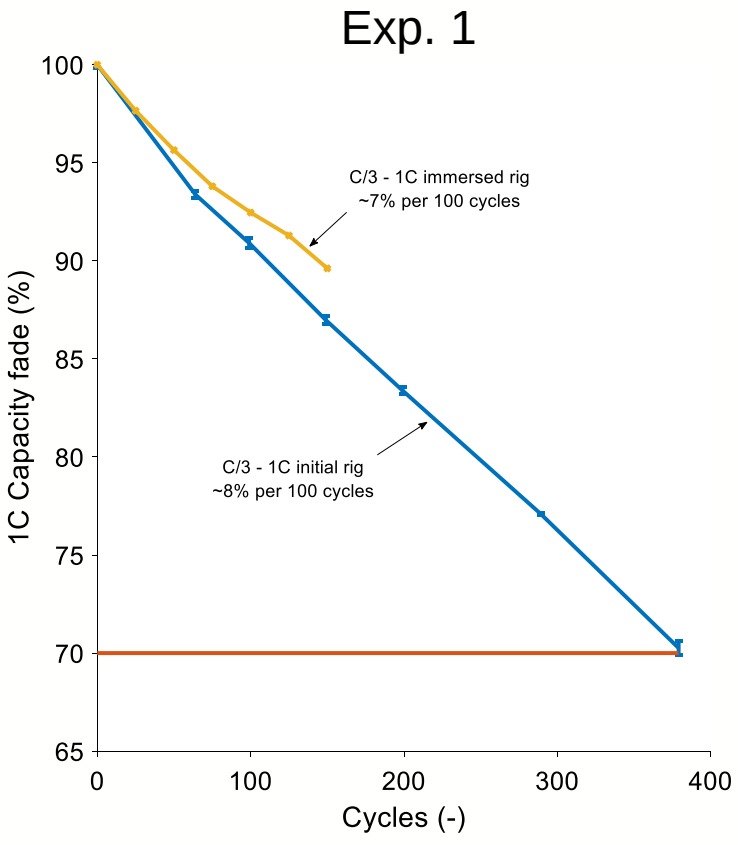
	Internal resistance		Percentage increase compared to cell resistance @3.5V
Initial test rig	7mΩ		54%
Immersed rig	0.2mΩ		2%
Experiments in immersed rig	C/3 – 1C cycling (Exp. 1)	C/3 – 2C cycling (Exp. 2)	1C – 1C cycling (Exp. 3)
Reason	To compare with initial rig	To study dependence of discharge rates (Exp. 2 vs 1)	To study dependence of charge rates (Exp. 3 vs Exp. 1)

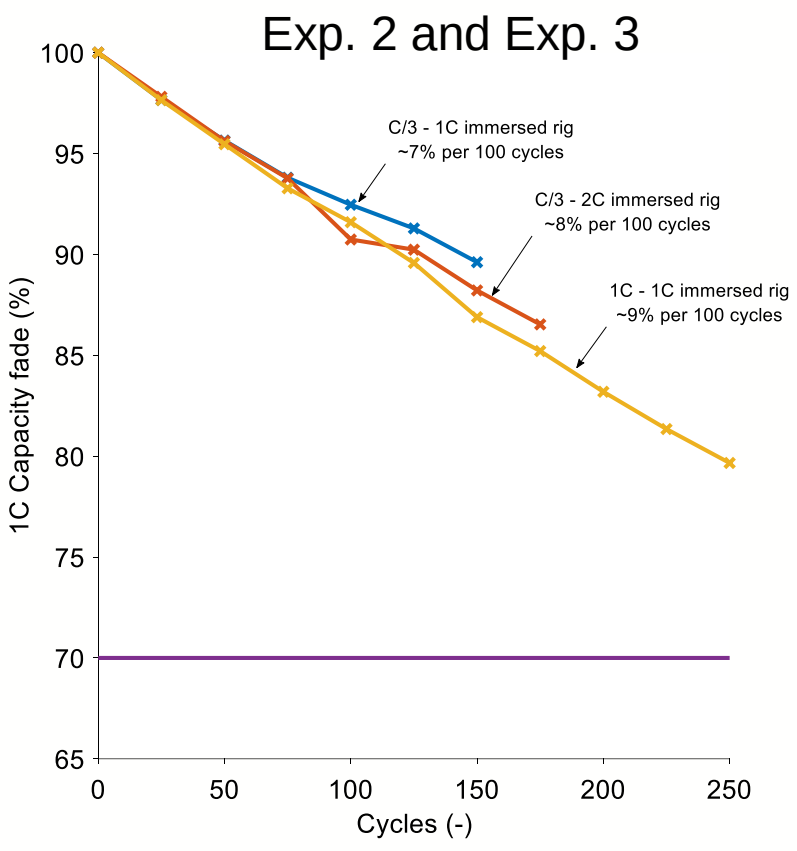
Partial immersed rig



Fully immersed rig

Comparison of partially immersed and fully immersed results





Conclusions

- Immersed test rig with temperature control provided reliable results
- Safety of cells during testing can be improved by using immersed setup
- Battery test cyclers can also affect accuracy of results due to their current sensitivity
- Higher initial contact resistances can cause rapid cell degradation

Thank You