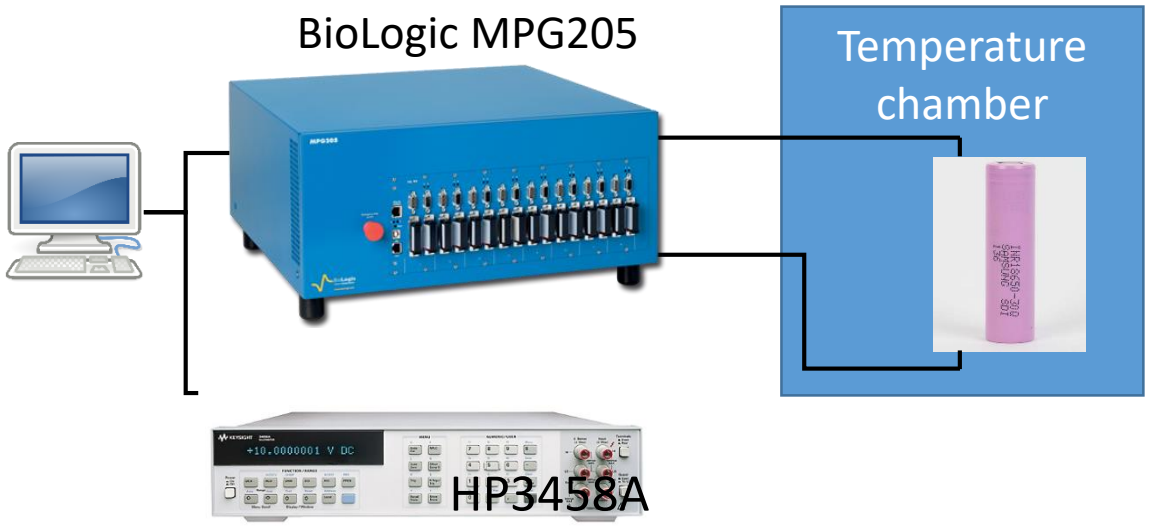
# Precision coulombic efficiency (T29)

In literature, the importance of Coulombic Efficiency (CE) is recognized as an indicator of lithium cell cycling stability and capacity fade.
During each cycle, small fractions of a cell's components are used in parasitic reactions. By carefully measuring the charge going in and out, the energy lost in these parasitic reactions can be tracked.

$$CE = {Q_{dsg}}/{Q_{chg}}$$

For contemporary lithium cells, the CE is close to 1, but becomes worse at higher temperatures and lower C-rates.

R&D Status: Test setup validation



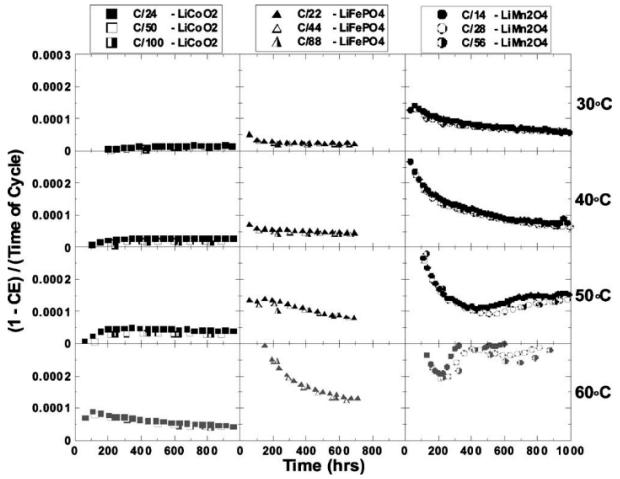




**Figure 4.** Coulombic inefficiency (1.0000 – CE) divided by time of a cycle plotted vs time for the 36 Li-ion cells charged and discharged at the C rates and temperatures indicated.

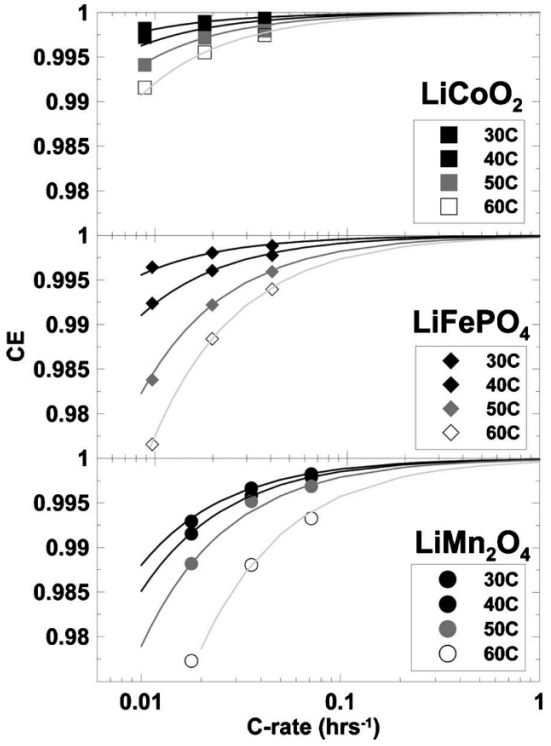



**Figure 5.** CE vs C rate for the 36 Li-ion cells tested at 30, 40, 50, and 60°C. The CE data were selected after 600 h of testing. The solid lines are fits of (1.0000 – CE) = $k$(time of one cycle) to the data, where $k$ is a constant. $k$ increases with temperature as shown in Table I.

A. J. Smith, J. C. Burns, and J. R. Dahn, "A High Precision Study of the Coulombic Efficiency of Li-Ion Batteries," Electrochem. Solid-State Lett., vol. 13, no. 12, p. A177, 2010.

# Precision coulombic efficiency

What can we characterize : cells

Experimental time: 1 day or longer

Advantage: a quick way to observe side reactions and therefore ageing

Drawback: Measurement is highly dependent on temperature influence.
Precise devices are needed (in comparison to normal battery testers and temperature chambers).

R&D Status: Advanced