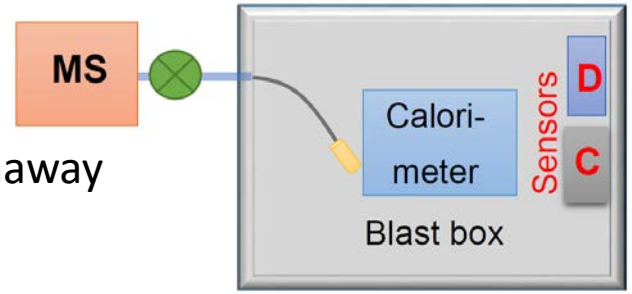
T23 ARC-MS: Accelerating Rate Calorimetry Coupled with external sensores and Mass Spectrometer - ZSW

TEESMAT
Open Innovation Test Bed for Electrochemical Energy Storage Materials

How it works

- Combination of accelerated rate calorimeter (ARC) and mass spectrometry (MS)
- Heating of Li-ion battery in ARC until onset-of-self-heating is detected, heating in exothermic mode until thermal runaway
- Simultaneous recording of evolving gases MS

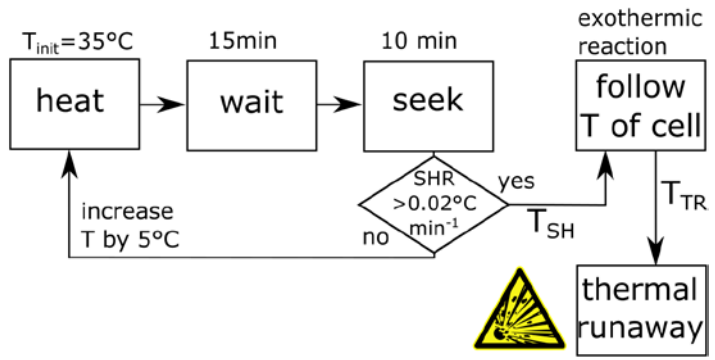


What can be seen

- Temperatures for onset-of-self-heating, venting onset-of-thermal-runaway
- Gases evolving from cell after venting

What kind of sample ?

Li-ion battery (typical size: 18650 or 21700), < 5 Ah
Tested batteries can be fresh, aged, or at different SOCs



Why is it useful ? Safety

Investigation time-scale : days

Maturity level : advanced

Grant Agreement
No 814106

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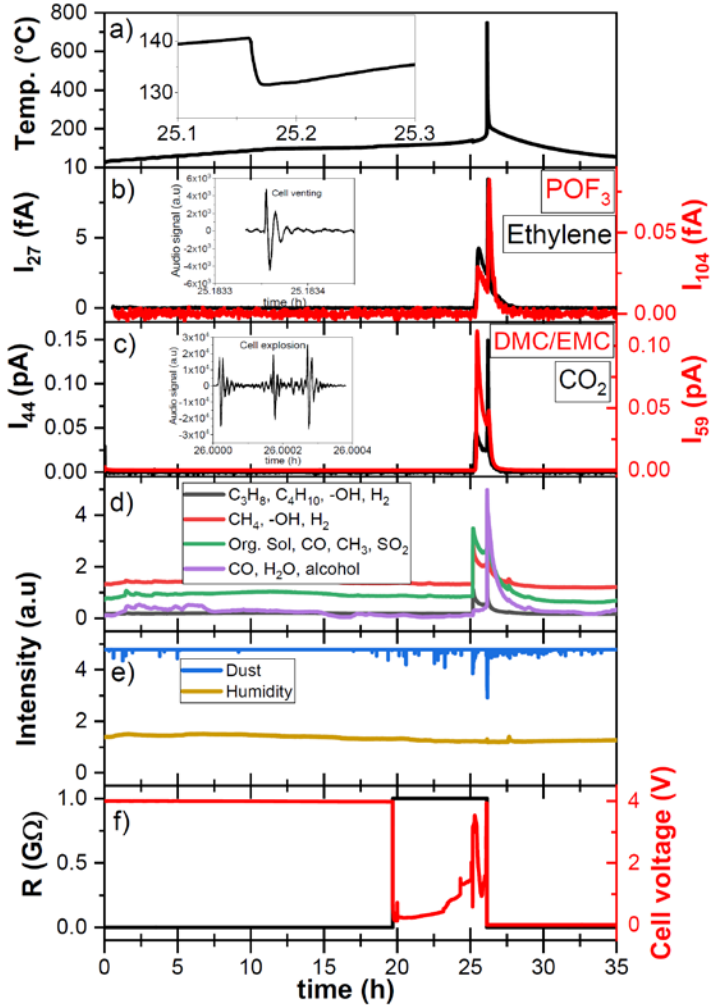
Example: commercial 18650 cell



Before test

After test

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References:

[1] 'Insights Into Thermal Runaway of Li–Ion Cells by Accelerating Rate Calorimetry Coupled with External Sensors and Online Gas Analysis', A.A. Abd-El-Latif, P. Sichler, M. Kasper, T. Waldmann, M. Wohlfahrt-Mehrens, Batteries & Supercaps 4 (2021) 1135, https://doi.org/10.1002/batt.202100023

[2] 'Effects of rest time after Li plating on safety behavior— ARC tests with commercial high-energy 18650 Li-ion cells', T. Waldmann, M. Wohlfahrt-Mehrens, Electrochim. Acta 230 (2017) 454, http://dx.doi.org/10.1016/j.electacta.2017.02.036