**On-line gas detection during the thermal runaway of Li-ion cells by coupling ARC with a mass spectrometer and external sensors**

Abdelaziz A. Abd-El-Latif, Peter Sichler, Michael Kasper, Margret Wohlfahrt-Mehrens, Thomas Waldmann

ZSW – Zentrum für Sonnenenergie- und Wasserstoff-Forschung, Baden-Württemberg, Helmholtzstrasse 8, D-89081 Ulm, Germany

In addition to the costs, high energy density, and fast-charging capability, safety of Li-ion batteries is most important – even after long-term usage or abusive conditions. A new combination of Accelerating Rate Calorimetry (ARC) coupled with a mass spectrometer (MS) [1] to study commercial 18650-type Li-ion cells will be shown. This novel ARC-MS setup allows monitoring the evolved gases during cell venting and thermal runaway. The tested cells were (i) un-aged, (ii) aged by low temperature cycling (leading to Li deposition on the anode [2,3]), and (iii) overcharged. The aged and the overcharged cells show an early onset of self-heating at 36°C whereas the self-heating started at 96°C for the un-aged cells. The rank of the time until explosion of the cells is in the order of overcharged cell < aged cell with Li deposition < un-aged cell. The thermal behavior and history of the studied cells and their effect on the type (see image) and mechanism of the formed gases [4] will be discussed in details.



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