ULTRASOUND INTERROGATION FOR BATTERY MONITORING ?(T21)

What?
- Non-destructive test (NDT) method;
- Study the propagation of acoustic waves throughout the battery’s materials;
- Acoustic waves interact with materials and interfaces.

Why?
- External setup, does not interfere with the normal operation
- Easy to put in place on any types of battery and battery cells
  ➔ Detect materials density variations, discontinuities, defects, bubbles generation…

Example of results
- Significant evolution of the waveforms during cycling;
- High repeatability of the physical behavior, even during cycling at different C-rates.

Estimate SoC from physical variation of materials, independently of electrochemical parameters (U, I, Q)

Main potential use:
- Formation process
- Optimal operation range (minimize stress)
- Detection of defects / Quality
- advanced BMS for better performance and safety
- Safety (abusive test, detect early signs)

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Advantages:
- Monitor variations of materials density during operation (monitoring of the formation process, detection of defects or bubbles generation…).
- External setup, does not interfere with the normal operation.
- Easy to put in place on every type of battery (18650, LiPo, Pb-acid…).

Drawbacks:
- The development of the technique is underway…
- Variable sensitivity to different phenomena (to be evaluated).
Acoustics measurements (T13)  
(VITO, CEA)

Ultrasound technique is a novel and non-destructive method, based on the use of two acoustic transducers (emission and reception). The study of the waveforms transmitted through batteries is particularly interesting for the supervision and management of batteries. As an example, CEA has already shown the usability of this technique in the early detection of thermal runaway events, and also in the establishment of state-of-charge (SoC) indicator without the use of classical parameters like voltage/current. Finally, this technique is also promising to define the optimal usage range of batteries, especially in the case of new materials, or aged materials such as in the case of second life of batterie.

R&D Status: Validation of literature results

Acoustics measurements

What can we characterize: cells

Experimental time: 1 h or longer

Advantage: a way to observe cell behaviour in another way than by the cell potential. So, additional BMS technique: for SOC and safety

Drawback: Response quite dependent on cell type and certainly on cell size. Not well established currently.

R&D Status: Validation of literature results