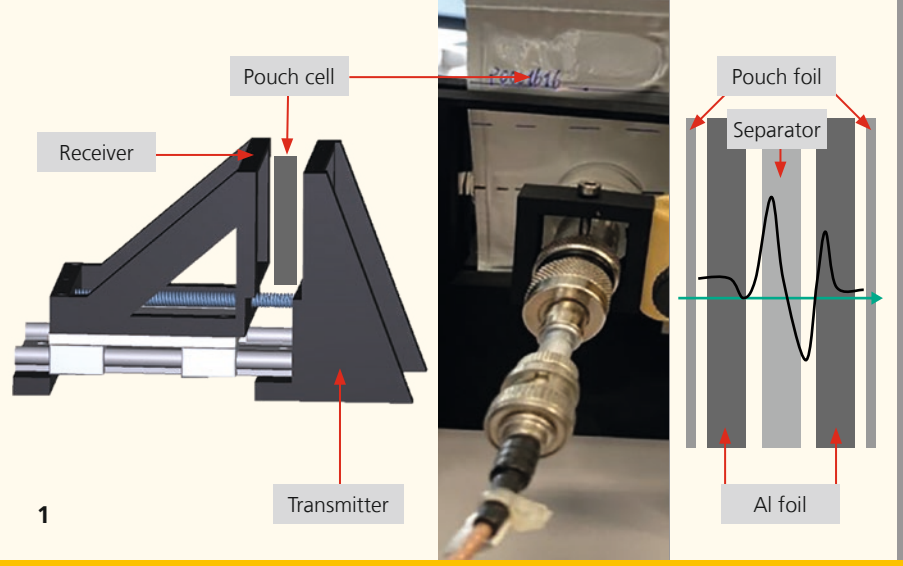

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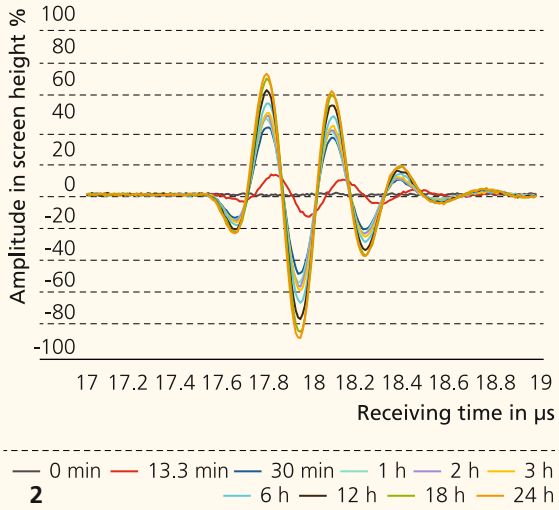

2

OPTIMIZING THE FILLING OF LITHIUM-ION BATTERY CELLS WITH IN-LINE METHODS

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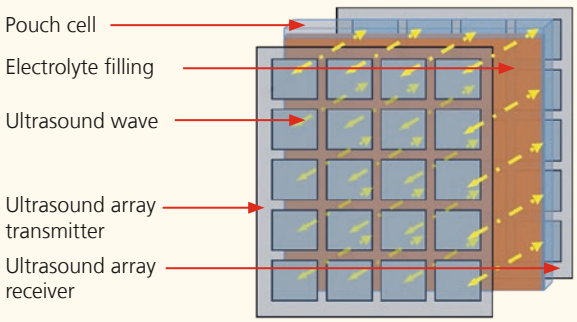
Electrolyte filling is a quality-relevant process step in the production of Li-ion battery cells (LIB), which has a direct influence on the performance and lifetime of the cell. Since there is currently no applicable in-line measurement method in the industry, empirical studies are conducted on cells. Most commonly, destructive methods, which involve the disassembly of the cell, are used. In order to reduce the production costs, there is a need for a non-destructive method with which the filling and wetting process can be visualized in situ during the production of the cell. The ultrasonic system developed at Fraunhofer IKTS (Figure 1) is used to monitor the wetting process of Li-ion batteries. The probes were fixed to both the front and back side of the cell. The measurement is carried out through the transmission of ultrasound through the cell while it is being filled with electrolyte. A visible change in the received signals (Figure 2) relating to the filling and wetting can be observed. The preparation path and the energy of the sound waves are strongly influenced by the wetting of the cell, whereby the pore volume of cell components is soaked in the electrolyte. This can be demonstrated by increasing the amplitude of the signal received from the measurement. A wet cell attenuates the sound wave less than a dry cell. More details about the filling process are obtained from the signal curve of the ultrasonic receiver. The change in the received signal can be divided into two parts: At first, there is a rapid increase in the signal amplitude – this corresponds to the macroscopic wetting of the cell. The subsequent slower signal change is attributed to the microscopic wetting. The different filling behavior of an LIB can thus be determined non-destructively by means of ultrasound detection.

With the integration of sensor arrays, this in-line method will be developed further into a measuring system. This would make it possible to resolve the wetting process spatially and ensure the complete wetting of the battery electrodes and the separator, thus shortening the safety margin for the filling time currently used throughout the industry.

Concept adaptive sensor array for wetting testing



ProZell Cell-Fill

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1 Ultrasonic system for monitoring the filling process.
2 Signals received from ultrasonic measurement during the filling process.

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