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Batteries & Supercaps

Cover Profile
doi.org/10.1002/batt.202300155

Chemistry Europe
European Chemical Societies Publishing

www.batteries-supercaps.org

Quantitative Cell Classification Based on Calibrated Impedance Spectroscopy and Metrological Uncertainty



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Invited for this month's cover picture is the group of researchers at Keysight Technologies Labs Austria. The front cover shows the error sources with different distribution functions affecting the battery impedance measurements. The uncertainties due to these errors are propagated in a metrology framework resulting in the confidence level of the impedance-based cell classification. Read the full text of the article at 10.1002/batt.202200524

What is the most significant result of this study?

This study shows how electrical impedance calibration and metrological uncertainty analysis can improve cell classification and make it quantitative including a confidence level. First, calibration is used to remove systematic errors from impedance measurements. Second, measurement uncertainty is provided based on metrological error propagation. Third, confidence levels are provided for the cell classification. Therefore, this research aims to address critical questions such as the trustworthiness of the measurement results and the context in which they are applicable, and the consistency of the results when repeating the same measurement procedures. It also provides answers regarding the statistical confidence level of classifying a cell as good or bad.

What was the inspiration for this cover design?

To show the new workflow for improved cell classification that incorporates metrological error analysis. It starts with error sources, then error propagation combined with the mathematical calibration and error correction procedures in order to get quantitative cell classification including a confidence level. While this procedure is new in the field of battery testing, it is commonly used in the field of modern telecommunication.

Does the research open other avenues that you would like to investigate?

In this study, impedance calibration and uncertainty were used for cell classification. In the future, we are interested to see the effect of uncertainty on battery model extraction and how this information affects the confidence level of model parameters, for instance in equivalent circuit models. Also, the application of uncertainty for the evaluation of automotive battery packs will be relevant for quality assessment and 2nd life applications. Finally, the extended application of electrical calibration and uncertainty will be a valuable basis for the ongoing battery passport initiative.

What other topics are you working on at the moment?

Currently, we are extending the impedance calibration and uncertainty to electric vehicle packs and corresponding tests of battery SoH. This also gives a solid and sound basis for 2nd life applications and augments the battery passport and corresponding reliability in the battery production value chain.

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