Spring 2021 Joint Colloquium
Materials Department & Materials Research Laboratory

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11:00 am, via Zoom

New Opportunities for Battery Research and Development from Inside-out MRI and Magnetometry

Rechargeable batteries are notoriously difficult to assess. Batteries need to hold a lot of energy, deliver power and recharge quickly and safely. Currently, there are very few techniques that allow characterizing the state of cells at different stages of their life-cycle. We are presenting new battery assessment technology based on MRI and magnetometry techniques, which allow non-destructive scanning of rechargeable cells. The techniques are fast, can detect changes in the electrode chemistry that occur as the battery is charged and discharged, or sense a range of different defects at early stages. In particular, we can determine site-resolved state-of-charge (where charge is stored in the cell), current distributions, as well as tiny transient effects. The vision is to use a benchtop-type instrument, which could be deployed in a variety of ways. The aim is to improve safety and performance, help in predicting battery life, clarify failure modes, and aid in the development of next-generation cells. Both MRI and magnetometry provide complementary measurement modalities with their own strengths and limitations. MRI allows sensitive state of charge determination in a localized manner, and magnetometry allows the detection of extremely weak electrical currents, both DC and AC at the level of nA in principle. Both these techniques provide new opportunities for battery diagnostics and research and could help reducing the development cycle for new batteries, determining obscure battery failure modes, and study fundamental electrochemical processes. All these new methods are aimed at enhancing our ability to characterize cells at all stages from research and development to production, deployment, and recycling.

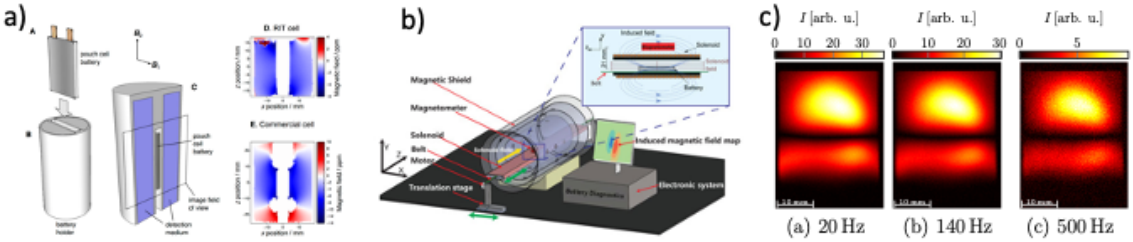

Figure 1: (a) schematic for ioMRI, (b) atomic magnetometry setup, (c) alternating current mapping with ioMIR.

Bio

Alexej Jerschow is a Full Professor of Chemistry at New York University, where he leads an interdisciplinary research group in magnetic resonance. Most recently, his work has been divided between battery research using in situ NMR/MRI and magnetometry, and the study of nuclear spin singlet states and relaxation theory.

https://wp.nyu.edu/jerschow/

Hosted by Raphaële Clément.