Cover Profile
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Heterogeneity of Graphite Lithiation in State-of-the-Art Cylinder-Type Li-Ion Cells


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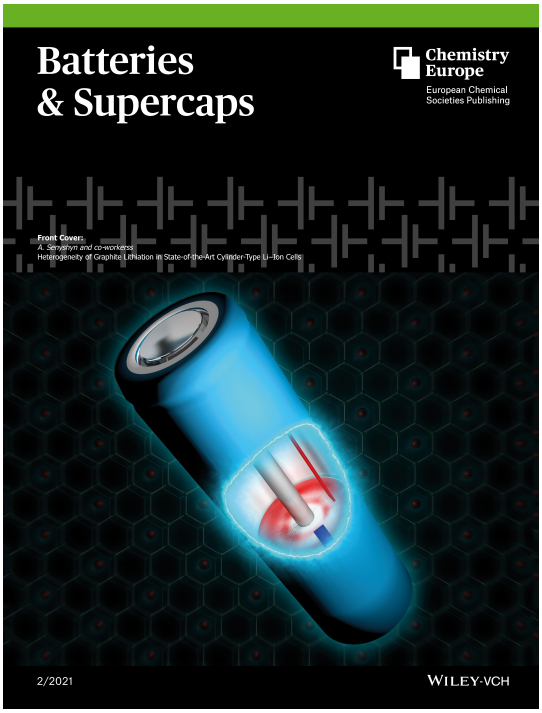
Invited for this month's cover picture is the group of Anatoliy Senyshyn. The cover picture displays the lithium distribution in the graphite anode of an 18650-type Li-ion battery. A look into the cell's interior illustrates a non-destructive character of the performed studies. The background template corresponds to the structure of lithiated graphite, referring to the diffraction technique as a tool for spatially resolved quantification of lithium concentration within the cell. Read the full text of the Article at 10.1002/batt.202000178.

What is the most important highlight of this article?

The article highlights the complex interplay between the local electrochemical reactions displayed in the intercalated lithium ions with selected cell properties like electrode thickness, position of the current tabs, etc. Different 2D shapes and magnitudes of graphite lithiation were observed for 34 state-of-the art cylinder (18650) – type cells, displaying rich diversity in lithium distribution. The obtained results emphasize the relevance of lithium uniformities on the cell performance, cycling stability, and safety, where state-of-the-art lithium-ion batteries do not fully exploit their ergonomic potential.

What future opportunities do you see?

Parallel to the search/optimization of new materials, a targeted cell design (e.g., towards development of new cell layouts, optimisation of current and electrolyte distribution etc.) is a promising way of increasing energy and power densities, improving the cycling rate and cycling stability of Li-ion batteries.



What are the main challenges in the broad area of your research?

Cylinder-type Li-ion batteries are massive objects characterized by strong scattering background and heavy absorption of incident X-rays or thermal neutrons. Maintaining a compromise between high signal-to-noise ratio (needed for extraction of structural signal from the cell's interior) and the best accessible spatial resolution (required for detalisation of spatial heterogeneities) were the major challenges in the current work. We are currently working on new methods potentially suited for sufficiently improved signal-to-noise ratio and submm spatial resolution.