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Studying the uniformity of custom-made Li-ion pouch cells using operando neutron powder diffraction and spatially resolved synchrotron X-ray diffraction

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A custom-made, multilayered Li-ion battery pouch cell was investigated using operando neutron powder diffraction (NPD) and spatially resolved powder X-ray diffraction (SR-PXRD) with the aim of comparing the information obtained from the two complementary techniques. The work focused on the anode and cathode lithiation as obtained from the LiC6/LiC12 weight ratio and the NMC111 c/a-ratio, respectively. Using a rotary stage, Rietveld refineable neutron powder diffractograms were measured with geometrical effects minimized. Using SR-PXRD, the cell was shown to be non-uniform in its anode and cathode lithiation, with the edges of the cell being less lithiated/delithiated than the center. This was more pronounced for high charging current than low charging current. The averaged SR-PXRD data was found to match the bulk NPD data well. This is encouraging as it seems to allow comparisons between studies using either of these complimentary techniques. This work will also serve as a benchmark for our future studies on pouch cells with novel noncommercial cathode and/or anode materials.

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