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## **In situ neutron diffraction study of lithium-ion batteries during operation and relaxation**

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Reduced capacity and rate capability, lithium plating and current collector corrosion are some of the effects detrimental to lithium-ion battery performance and safety at low temperature operation. Novel electrode designs and electrolytes that suit these conditions are currently investigated. Detailed knowledge of the effect of low temperature conditions on the battery during operation is helpful for further improvements. In operando visualization of the impact on electrode inhomogeneity can illustrate shortcomings in current electrode design.

We performed time resolved in situ neutron diffraction measurements on custom made NCM/graphite pouch cells at STRESS-SPEC, MLZ. The batteries showed a lithiation gradient in the graphite anode during operation and subsequent relaxation. Diffraction data of the discharge and relaxation processes is presented and the effect of active material loading and electrode morphology on anode inhomogeneity are discussed.

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