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Battery research using synchrotron powder X-ray diffraction

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Research and development of rechargeable batteries is critical to meet the worldwide demand for clean and sustainable energy collection and storage. A vital part of this research is to get clear understanding of how the crystal structures of electrode materials affect the the resulting properties of the batteries. As structural changes in both the anode and cathode materials play an important role in overall battery performance, synchrotron powder X-ray diffraction (PXRD), with high beam flux and resolution, is an extremely useful tool for studying the battery both in-situ and ex-situ. Several simple in-situ cell designs have been designed for synchrotron PXRD measurement. The cell is available for researchers in the field of battery research. The effectiveness and simplicity of the cell design have been demonstrated at Powder Diffraction Beamline at Australian Synchrotron for several user groups. Case studies of analysis of the lithium insertion reaction for Li0.18Sr0.66Ti0.5Nb0.5O3 defect perovskite [1], crystal structure of Li4Ti5O12−xBrx electrode material [2] and LiNi1/3Mn1/3Co1/3O2 (NMC) as a new synthesized cathode material [3] will be discussed, respectively.

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