ION DYNAMICS IN LITHIUM and ZINC ION CELLS REVEALED BY MAGNETIC RESONANCE SPECTROSCOPY and RELAXOMETRY. **Gillian R. Goward**, Department of Chemistry & Chemical Biology, McMaster University, Hamilton, Canada. (goward@mcmaster.ca)

Li-ion batteries (LIBs) have become ubiquitous in society, ranging from hand-held portable electronics to widespread adoptions in electric vehicles. Beyond mobile devices, a Net-Zero future requires appropriate energy storage for the grid, for which LIBs are impractical. Alternative chemistries are composed of abundant materials and utilize aqueous electrolytes, which are environmentally friendly, sustainable, and cost-effective. Magnetic resonance spectroscopy and imaging techniques are powerful tools for probing dynamic processes in lithium-ion batteries [1]. We have recently reported the application of a parallel-plate resonator to the *real-time* ^{7}Li *operando* NMR monitoring of Li metal deposition on a graphite anode during repeated charging and discharging of a single layer prismatic cell [2]. The method allows the quantification of the lithiation of the anode material as well as the early detection of plated metallic lithium throughout the duration of cell charging. Optimized ^{1}H and ^{7}Li PPRs are utilized to enable high sensitivity *in situ* and *operando* NMR experiments with fine temporal resolution, allowing identification of transient species such as Mn^{2+}(aq) dissolution, and accumulation of defect sites.

[1] Pecher, O., Carretero-Gonzalez, J., Griffith, K., Grey, C.P., *Chem. Mater.,* 2017, **29** 213−242. DOI.org/10.1021/acs.chemmater.6b03183
[2] K.J. Sanders, J.R. Keffer, A.R. Aguilera, B.J. Balcom, I.C. Halalay, G.R. Goward *Carbon* 2022,**189** (377-385) DOI.org/10.1016/j.carbon.2021.12.082