HOW DO YOU SOLVE A PROBLEM LIKE LITHIUM POLYSULFIDES?

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The drive to identify high energy batteries remains an on-going challenge. Whilst companies and researchers continue to pursue intercalation materials that can operate high voltages (5 V vs $Li|Li^+$), these materials and devices don't offer the step change in energy density that a battery hungry world requires.

Although a 10 fold increase in specific energy is possible with recent advances in Li-Sulfur (2567 Wh per kg) technologies, there are several challenges in the development of these devices. The most vexing of these challenges is the generation of lithium polysulfides which are highly prone to irreversibly move into the electrolyte media. These can have deleterious effects on the performance of the device such as reduced capacity and cycle-life. To overcome this problem, numerous different approaches have been trialled to "lock" S within a conductive structure / matrix whilst still making it available to lithium ions from the electrolyte to form the required lithium polysulfides that deliver the high capacity of the device.

At CSIRO, we have been looking at a range of different methodologies to understand the formation of polysulfides both in the electrolyte and the cathode and then examine various methods to keep them electrically connected within the cathode. In this presentation, we will highlight our work in various cathode structures, both organic and inorganic based, methods to prevent polysulfide dissolution, changes to the electrolyte and the effect on cycling and *in-situ* studies at the Australian Synchrotron.

Reference to a journal publication:
[1] M. Barghamadi, A. S. Best, A. I. Bhatt, A. F. Hollenkamp, M. Musameh, R. J. Rees and T. Rüther, Energy Environ. Sci., 2014, 7, 3902
[2] R. Chen, T. Zhao, Feng Wu, Chem. Commun., 2015, 51, 18
[3] M. Barghamadi, A. S. Best, A. I. Bhatt, A. F. Hollenkamp, P. J. Mahon, M. Musameh, T. Rüther, Electrochimica Acta 180 (2015) 636–644