Mechanism Keynote Abstract & Speaker Biography

Towards thorough characterization of lithium/sulfur batteries using tomography techniques

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High specific energy density of sulfur electrodes are expected to serve in high performances low cost next generation lithium rechargeable batteries. However, contrary to conventional Li-ion mechanisms, Li/S cells transport charge via a series of complex chemical reactions between solid and soluble sulfur species, causing severe morphological changes of the positive electrode upon cycling, and which generally lead to lower performances with respect to the theoretical capacity. High specific energy density also means high areal capacity and highly demanding depths of discharge for the lithium metal electrode during striping/plating cycles. As a matter of fact, morphology changes of both electrodes upon cycling are still key parameters for Li/S batteries, while different strategies can be found in the literature to address these degradation mechanisms [1-2].

In parallel, a number of investigations are currently ongoing to understand these degradation phenomena and the involved mechanisms [3-4]. In particular, in situ and operando X-ray diffraction technique is an interesting characterization method [5], providing qualitative and quantitative information on crystalline active species upon cycling, for example at the positive electrode. As well, X-ray absorption tomography allows changes in the global morphology of the electrodes to be studied upon cycling [6]. In this work, X-ray tomography was combined with X-ray diffraction spectroscopy, to follow operando the full cell behaviour thanks to morphological and chemical information, and then to understand the ageing mechanisms of the cell components. To this purpose, sequential X-ray absorption tomography and X-ray diffraction measurements were combined as an efficient tool for thorough characterization of Li/S cells operando, and information on both positive and negative electrodes could be recorded using a representative cell design. As a perspective of this work, such a characterization tool could be applied by material scientists while designing and characterizing new solutions developed for Li/S cells [7].

References

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Speaker Biography:

Dr. Céline BARCHASZ received her Ph.D. in materials science and electrochemistry about the "development of lithium/suphur battery technology" in 2011 from Grenoble University (France), in collaboration with LEPMI laboratory (Grenoble – France).

Since 2011, she works as a R&D engineer in the battery materials laboratory in CEA-LITEN (Grenoble – France). She is the author of 14 papers and has filled 11 patents. She is currently involved in different projects in the field of lithium batteries.