Understanding gas evolution from batteries via operando measurements

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Abstract:

The formation of gases from lithium-ion batteries under abuse conditions is a serious safety issue that can cause the cell's rupture and explosion [1], as well as the release of highly toxic gases [2]. In addition, the formation of gases under typical operation conditions is also very problematic, and a symptom of battery degradation that can be used to predict the battery lifetime [3]. However, the techniques currently available for the study of gases from lithium batteries are limited, and consequently, we have recently developed a new a new, simple and reliable cell design to monitor the operando pressure changes of Li-ion battery materials, and we have successfully applied it to quantify the gases involved in the formation of the graphite SEI and to study the changes in the electrode's volume induced by the electrochemical reactions of lithium insertion and extraction [3]. We have also characterized the evolution of gases from lithium-oxygen batteries, and we have shown that it is possible to transform the mechanism of the oxygen redox reactions and efficiently bypass the formation of detrimental reaction intermediates (e.g. superoxide) via the incorporation of redox mediators [4], and in a recent study we have shown that unsuitable electrolytes, prone to degradation, can be made suitable via such transformation of the reaction mechanism [5].

References:

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Biography:

Dr. Nuria Garcia-Araez obtained her PhD in 2007 in the field of single-crystal electrochemistry under the supervision of Profs. Juan Feliu and Victor Climent at the University of Alicante, in collaboration with Prof. Jacek Lipkowski (University of Guelph). Then, she worked as postdoctoral researcher on the study of water-metal interaction with Profs. Marc Koper and Huib Bakker (The Netherlands), and as senior scientist on battery research with Prof. Petr Novak (Paul Scherrer Institute). In 2012, she was appointed lecturer in electrochemistry at the University of Southampton. Her current research focuses on the rational development of rechargeable metal-oxygen/sulfur/ion batteries.