A High-Temporal-Resolution Online Electrochemical Mass Spectrometer System for Battery Studies

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Addressing technological challenges of advanced batteries requires in-depth understanding of the fundamental reaction mechanisms of the battery chemistry. Online electrochemical mass spectrometer (OEMS) is a vital tool for conducting fundamental investigation since it captures real-time information of the gas phase reactants and products, especially O_2, which is central to the complex reactions involved in discharge and charge of rechargeable Li-O_2 batteries. Although OEMS systems have successfully been applied to support many important studies,[1-3] the temporal resolution is typically limited to over ten minutes. Further improvement in the temporal resolution will help to reveal finer features of gas evolution profiles, and to probe gas evolution in a fast charging process that is relevant to practical applications. In this work, we describe an OEMS system with a high temporal resolution of less than 1 min. Figure 1 shows an example of the gas evolution profiles, which is obtained when charging a Li-Li_2O_2 cell at 1000 mA/g_c (equivalent to 2C). Multiple stages and fine features are observed in the profiles of voltage and gases. We will discuss the detailed structure of the OEMS system, the design consideration to enable high temporal resolution and critical insights revealed by the high-temporal-resolution OEMS on the reaction mechanism of Li-O_2 batteries.

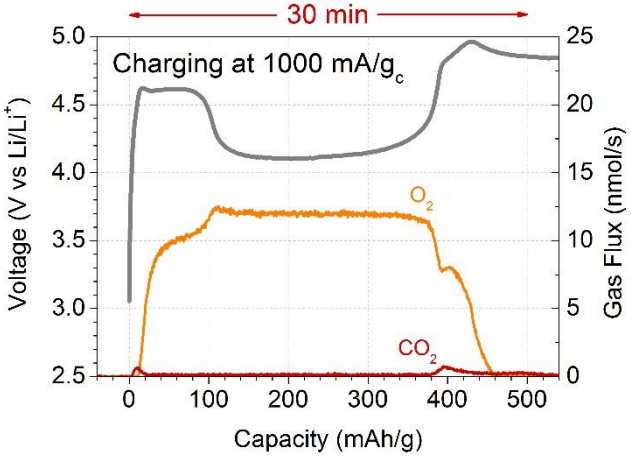

Figure 1. Voltage and gas evolution profiles of charging a Li-Li_2O_2 cell at 1000 mA/g_c.

References:

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