The Rechargeable Aprotic Li-O_2 Battery

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ABSTRACT

Li-ion and related battery technologies will be important for years to come. However, society needs energy storage that exceeds the capacity of Li-ion batteries. We must explore alternatives to Li-ion if we are to have any hope of meeting the long-term needs for energy storage. One such alternative is the Li-air (O_2) battery; its theoretical specific energy exceeds that of Li-ion, but many hurdles face its realization.[1-5] One spin-off of the recent interest in rechargeable Li-O_2 batteries, based on aprotic electrolytes is that it has highlighted the importance of understanding the fundamental electrochemistry at the positive electrode within the battery.[6-15]

The challenges of obtaining efficient, reversible charge and discharge are well-documented in the field. Here, we describe how our recent studies into the electrochemical mechanism of O_2 reduction to form Li_2O_2 at the positive electrode might allow us to design new strategies to overcome these limitations;[16] For example, exploiting the effect of solvent donor number, Fig. 1. We will describe our resent results using redox mediators[17] to facilitate the electrochemistry along with the implications of the results for the future of rechargeable Li-O_2 batteries.

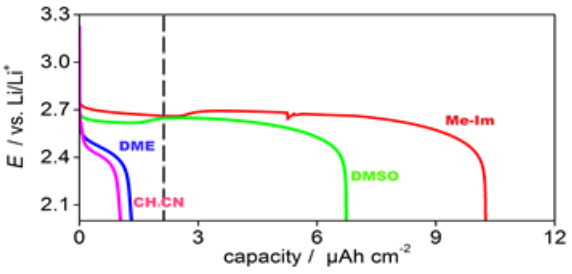

Figure 1. Potential vs. time at a planar Au electrode in various O_2 saturated aprotic solvents, 100 mM $LiClO_4$ showing early cell death for low donor number solvents but sustained capacity beyond the 7 nm limit (dashed line) for a Li_2O_2 film in high donor number solvents.

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