RuO_2 Inverse Opal Cathodes for High-Performance Li-O_2 Battery

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The incorporation of catalytic functionalities in the development of cathodes in the Li-O_2 battery has unveiled encouraging results in the overall performance of these energy storage devices. In particular the introduction of ruthenium oxide (RuO_2)-based catalysts has been underlined according to their superior bifunctional electrocatalytic activity toward both the oxygen reduction reaction (ORR) and oxygen evolution reaction (OER).[1] Herein we report the synthesis and application of rationally designed highly ordered porous RuO_2 inverse opal nanostructures with enhanced surface area and metal-like conductivity for superior charge transport.[2] Meticulous characterization of these materials has been conveniently acquired. In the presence of a DMSO-based electrolyte, the Li-O_2 cell employing RuO_2 as the cathode revealed a charge overpotential at ~3.2 V, corresponding to a ~600 mV decrease compared with that of carbon-based cathodes such as Super P and Ketjen Black. In addition when compared with the aforementioned carbon-based references, a transition from a 2 to 4 e^-/O_2 process on discharge and charge, respectively, was suggested by *in situ* differential electrochemical mass spectrometry (DEMS) monitoring. The formation of LiOH as a discharge product of the RuO_2 cathode based Li-O_2 cell was corroborated by Raman and XRD spectroscopy. The results herein presented significantly add to the current state-of-the-art in the development of cathodes in Li-air systems and the study of the underlying reaction mechanism.

References:

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