A comparative analysis of redox mediators in Li-O_2 batteries

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To solve the low-energy efficiency problem of Li-O_2 batteries, many kinds of redox mediators (RMs) have been studied. However, systematic research looking into the problems of RMs in these systems are insufficient. We compare herein effects and problems of RMs in Li-O_2 batteries by applying unique methodology, based on two types of cells, comparison between argon and oxygen atmospheres and combining electrochemistry in conjunction with spectroscopy. Using systematic electrochemical measurements, representative RMs in Li-O_2 battery prototypes were thoroughly explored with respect to oxygen presence, voltage ranges and scan rates. By this comparative, multi-parameters study we reached valuable insights. We identified possible routes for RMs degradation in Li-O_2 batteries related to the cathode side, using bi-compartments cells with solid electrolyte that blocks the crossover between the cathode and the Li metal sides. Based on comparative research, we confirmed that degradation of the RMs activity was caused by intrinsic decomposition of the RMs in the electrolyte solution at the cathode part, even before further reactions with reduced oxygen species.