Impedance-Based Battery Management for Metal-O2 Systems - DTU Orbit (29/03/2019)

Impedance-Based Battery Management for Metal-O2 Systems

In electric vehicles, reliable estimation of the state-of-charge (SoC) is crucial to determine the remaining capacity, but the electrochemical processes in metal-O2 batteries are very different to the Li-ion batteries used today, and current SoC-estimation methods prove insufficient. In Li-O2 batteries, the capacity is highly dependent on the discharge rate, since different current densities enable different growth mechanisms of Li2O2, and an on-board calibration of the SoC is therefore needed. Such a calibration is typically performed by measuring the open-circuit voltage (OCV), but as the OCV of many metal-O2 battery does not change as a function of capacity, this method cannot be used. In this manuscript, we propose a method, based on a single-frequency electrochemical impedance measurement, to estimate the remaining capacity and assess the state-of-health of reversible metal-O2 batteries by calculating the capacitance of the positive electrode where the discharge products are formed. The results from experiments on Li-O2 batteries show that the capacitance is a good measure of the remaining capacity and that the SoC estimation can be improved significantly by the calibration.

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