On the Stability of NaO_2 in Na-O_2 Batteries

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Alkali metal-oxygen batteries, such as Li-O_2 and Na-O_2, have been of great research interest over the past decade. They are considered as high specific energy alternatives to current state-of-the-art lithium-ion batteries. Particularly attractive is the emerging Na-O_2 battery with NaO_2 as the discharge product. Despite a lower energy density it has the potential to provide a higher energy efficiency, rate capability and chemical reversibility compared to Li-O_2. Sodium is also cheaper and more abundant than lithium.

In this work, we investigated reaction products formed during discharge of Na-O_2 cells and their stability over relaxation (pause) time. *In operando* and *ex situ* XRD were used to quantify the amount of the main reaction products, i.e. NaO_2, and to understand the possible factors that affect the stability of the discharge products.

NaO_2 forms during discharge of the Na-O_2 cell. The sodium superoxide formed is not stable but decomposes. Several decomposition routes can be identified, both self-decomposition through disproportionation and decomposition through chemical reactions with components in the cell. It is possible to quantitatively follow the decomposition rates with *in operando* and *ex situ* XRD.