Understanding The Structure and Properties of The Elusive Non- Stoichiometric Lead Dioxide

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Underutilization of the active material on the positive plate has been a persistent restriction on the performance of lead-acid batteries. Initial utilization of chemically-prepared and PbO2 phases formed in a battery during charge suggests that the stoichiometries change with cycling1 and proximity to oxygen evolution. Moreover, the lifetime of the battery is often limited by the ratio of α and β-PbO2 and the adhesion between PbO2 and the underlying Pb current collector. This interface, referred to as the "corrosion layer" is thought to contain lead oxides with intermediate composition between PbO and PbO2. Similar phases have previously been identified by mass loss or color change during thermal decomposition of PbO2 to PbO, suggesting at least two phases2, 3. Here, we identify the structure of these phases using multiple in situ analysis techniques. Isolation of PbOx phase/s using TGA enabled determination of a PbOx structure and further analysis with NMR and XPS to provide Pb oxidation states and Pb environments. Finally, we compare these results to data collected from industrial battery plates.

References

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