MSE-9: Anion Charge Storage System

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Problem Statement:

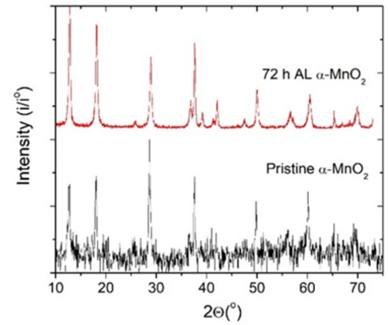
How is the structure changed by varying the oxygen vacancy content using acid-leaching (AL) method affecting the electrochemical performance of α-MnO_2?

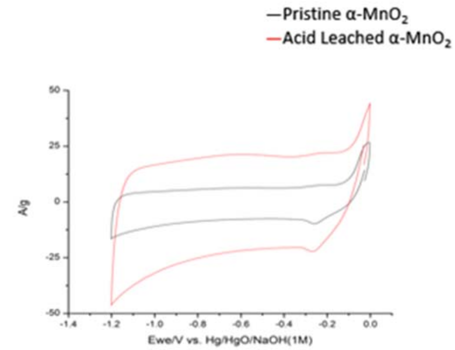
Approach:

Correlated structure & electrochemical performance with fabrication method:

- Manipulated the oxygen vacancy content of pristine α-MnO_2 by using an acid-leach method and drop-cast the materials onto electrodes.
- Characterized the samples *via* XRD, SEM, cyclic voltammetry.
- Compared electrochemical results of the electrodes. Capacitance was found to vary with different oxygen vacancy contents.

Results:





- XRD – confirmed the crystal structure of α-MnO_2 not changing before and after acid-leaching.
- SEM – showed different morphologies of both pristine and AL α-MnO_2.
- Cyclic Voltammetry – showed pristine α-MnO_2 having capacitance of 464 F/g and AL α-MnO_2 having capacitance of 782 F/g.

Discussion & Conclusions:

- Acid-leaching method removed some oxygen content from pristine α-MnO_2 and created oxygen vacancies while the crystal structure of the material did not change.
- The morphology of the pristine α-MnO_2 changed from nanowires to an amorphous structure after the acid-leaching process.
- Cyclic voltammetry curves showed the AL α-MnO_2 having a higher capacitance of 782 F/g, which indicated that the material with a higher oxygen vacancy had a better electrochemical performance.

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