Identifying phosphate materials that can intercalate 2 Li to enhance the capacity of a Li battery

Scientific Achievement

We have shown that some vanadium and molybdenum phosphates can react with more than 1 Li ion per transition metal redox center in a reversible manner over many cycles. We are determining the reaction mechanism (structural changes) that allows for the Li incorporation, and what limits the complete reaction (350 mAh/g) and causes an increased overpotential on lithium removal.

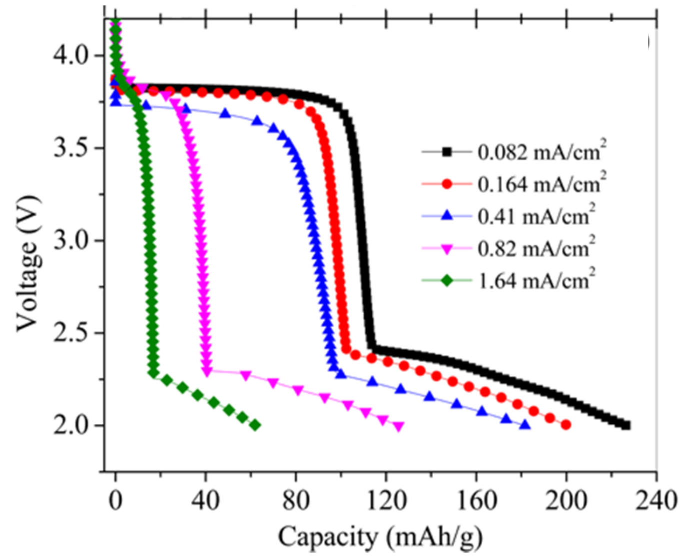
Significance and Impact

Finding and understanding materials that can reversibly intercalate more than one lithium ion per redox center will allow the designing of the next generation battery materials that will have significantly higher capacities than today's electrochemical couples.

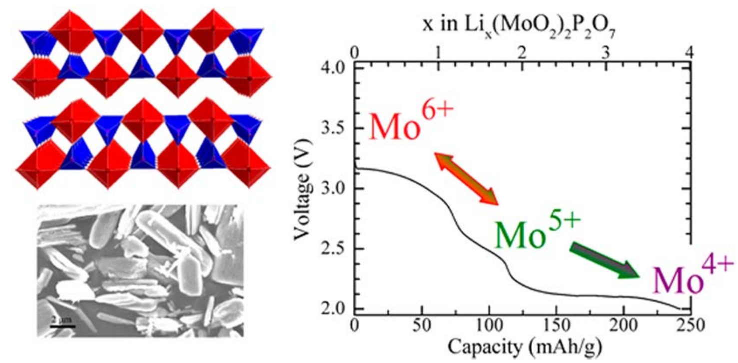
Research Details

- Powder samples of ε-$VOPO_4$ and molybdenum (oxy)-pyrophosphate δ-$(MoO_2)P_2O_7$ were synthesized and characterized structurally.
- Their ability to reversibly intercalate lithium was determined.

Z. Chen, Q. Chen, L. Chen, R. Zhang , H. Zhou, N. A. Chernova, M. S. Whittingham – J. Electrochem. Soc., 2013, 160, A1777. DOI: 10.1149/2.064310jes
B. Wen, N. A. Chernova, R. Zhang , Q. Fang, F. Omenya, J. Fang, M. S. Whittingham – Chem. Mater. 2013, 25, 3513. DOI: 10.1021/cm401946h
This work was performed at Binghamton University, Brookhaven National Laboratory, and Stony Brook University.



Electrochemical behavior of ε-$VOPO_4$



Structure, morphology and lithium insertion in molybdenum pyrophosphate

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