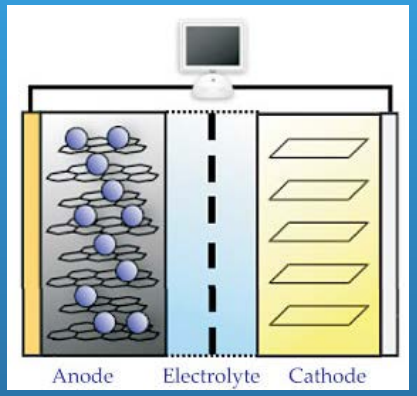
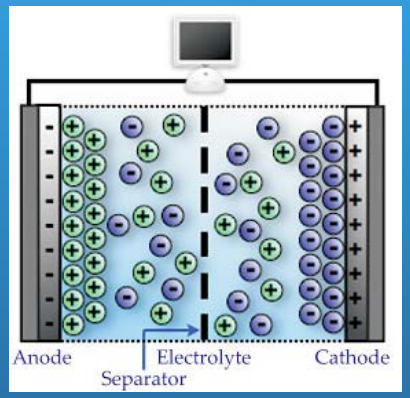
Improving electrochemical energy storage device performance

Matthew Charlton, MS&E Ph.D candidate, advised by Prof. Stevenson

Battery and SC Principles

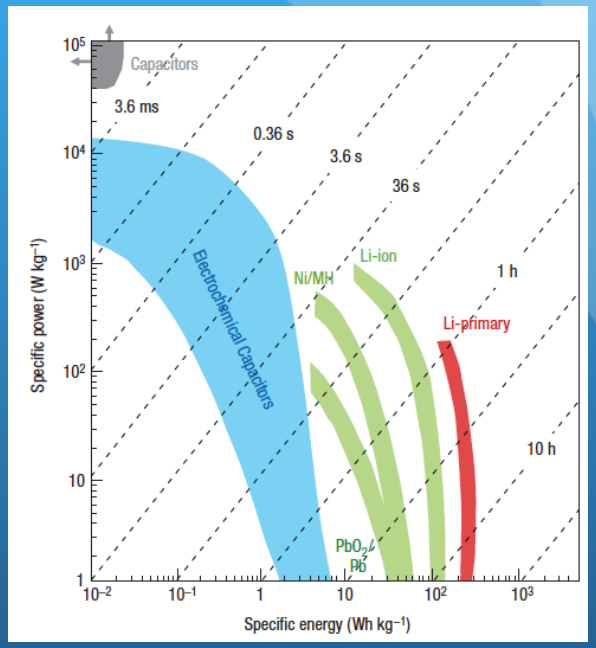




Abruña, H. (2008). Phys. Today **61(12): 43.**

Supercapacitor Applications

- Battery or Fuel Cell hybrids
- Load leveling in Power Systems
- Automotive Applications
- Uninterruptible Power Sources
- Solar supercapacitors
- Wind power

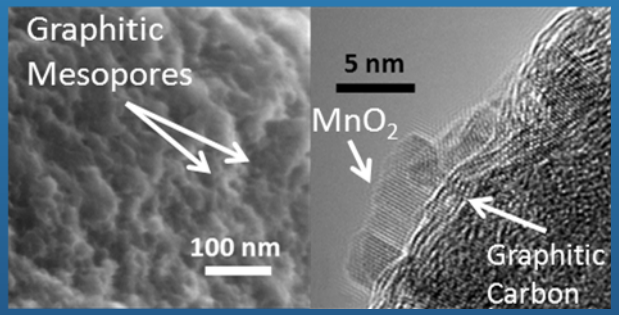


Simon, P. and Y. Gogotsi (2008). Nat Mater **7(11): 845-854.**

Battery = Redox between electrodes
EDLC = Charge separation at interface
Pseudocapacitor = Redox at interface

Addition of M-Ox coatings onto carbon powders

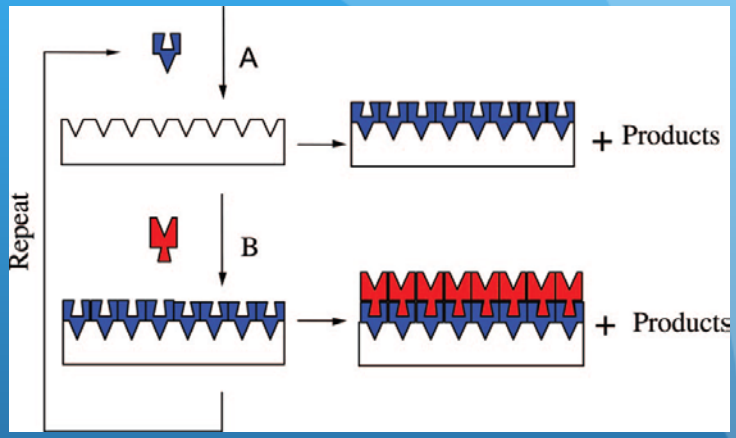
Goal: Effectively combine mesoporous carbon used in EDLC's with thin redox active metal oxide coatings via ALD in order to increase the overall material capacitance with the addition of pseudocapacitive character



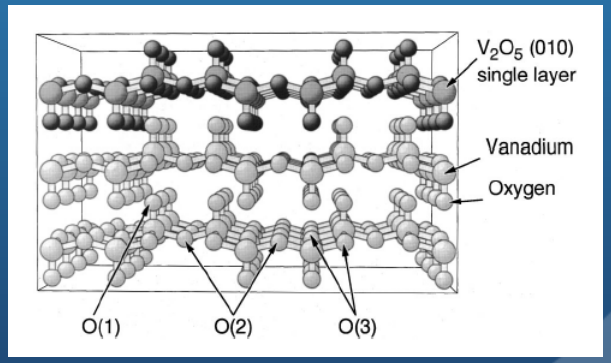
Patel, M. *et al. submitted, 2011.*

Mesoporous means large electrode-electrolyte interface

Atomic Layer Deposition



George, S. M. (2010). Chem. Rev. **110: 111-131.**



Li-Ion Batteries also possible

Chakrabarti, A., K. Hermann, et al. (1999). Physical Review B **59(16): 10583-10590.**

Education – 2nd year Ph.D in MS&E

- B.S. in MS&E from Lehigh University in 2008
- Advised by Prof. Stevenson, Clean Energy Materials Thrust
- Member of the Doctoral Portfolio Program in Nanoscience and Nanotechnology
- Classes include Electrochemistry, Electrochemical Energy Materials, Energy Technology and Policy

- GEC Energy Seminar Series Director
- ExploreUT on campus
- Nanodays at the Austin Children's Museum
- Smart.Clean.Energy Short Course