

PROJECT FACTS

UNIVERSITY OF KENTUCKY CENTER FOR APPLIED ENERGY RESEARCH

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ELECTROCHEMICAL POWER SOURCES

Lithium-ion anode materials

Current anode materials for lithium-ion batteries are based on graphite, due to abundant supply, relatively low cost, and long cycle life. Graphite has a theoretical capacity of 372 mAhg^{-1} , but suffers from relatively low reversible capacity ($\sim 310 \text{ mAhg}^{-1}$), caused by formation of the solid electrolyte interface (SEI) during the first charge cycle of the cell (i.e. irreversible capacity loss). Electrode materials with enhanced power performance, reduced irreversible capacity loss, long cycle life, and higher capacities are required for continued improvements in energy density, power density, and cycling performance of next-generation lithium-ion cells. Nanomaterials, including nanoparticulates and nanowires, are advantageous for lithium-ion batteries, due to reduced lithium ion diffusion lengths, maximization of the electrode/electrolyte interface, and reduced strain associated with intercalation/deintercalation processes. Anode development at CAER is focused on the synthesis of nano-sized, lithiated metal oxide (Mo, Ni) anode materials with high theoretical capacities ($\sim 280\text{-}300 \text{ mAhg}^{-1}$). Metal oxide nanowires were fabricated through a combination of electro-deposition and thermal processing steps, using anodized aluminum oxide (AAO) templates for generation of the nanowire architectures.