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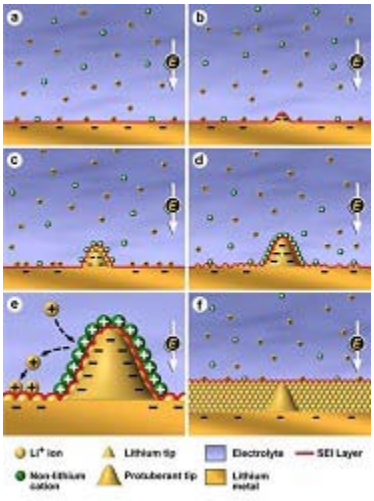
Available Technologies

Dendrite Growth Prevention Technology for Lithium Metal Batteries

SUMMARY

One of the most significant barriers to practical use of lithium metal batteries for energy storage has been uncontrollable dendrite lithium growth upon repeated charge/discharge cycling, which degrades battery performance and increases safety risks. PNNL scientists have developed novel materials and processing methods that substantially reduce such growth.



These methods include processing techniques and electrolytes for electrodeposition that result in self-healing, instead of self-amplification, of protuberant tips, which create roughness and/or dendrite formation. The electrolytes used in the system are also designed to maintain high Coulombic efficiency.

Using the materials and methods claimed in the pending patents, a positively charged self-healing electrostatic shield (SHES) can be formed that covers the protruded region formed during electrodeposition. During the charging process, the positively charged Li ions will be prevented from deposition in the protruded region of the anode by the SHES effect and will instead be preferentially deposited in the non-protruded region. This will effectively improve the smoothness of the deposited Li film and limit dendrite growth.

Appropriate selections of the electrolyte solvents can further increase the Coulombic efficiency of Li metal deposition/stripping and enable long-term cycling of the Li metal electrode.

ADVANTAGES

* Reduced dendrite formation during lithium and other metal deposition
* High Coulombic efficiency
* Safer, longer lasting lithium metal batteries

RELATED LINKS

» **Article: Journal of the Electrochemical Society (2013)**

Effects of Carbonate Solvents and Lithium Salts on Morphology
http://jes.ecsdl.org/content/160/10/A1894.full.pdf+html?sid=eabb4048-c05e-4abd-9ed3-c8bf7e9538fb

U.S. DEPARTMENT OF ENERGY

» **Article: Journal of the American Chemical Society (2013)**

Dendrite-Free Lithium Deposition via Self-Healing Electrostatic Shield Mechanism
http://pubs.acs.org/doi/abs/10.1021/

Technology Portfolio(s)

- » Chemistry
- » Energy
- » Materials Forming, Joining and Deposition
- » Materials Synthesis and Functionalization
- » Energy Storage - Electrochemical
- » Microtechnology

Potential Industry Applications

- » Consumer Products
- » Energy & Utilities
- » Manufacturing & Warehousing

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