Docket #: S22-160

Electrolytes for high-voltage and low-impendence lithium metal batteries

Stanford Researchers have discovered fluorinated acetal electrolytes for lithium metal batteries that demonstrate fast stabilization of lithium metal, compatibility with high-voltage cathodes, and low cell impedance.

Improving the energy density in rechargeable batteries is a highly sought after goal, particularly for applications in electric vehicle (EV) technologies. Currently, a promising approach is moving from lithium-ion batteries, for which current technologies are close to the energy density theoretical limit, to new materials. Anodes composed of lithium metal, instead of the traditional graphite, have been shown to increase anode specific capacity by about 10-fold. Yet, commonly used electrolytes for lithium-ion batteries are incompatible with lithium metal anodes. Recently developed electrolytes that are compatible with lithium metal often have limitations including low initial Columbic efficiencies, slow ion transport properties, incompatibility with high-voltage cathodes, and expensive salts and/or solvents that limit scalability.

When combined with commonly used salts, the fluorinated acetal electrolyte based formulations in this technology can overcome many of these challenges faced by current electrolytes. Fast stabilization of lithium metal provides high Columbic efficiencies (greater than 99%) within the first 10 cycles. Fast ion transport properties result in low cell impendence. The electrolytes display good compatibility with existing high-voltage cathodes. Finally, the fluorinated acetals are synthesized in high yields from common chemical feedstocks and are combined with standard inexpensive salts, enabling cost-effective and scalable electrolyte production. Altogether, the improved electrolytes offer improvements that could aid in the translation of lithium metal batteries to widespread use.

Stage of Development Proof of concept

Applications

- Electrolyte formulations for lithium metal batteries

Advantages

- Fast stabilization of lithium metal cycling
- Low cell impedance
- Compatibility with existing cathodes
- Inexpensive and scalable production

Patents

- Published Application: WO2023215607
- Published Application: 20250300232

Innovators

- Yuelang Chen
- Zhiao Yu
- Zhenan Bao
- Yi Cui

Licensing Contact

Evan Elder

Associate Director, Licensing and Strategic Alliances, Physica

Email