Novel Solid Polymer Electrolyte Compositions for Improved Lithium-Metal Polymer Batteries

Invention Summary

The invention relates to a novel solid polymer electrolyte composition that displays both high conductivity and exceptional dendrite growth resistance thus can be used in rechargeable LMP battery technologies.

Technology Overview

Solid polymer electrolytes (SPEs) are an alternative to liquid electrolytes due to their non-volatility, low toxicity, and high energy density. These SPEs can be useful in Li-metal based batteries and related electrochemical energy storage devices that require high ionic conductivity at ambient temperature and suppression of lithium dendrite growth. Such dendrite growth can occur in other batteries, which can cause short circuiting/over-heating/thermal run-away.

Prof. Coates’ group has developed SPE compositions containing a mechanically rigid phase and a novel cross-linker that displays both high conductivity and dendrite growth resistance at ambient temperature, for use in lithium-metal based batteries and related electrochemical energy storage devices.

Technical Merits

- Compared to other SPE, this composition containing a novel cross-linker displays greater dendrite growth suppression while retaining high conductivity at ambient temperatures
- To further exemplify the dendrite-resistant properties of this material, it was also successfully tested using the continuous one direction plating test, also known as the galvanostatic polarization method.

Potential Applications

- For use in rechargeable lithium-ion technologies for high energy density applications and related electrochemical energy storage devices that require high ionic conductivity at ambient temperature
- For potential electrolyte components for next generation high energy density lithium battery technologies, lithium-sulfur and lithium-air batteries that utilize lithium metal as an anode material.

Advantages

- Overcomes the current limitation of formation of irregular Li electrodeposits (dendrites) during repeated charge-discharge cycles
- Prevents short circuit events that could cause over-heating and thermal run-away
- Can be synthesized from inexpensive starting materials.

Publications

- PCT Application WO2015058187