

Novel Redox Shuttles for Overcharge Protection of Lithium-ion Batteries (ANL IN 05012)

Battery overcharge protection, increased safety and long-term stability.

The Invention

Electrolytes containing novel redox shuttles (electron transporters) for overcharge protection of lithium-ion batteries. The electrolytes can be alkali metal salts or polar aprotic solvents, and the shuttle is an aromatic compound with at least one aromatic ring with four or more electronegative substituents, two or more oxygen atoms bonded to the aromatic ring, or no hydrogen atoms bonded to the aromatic ring. The electrolyte solution is non-aqueous. These redox shuttles are capable of thousands of hours of overcharge tolerance—the dangerous voltage of the battery will never be reached even when over-abused.

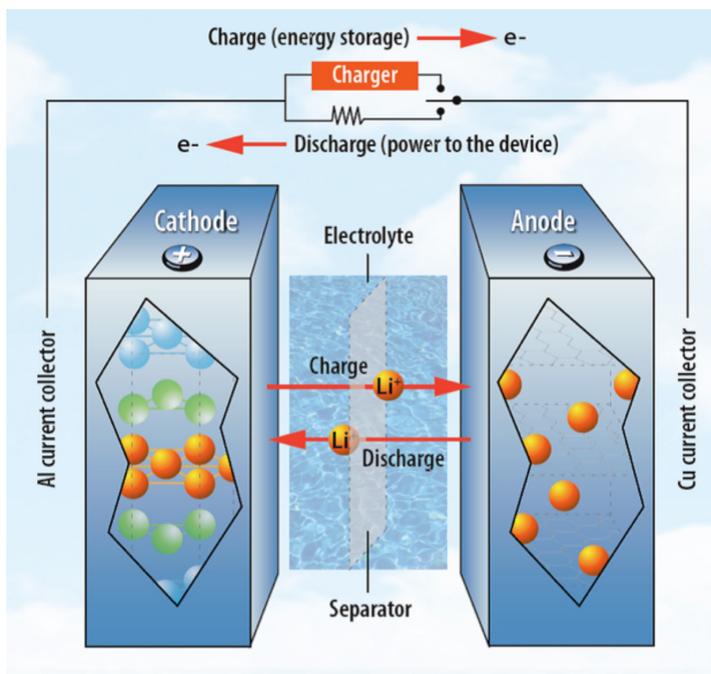
Benefits

- ▶ Provides thousands of hours of overcharge protection;
- ▶ Increases the safety of lithium-ion batteries;
- ▶ Compatible with current battery technology as it is very soluble in conventional carbonate-based electrolytes; and
- ▶ Increases battery long-term stability and oxidation potential.

Applications and Industries

Electrodes used in batteries for

- ▶ Electric and plug-in hybrid electric vehicles;
- ▶ Portable electronic devices;
- ▶ Medical devices; and
- ▶ Space, aeronautical, and defense-related devices.



Charge Transfer Mechanism for Li-ion Battery Overcharge Protection: The boron and fluorine additive is in the electrolyte. When the battery is overcharged, the redox shuttle will be oxidized by losing an electron to the positive electrode. The radical cation formed will then diffuse back to the negative electrode, causing the cation to obtain an electron and be reduced. The net reaction is to shuttle electrons from the positive electrode to the negative electrode without causing chemical damage to the battery.

Developmental Stage

Development continues on the low cost synthesis of the material

Availability

Available for licensing

Patent Information

US Patent 7, 851,092 and GB Patent 2,437,902

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