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Chelating Ionic Liquid Family for Magnesium Battery

Lithium ion batteries are a popular in consumer electronics and many other applications. However, dendrite formation in lithium ion batteries can cause the batteries to short circuit, thus limiting their performance and creating safety hazards. Magnesium batteries offer an alternative solution to lithium ion batteries as they do not have the problem of dendrite formation. Additionally, magnesium anodes offer nearly twice the volumetric capacity of their lithium counterparts, and magnesium is less expensive as it is significantly more abundant than lithium. However, previous prototypes of magnesium batteries have used electrolytes that are very corrosive and have relied on relatively volatile solvents. Therefore, there is a need for a reliable, safe, and high performing magnesium battery.

Researchers at Arizona State University have invented a rechargeable magnesium battery. This is the first magnesium battery that is both rechargeable and uses a purely ionic liquid solvating medium. The ionic liquid uses chelation to reversibly reduce and oxidize the magnesium anode during charging and discharging. A chelating functional group is a common ion exchange resin resulting from bonds to a metallic ion, and creates a thermodynamically stable battery. Additionally, the ionic liquid is nonvolatile, nonflammable, and has high conductivity. This battery offers a promising alternative to lithium ion batteries, with dendrite-free morphologies and coulombic efficiencies measured at over 90%.

Potential Applications

- Batteries
- Consumer electronics
- Electric vehicles

Benefits and Advantages

- Improved Safety – Ionic liquid solvating medium is non-volatile and non-corrosive.
- Thermodynamically Stable - Chelating ligands and the ionic liquid solvating medium are much more thermodynamically stable when compared to previously technologies.
- Increased Conductivity – Higher conductivity than other magnesium based batteries.
- Rechargeable – First magnesium battery with reversible electrochemical deposition and dissolution, producing coulombic efficiencies over 90% and dendrite-free morphologies.
- Less Expensive – Magnesium is more earth abundant (2.9%) than lithium (0.0017%).

For more information about the inventor(s) and their research, please see

[Dr. Daniel Buttry's directory webpage](#)