Engineering

VCU Innovation Gateway
Office of Research and Innovation

Non-toxic Electrolytes for Li-ion Batteries

Market Need

Li-ion batteries provide a portable light-weight means to power commonly used electronic devices with high energy density. In 2013, the global market for Li-ion batteries was approximately $18 billion, and was anticipated to grow up to $75 billion by 2020. In a 2012 analysis, electrolytes produced for batteries amounted to $500 million with a projection for steady growth for the year 2020.

Often, halogen-based electrolytes are used in Li-ion batteries in order to produce high power and energy densities. As a trade-off to these characteristics, many batteries have increased volatility and flammability issues that pose serious safety threats. Pairing different electrolytes with Li-ion cells can produce significant side effects ranging from safety, thermal stability and performance of the cell. To counteract these issues, additives are often used to reduce gas generation and mitigate flammability. Adversely, these additives pose a threat to cell performance; therefore, producing a need to replace current electrolytes in batteries with a new class of electrolytes that achieve efficient performance without the trade-off of safety.

The technology

Researchers at Virginia Commonwealth University (VCU) have identified a new method of implementing halogen-free electrolytes in Li-ion batteries. Dr. Puru Jena has diligently worked on developing this new class of halogen-free electrolytes, which have stronger electron affinities than that of halogen atoms. By incorporating this new class, batteries will become safe and environmentally friendly without disrupting the performance of the cell. Since the binding energy between Li and the halogen-free electrolytes are small, Li-ions can easily transition from one electrode to the other, thereby improving performance. Additionally, since these electrolytes have low affinity to water battery life is increased drastically. With the implementation of this new class of halogen-free electrolytes developed at VCU, cell performance is optimized without compromised adverse safety effects.

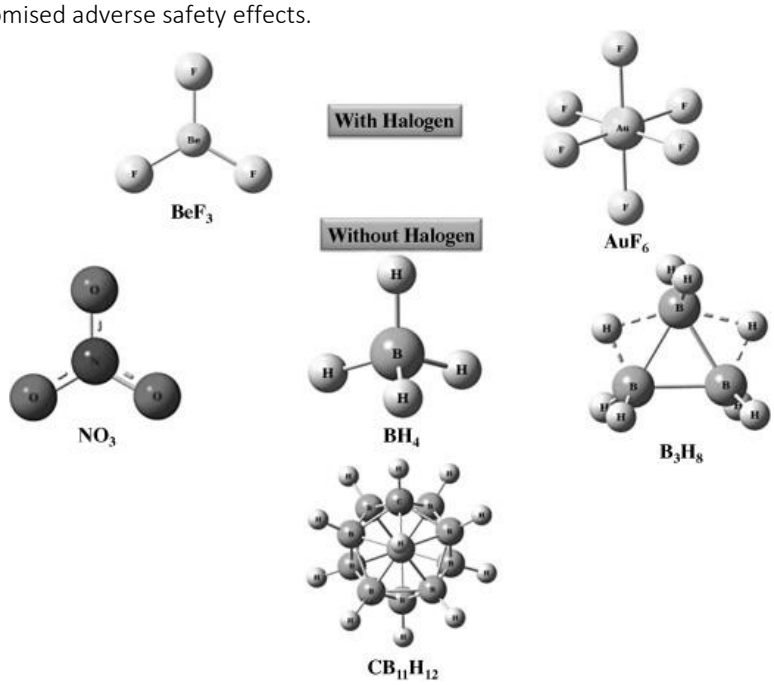

Figure 1. *Optimized geometries of anions of four potential candidates for halogen-free electrolytes. Also given for comparison are two other halogen-containing anions that are not currently used in commercial applications.*

Benefits

- Safe and environmentally friendly without compromising effectiveness
- Increased battery life
- Lithium (Li) ions are transported much easier than current system

Applications

- Halogen-free electrolytes
- Non-toxic batteries
- Batteries can be applied to:
  - Cell Phones
  - Automobiles
  - Airplanes
  - Mobile and static devices

Patent status:
Patent pending: U.S. and foreign rights are available.

License status:
This technology is available for licensing to industry for further development and commercialization.

Category:
Engineering, Material Science

VCU Tech #:
14-072

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External resources:
Zhao, H., et al (2016)
Giri, S., et al (2014)

Contact us about this technology

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