Docket #: S21-170

Non-flammable polymeric electrolyte with wide operational temperature range

Liquid electrolytes in lithium-ion batteries have high ion-conductivity at room temperature, but lose this feature as temperature increases. They are often highly flammable, which is especially concerning for batteries used in automobiles or other devices with the potential for thermal runaway events. To combat both problems, researchers in the labs of Prof. Zhenan Bao and Prof. Yi Cui have developed a dry polymer and salt based electrolyte for lithium-ion batteries. A poly(dimethylsiloxane) polymer backbone functionalized with pyrrolidinium bis(fluorosulfonyl)imide side chains (PPyMS-FSI) is mixed with a high concentration of lithium bis(fluorosulfonyl)imide (LiFSI) to form the electrolyte. This electrolyte is highly conductive at room temperature (1.6 mS/cm) and maintains operation through 100^{o} C in lithium | nickel manganese cobalt cells.

Stage of Research

- Prototype

Applications

- Lithium-ion batteries operating in range of 25-100 ^{o} C
- Battery operated vehicles: won't ignite during thermal runaway events

Advantages

- Ionic conductivity: order of magnitude higher than poly(ethylene oxide) electrolytes
- Operating temperature range: 25-100 ^{o} C

- Electrolyte stability: stable at high oxidative voltages (4V with nickel manganese cobalt oxide cathodes)

Publications

- Huang, Zhuojun, et al. "A solvent-anchored non-flammable electrolyte." *Matter* (2022).
- Patrick, Chris. Flameproofing lithium-ion batteries with salt. *SLAC News* (2022).

Patents

- Published Application: 20230036244

Innovators

- Zhuojun Huang
- Jiancheng Lai
- Zhenan Bao
- Yi Cui

Licensing Contact

Evan Elder

Associate Director, Licensing and Strategic Alliances, Physica

Email