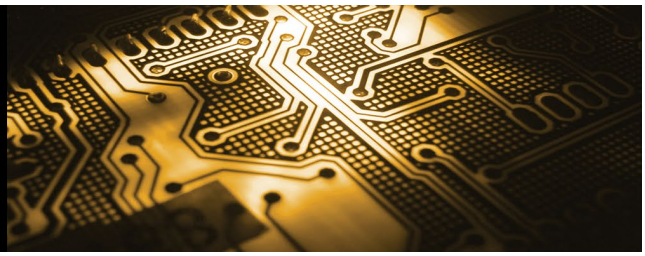

REDOX SHUTTLE ADDITIVES FOR SAFER BATTERIES

OTT ID #1685

APPLICATIONS

Energy Storage, Electrolyte Additives, Rechargeable Batteries, Lithium Ion Batteries (LIBs) and Lithium Metal Batteries (LMBs), Sodium Ion Batteries (SIBs), and Potassium Ion Batteries (KIBs).

TARGET PROBLEMS

- Overcharge abuse can trigger thermal runaway when device is left unattended.
- Existing redox shuttles cannot achieve efficient protection under high charging rates (≥1 C) with a relatively low addition amount.
- Conventional redox shuttle additives are reported to protect mainstream cathodes for high-energy-density LIBs and not for other battery systems like sodium or potassium ion battery.

KEY FEATURES

- **Wider Applications** – Can be used with any kind of battery systems such as LIBs, KIBs, SIBs etc.
- **Proven safety -** Decrease in overcharge heat generation with TAC addition during charge-discharge cycle at lab scale in full cell.
- **Improve the Anode Performance** - Suppress possible Li dendrite growth at anode side.
- **Overcharge Indicator** - TAC can change color when overcharge happens and stops, offering direct visualization of the health state of batteries.
- **Retrofits Existing Manufacturing Process -** Does not require a new setup or change in the manufacturing line. Just adding TAC electrolyte to existing injection process.

TECHNOLOGY

Inventors have developed a library of safe redox shuttle additives based on cyclopropenium salts of trisaminocyclopropenium perchlorate (TAC) and its derivatives for overcharge protection in rechargeable batteries including LIBs, alkaline, LMBs, SIBs and KIBs. Studies have shown that during the overcharging process, the redox-active TAC can repeatedly shuttle between two electrodes, maintaining the cell voltage within a safe value. Furthermore, a distinctive electrochromic behavior of TAC electrolyte can provide the device an overcharge alarm to further enhance the safety level.

INTELLECTUAL PROPERTY:

U.S. Patent Pending

PUBLICAITONS: *J. Mater. Chem. A*, 2020, *Nano Energy 2020* & *Energy Storage Materials 2020*

INVENTOR: **Deyang Qu,** Prof./Dept. Chair/Johnson Controls Endowed Professorship in Energy Storage

For more information contact: Smruti Patil, Ph.D., IPMM | *Licensing Associate* | Tel: 414-906-4657