Solvent Systems Comprising A Mixture of Lactams and Esters for Nonaquous Electrolytes and Nonaqueous Electrolyte Cells Comprising the Same

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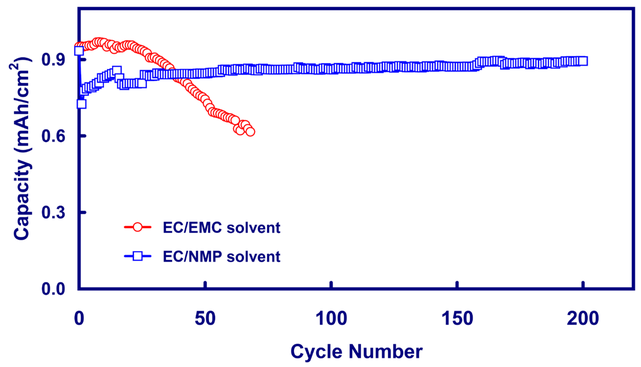
Technology Overview

- This is a new electrolyte system for Li-ion batteries.
- The addition of lactam based solvent in state-of-the-art lithium electrolytes can improve the performance of Li-ion batteries.
- This solvent can be inserted easily in the present electrolyte manufacturing.
- This new electrolyte system can be applied to Li-ion battery systems made of carbonaceous anode and wide variety of cathode materials.

Improves Capacity Retention and High Temperature Stability



New ARL EC/NMP solvent versus standard EC/EMC solvent

Technology Advantages

- Improves capacity retention and extends operating life
- Allows cycling with excellent capacity retention at high temperatures up to 60ºC
- The new electrolyte formulations can apply to various cathode materials.
- It does not add cost for electrolyte materials.
- It does not alter manufacturing process for the production of Li-ion batteries.

Proof of Concept

- Demonstrated insignificant capacity loss of the graphite/Li $Ni_{0.15}$ Co $_{0.80}$ Al $_{0.05}$ cell at 60ºC using the electrolytes containing N-methyl pyrrolidone (NMP). a lactam based solvent.
- Demonstrated excellent cycling stability (more than 200 cycles) for the graphite/Li $Ni_{0.15}$ Co $_{0.80}$ Al $_{0.05}$ cells and graphite/LiMn2O4 cells.
- TRL 5: Prototype cells have been demonstrated.

Technology Differentiation

- Increased capacity fading most cells experience at elevated temperature robs charge capacity and cycle life of batteries. This reduces the operational run time of the electrical power system and increases the logistical burden of transporting extra Li-ion batteries to battle field environments.
- Capacity fading also creates a demand–cost problem whereby battery materials are diverted for Soldier use and away from the approaching wave of commercial HEV and PHEV applications.
- This invention reduces capacity fading at elevated temperatures . This allows longer operational run time and reduces logistical burden of supplying Li-ion batteries to the military.

Technology Agreements

- Patent License Agreements, CRADA, and/or Test Service Agreement are sought.
- The agreements would be used for accelerating the commercialization of the invention.
- This technology is currently at a TRL of 5 and has been patented (US Patent 7,442,471).

Technology Applications

Commercial:

- Portable electronic devices such as Notebook PC, smart phones
- HEV and PHEV
- World-wide electrolyte market for Li-ion cells is estimated currently to exceed $1 billion

Military:

- Soldier power for all portable devices
- Vehicle power for hybrid electric drives
- Electrolytes containing new solvent could be developed by electrolyte materials companies for a number of additional military uses.

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