Daikin Advanced Lithium Ion Battery Technology – High Voltage Electrolyte

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

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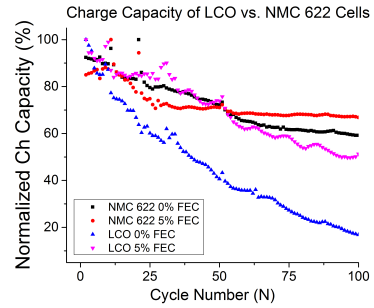
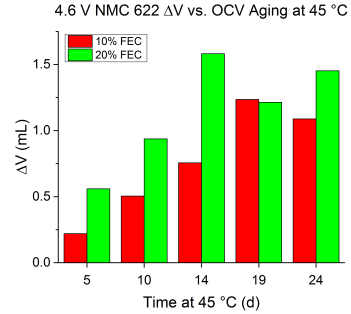
- ***Objective:*** Research, develop, and demonstrate an electrolyte which is capable of cycling NMC lithium ion batteries at 4.6 V for > 300 cycles
- ***Impact:***
- Current lithium ion battery electrolytes can operate at voltages < 4.35 V. Operation at voltages above this threshold pose significant safety and performance risks during the vehicle's operation.
- Electrolyte will help form a stable solid-electrolyte interphase (SEI) layer leading to increase cycle performance when operated at high (> 4.35 V) voltage.

Battery Performance and Gas Analysis as a Function of FEC Concentration in NMC 622 Cells





Charge performance (above, left), gassing volume change (above, right), and gas analysis by GC/MS (below) for NMC 622/graphite cells

[FEC]	CH_4	C_2H_2	C_2H_4	C_2H_6	CH_3F	C_2H_5F	CO	CO_2	O_2	H_2
10%	X		X	X	X	X	X	X	X	X
20%	X	X		X	X	X	X	X	X	X

Accomplishments:

- Established battery gas composition as a function of different operating conditions including: FEC concentration, cycle number, and voltage
- Determined gas composition as a function of ickel ratio in battery cathode
- Investigated the role of fluorinated electrolyte components in battery gassing
- Developed analytical tools to analyze battery gas and solid electrode materials
- Studied gassing kinetics of FEC and its role in battery decomposition

FY 17 Milestones:

- Establish current physical and performance baselines for fluorinated electrolyte
- Gas composition as a function of voltage and cathode surface
- Gassing kinetics of FEC
- Gas kinetics based on cathode surface composition

FY18 Deliverables: Submission of interim cells for evaluation which show significant improvement when cycled at 4.6 V

Funding:

— FY17: 669K, FY18: 583K, FY19: 575K