Flammable Gas Analysis UN Lithium Battery Working Group

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Federal Aviation Administration

Test Procedure

•21.7 liter stainless steel pressure vessel

•General test procedure found in <u>Thermal Runaway</u> <u>Initiation Methods for</u> <u>Lithium Batteries</u>





Scope of Test

To measure the volume and composition of thermal runaway vent gas across various states of charge (SoC) and heating rates

Cell Style	Nominal Voltage, V	Capacity, Ah	Power, Wh
Cylindrical	3.7	2.6	9.62
Pouch	3.7	4.8	17.76

	30% SoC	50% SoC	70% SoC	100% SoC
5 C/min	Priority #4	Priority #10	Priority #5	Priority #3
10 C/min				Priority #8
15 C/min				Priority #7
20 C/min	Priority #2	Priority #9	Priority #6	Priority #1



Test Setup Pouch Cell



Insulated all sides asides top



75 watt heater



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Volume of vent gas vs state of charge





Percentage of vent gas vs state of charge





Pareto chart average volume of vent gas across all SoC





Combustion energy if ignited vs state of charge by heating rate





Combustion energy if ignited vs heating rate at 100% SoC



Test Setup





100 watt heater



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Volume of vent gas vs state of charge





Percentage of vent gas vs state of charge





Pareto chart average volume of vent gas across all SoC





Combustion energy if ignited vs state of charge by heating rate





Combustion energy if ignited vs heating rate at 100% SoC



Conclusion

- Heating rate affects the combustion hazards due to thermal runaway
- Test in an inert environment (nitrogen) to collect the vent gases before decomposition to measure the combustion hazard

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