Performance and Safety Evaluation of High-rate Lithium IronPhosphate Cells

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Introduction

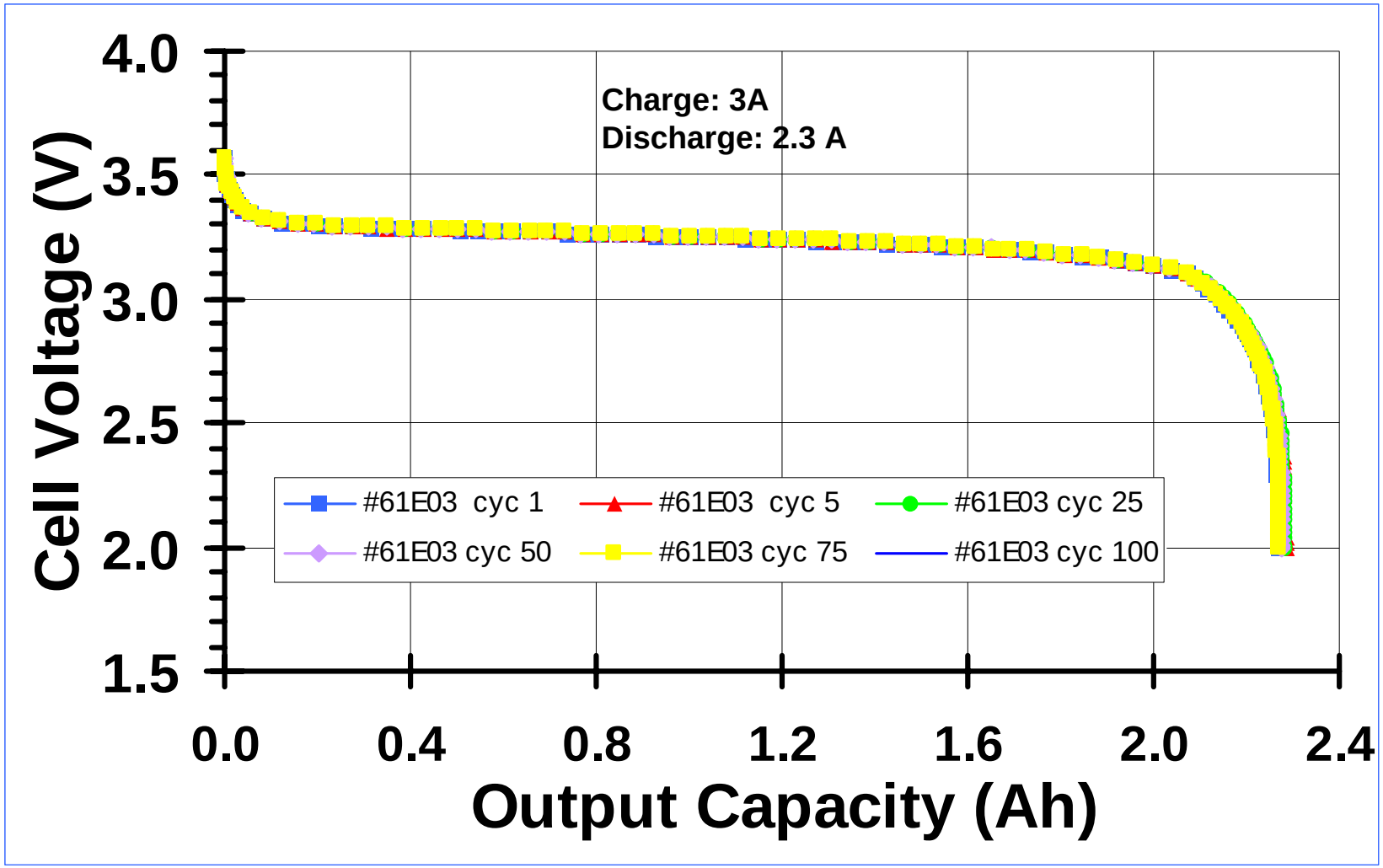
- The A123 cell has the $LiFePO_4$ olivine Li-ion chemistry
- Capacity : 2.3 Ah
- Model # : ANR26650M1

- Voltage range: 3.6 to 2.0 V
- Cells currently installed in Black And Decker Dewalt Impact Wrench (36 V)

Tests Performed

- Rate Capability
- Thermal environment capability
- High-power pulse capability
- External short
- Simulated Internal short
- Overdischarge into reversal
- Heat-to-Vent
- Overcharge at single cell and 6-cell string levels

Rate Capability Test on A123 Li-ion Cells



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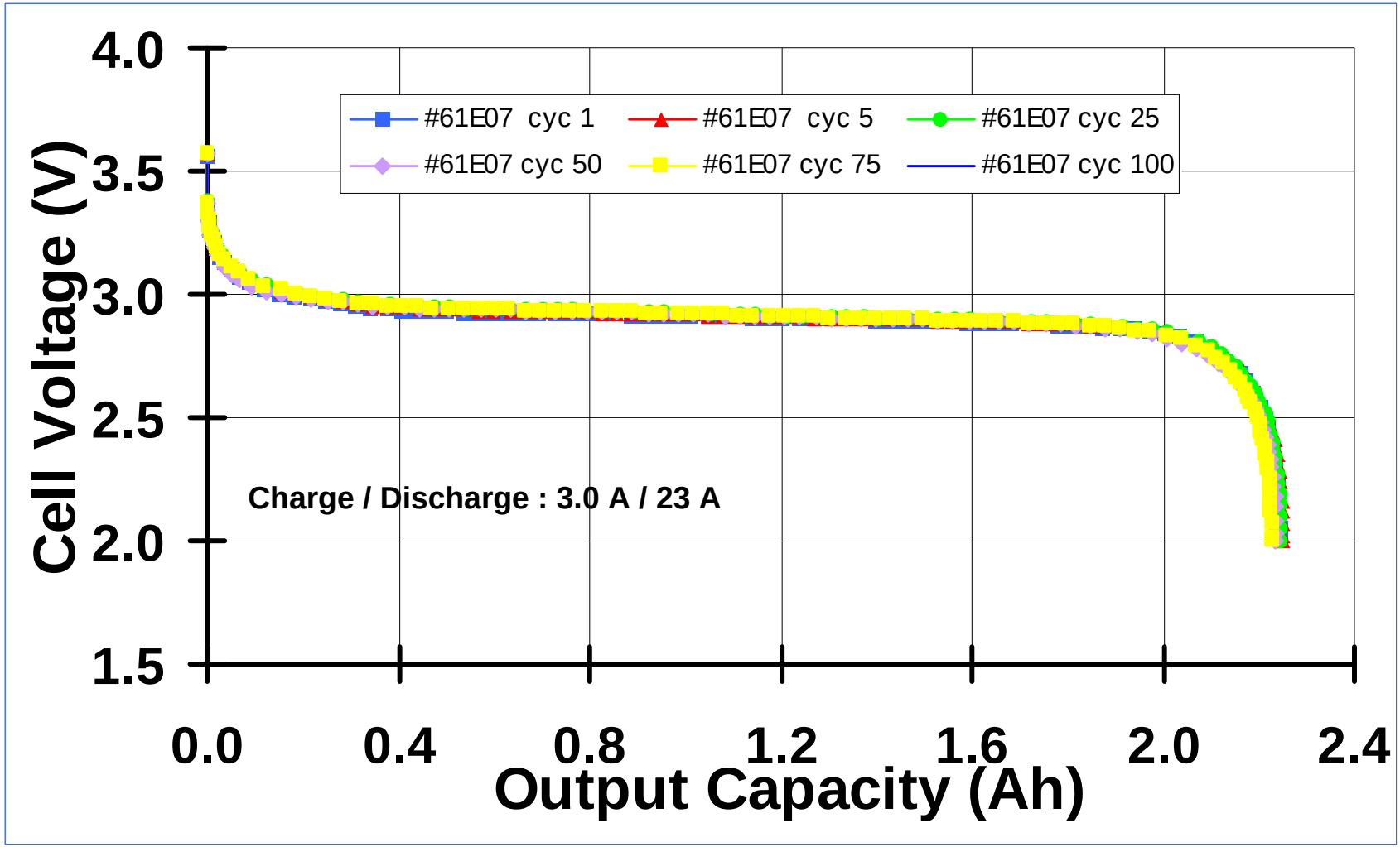

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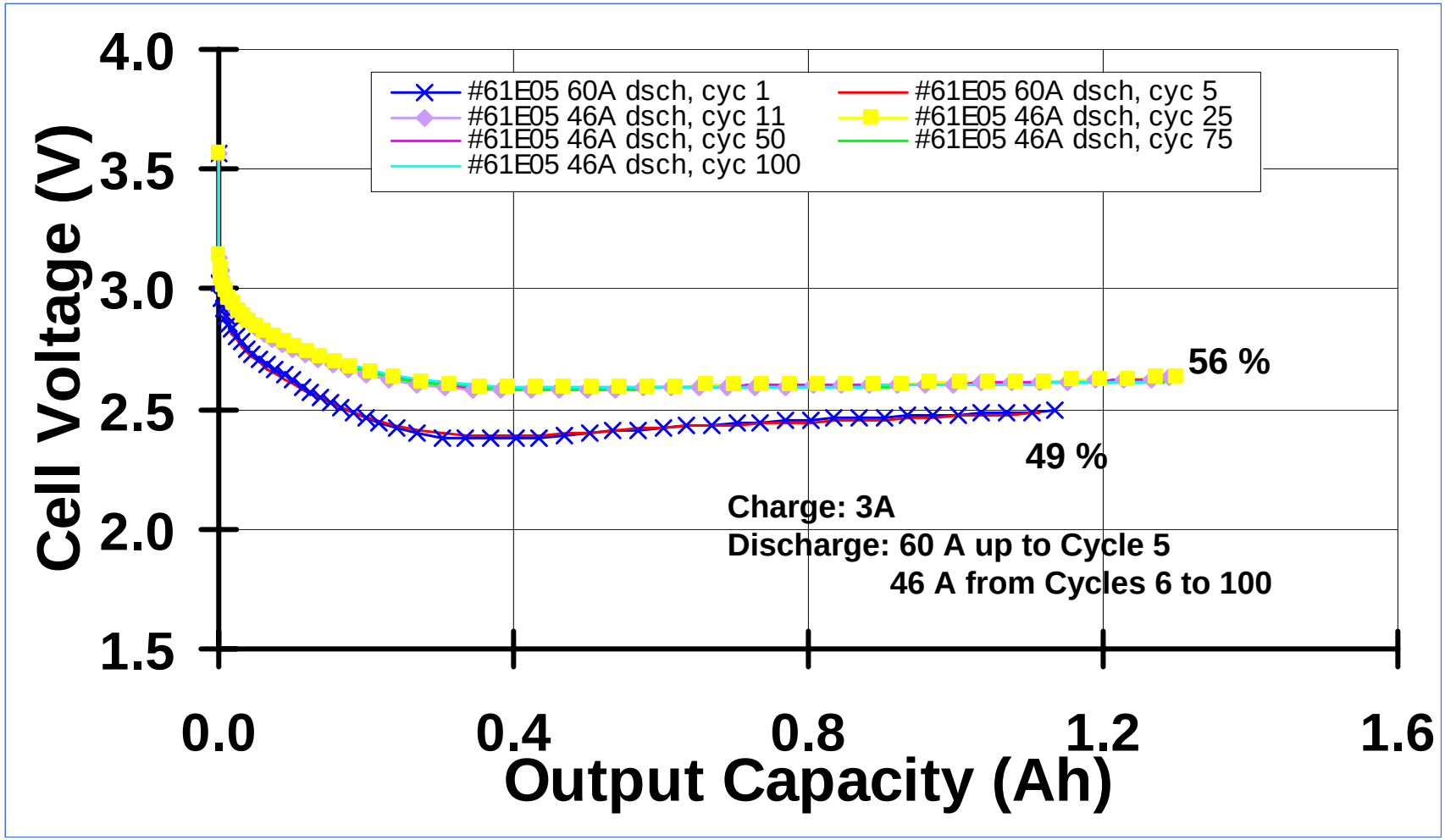

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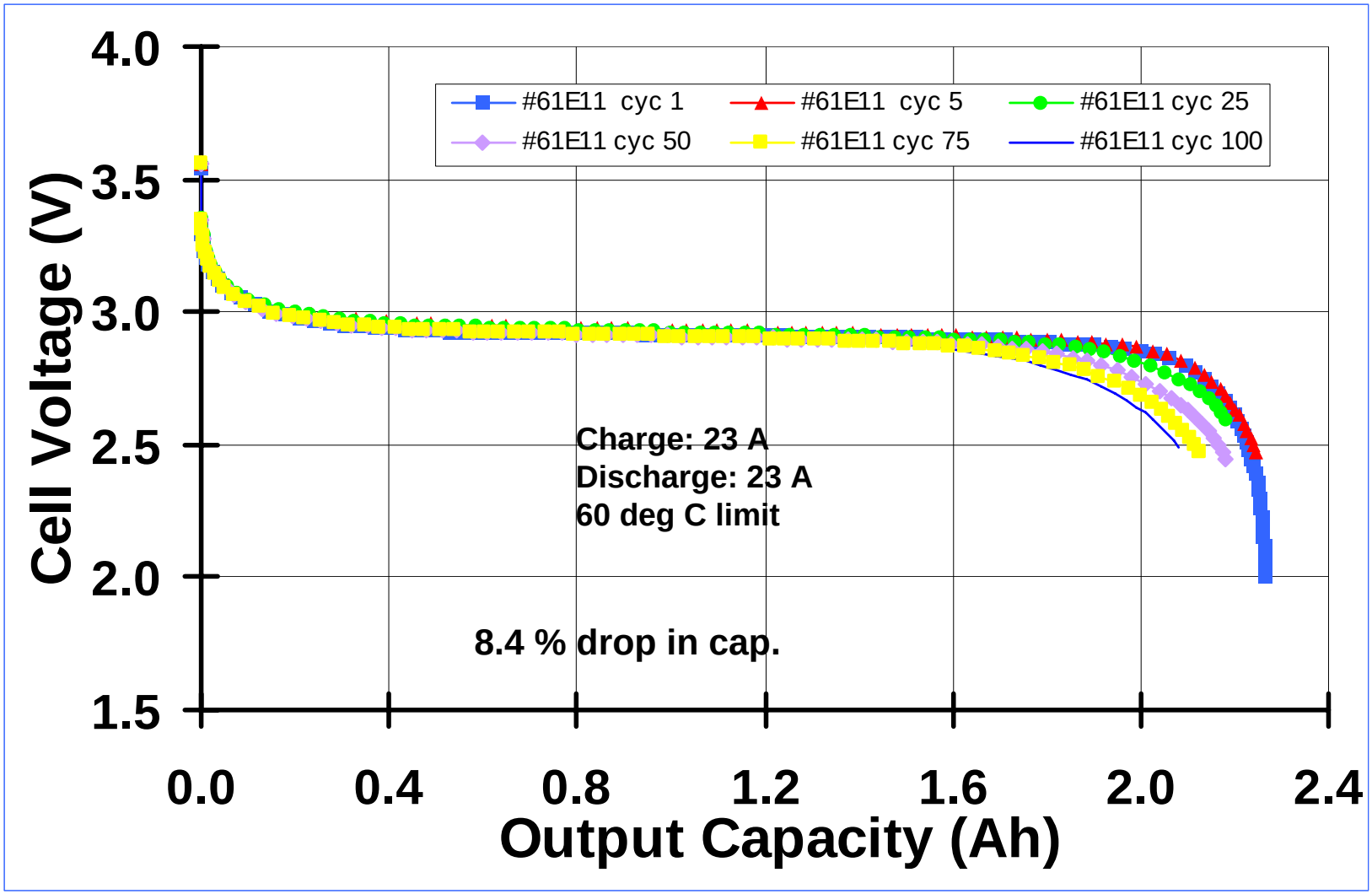

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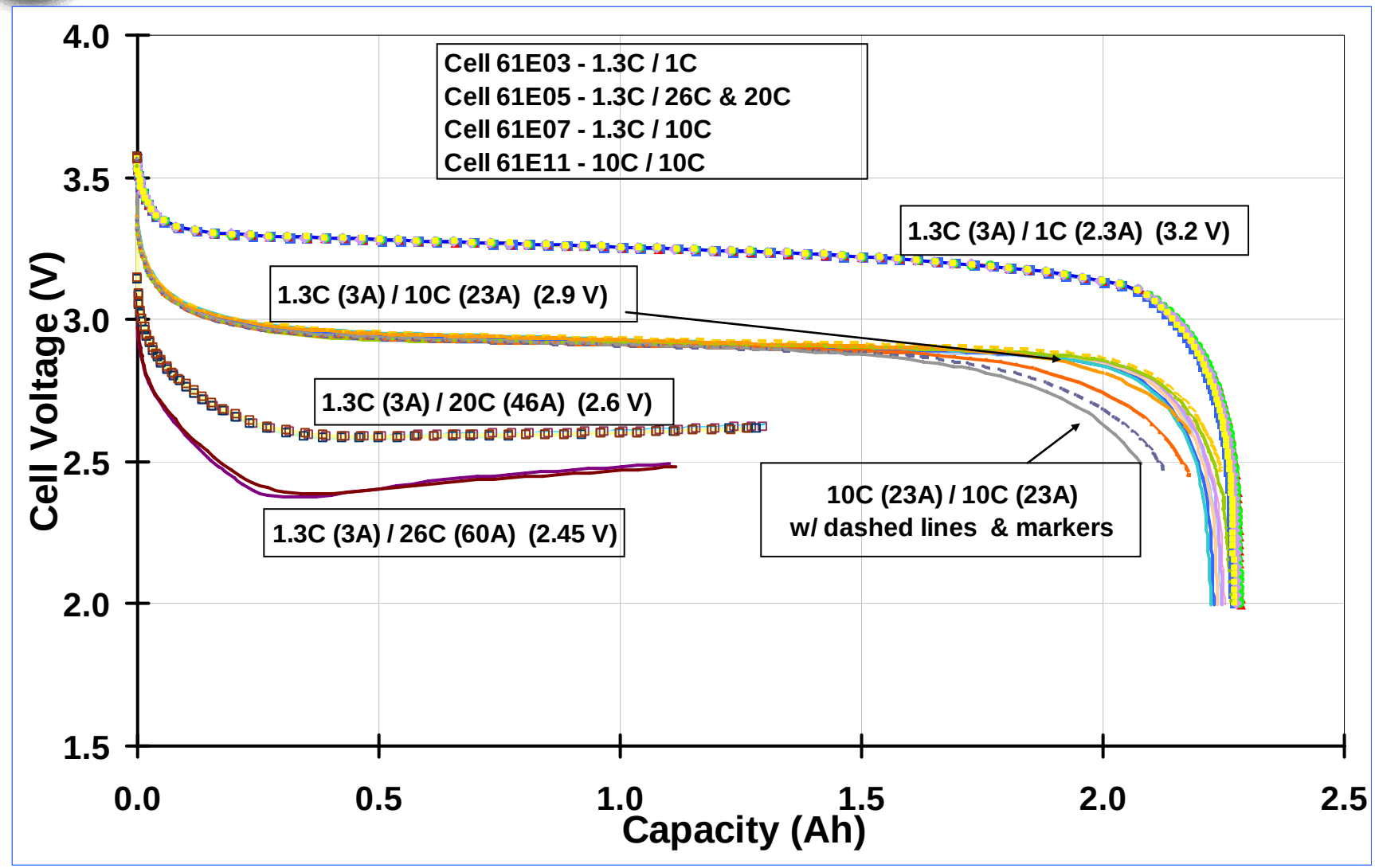
Summary of Rate Capability Tests



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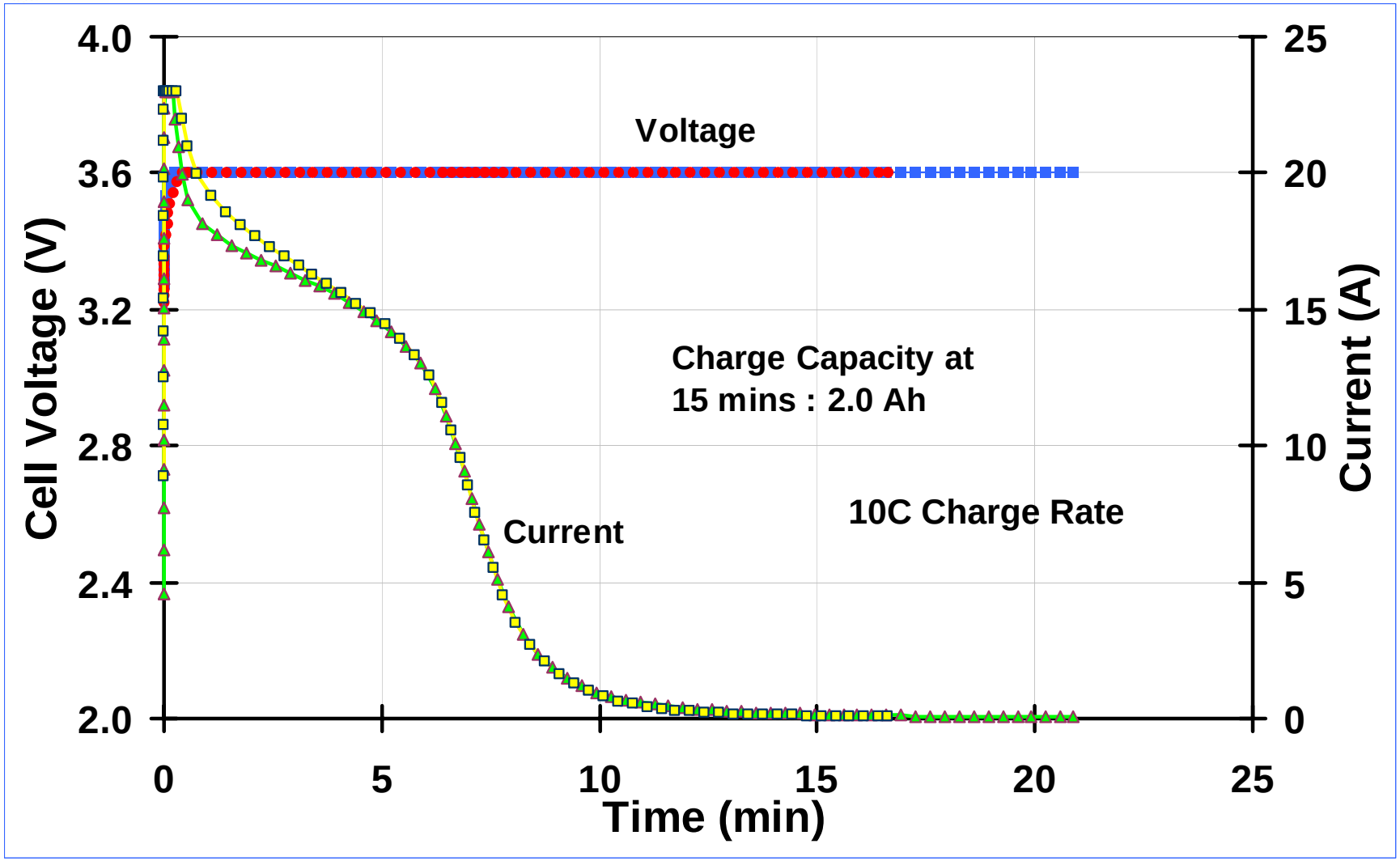
Fast Charge Test on the A123 Cells



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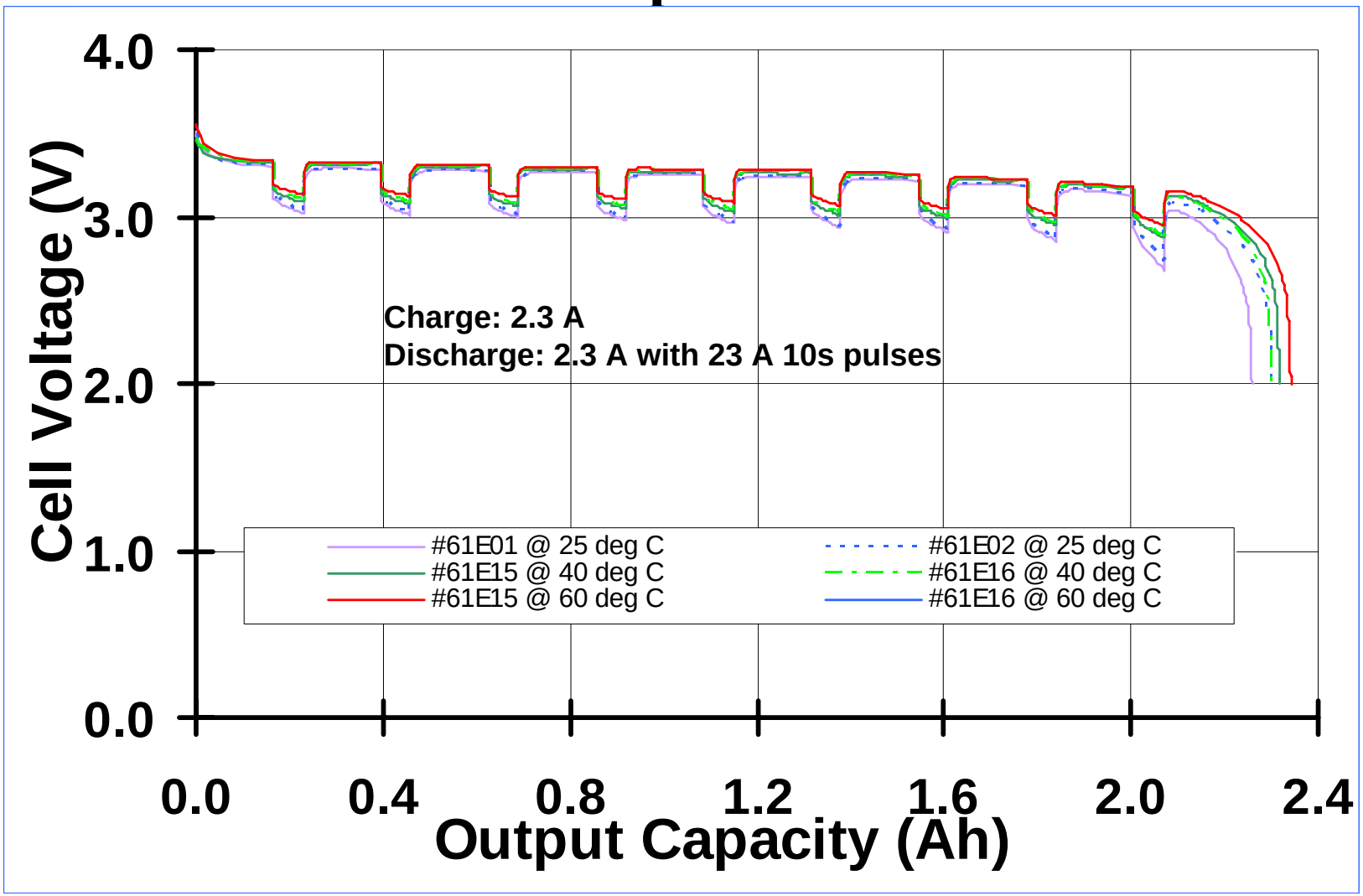
Pulse Performance of A123 Cells at Different Temperatures



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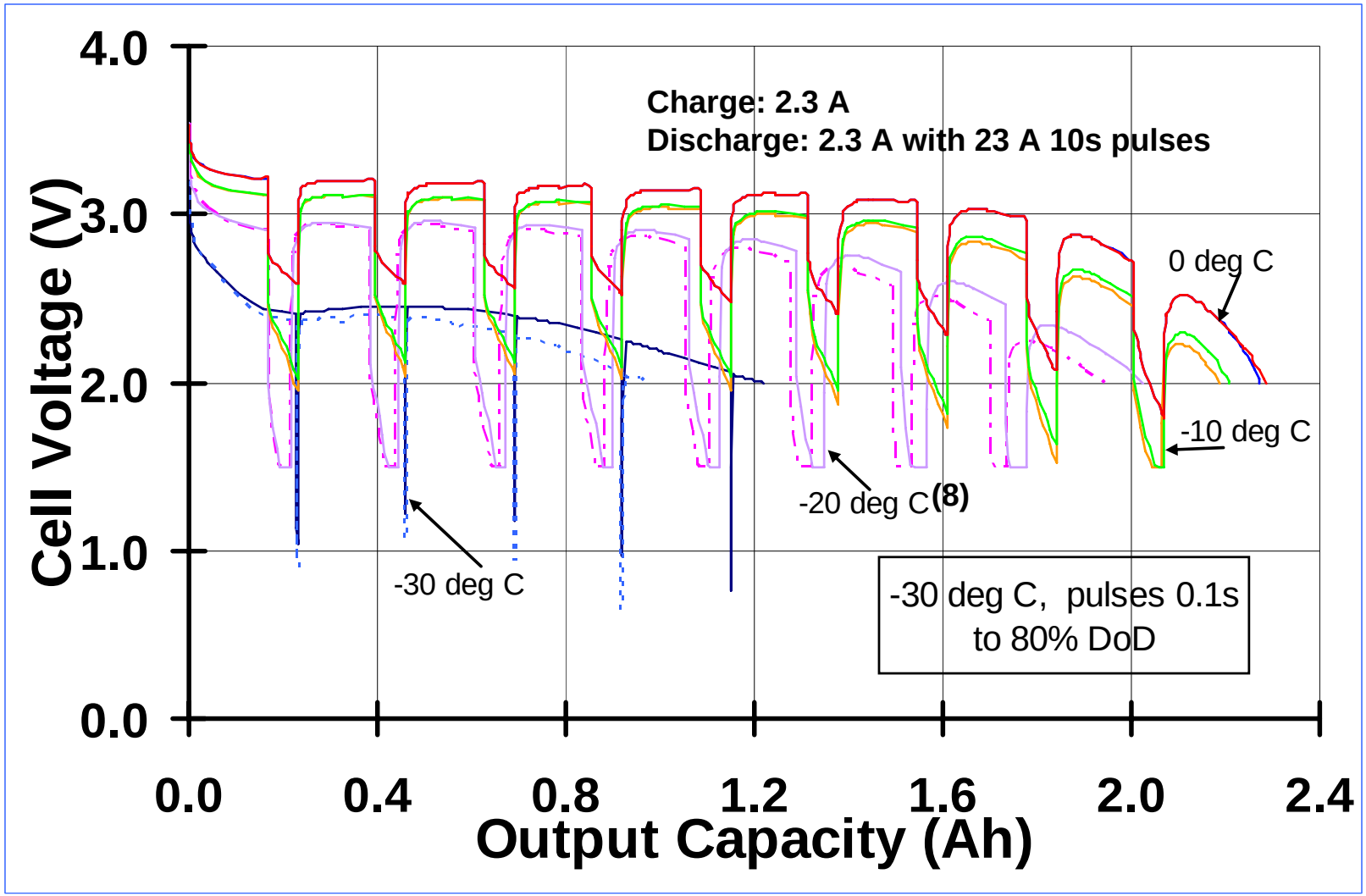
Low Temperature Pulse Performance for the A123 Cells



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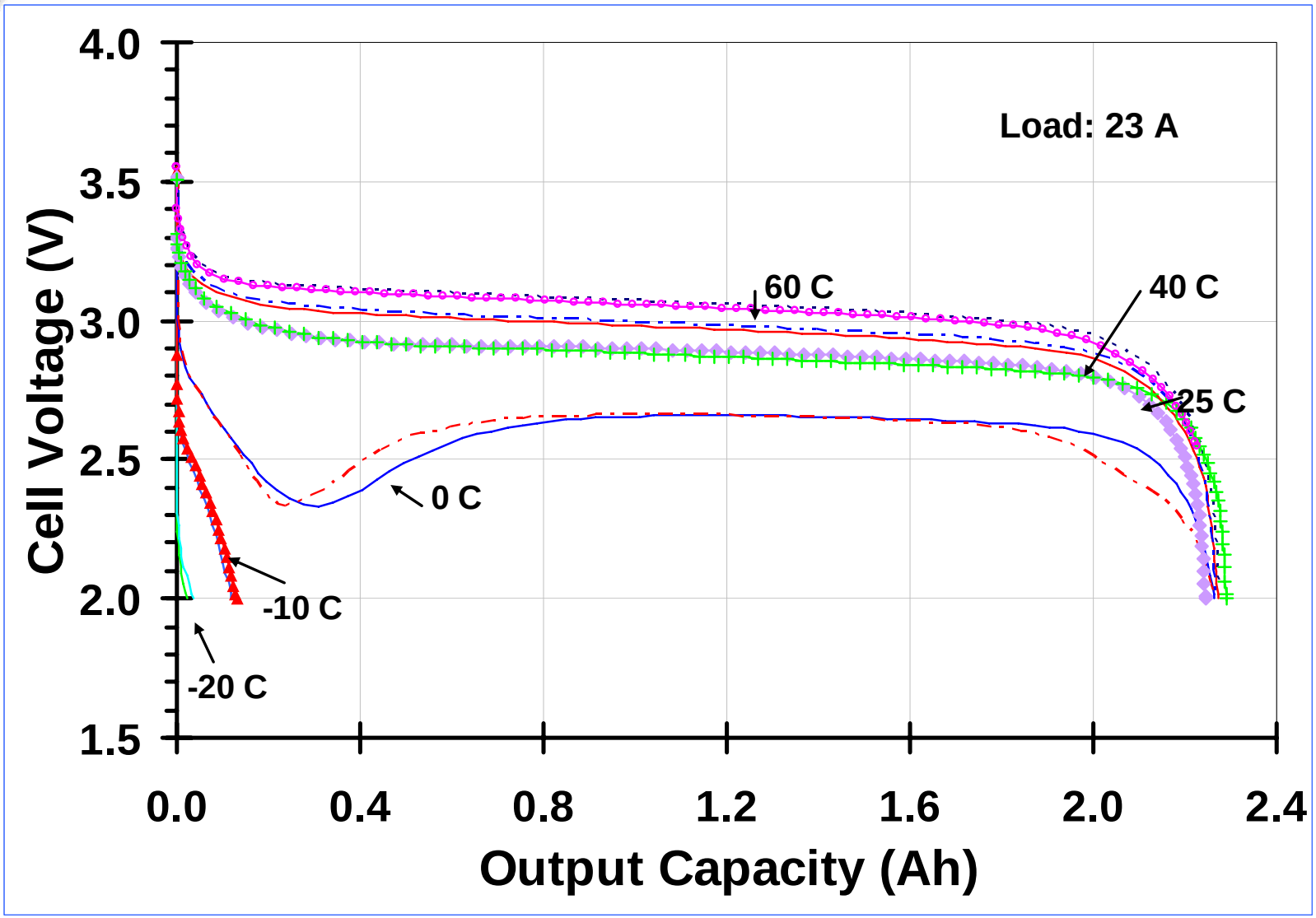
Performance of Cell at Different Temperatures



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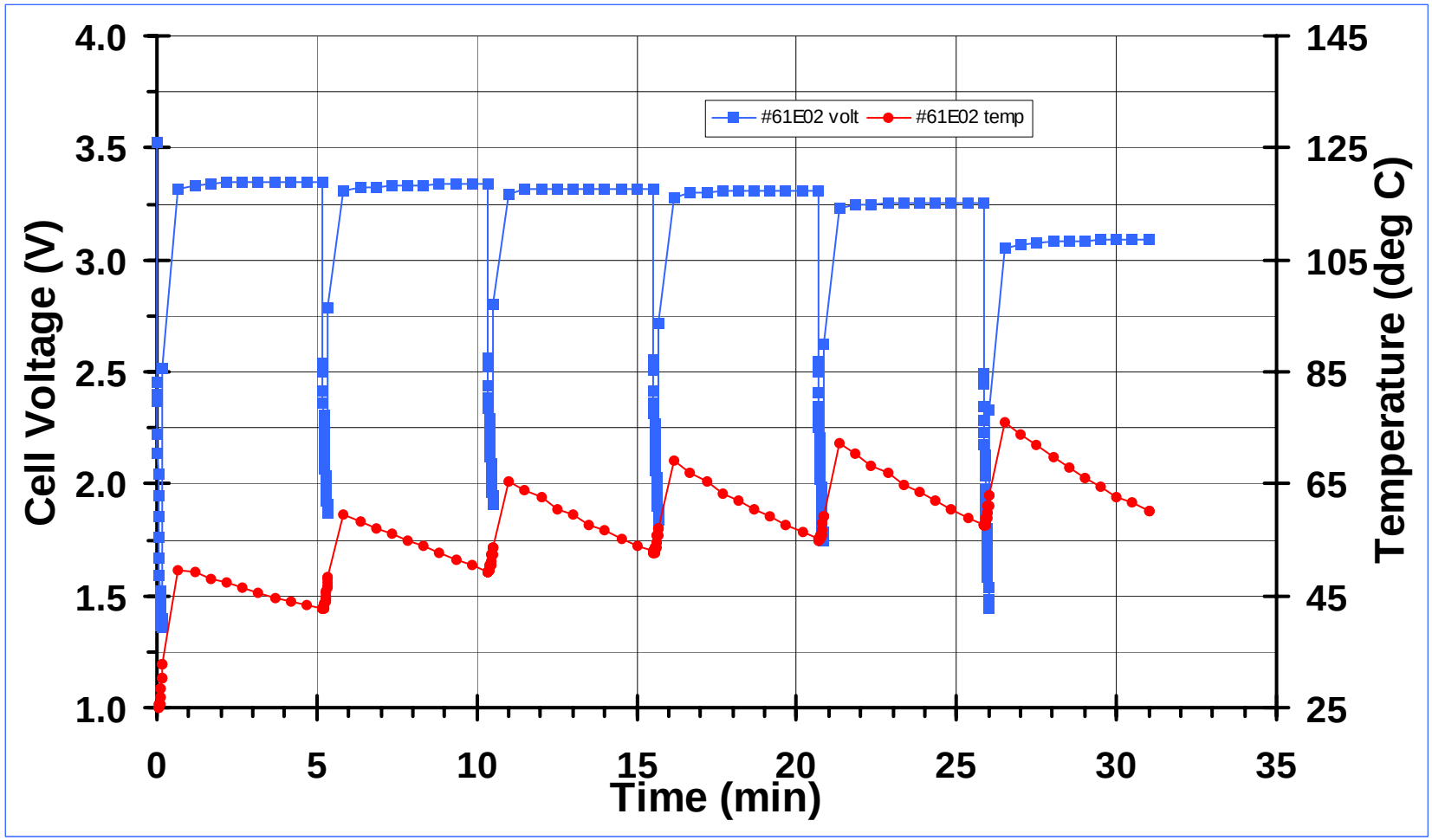
Maximum Pulse Capability for the A123 Cells



Pulse Load: 130 A

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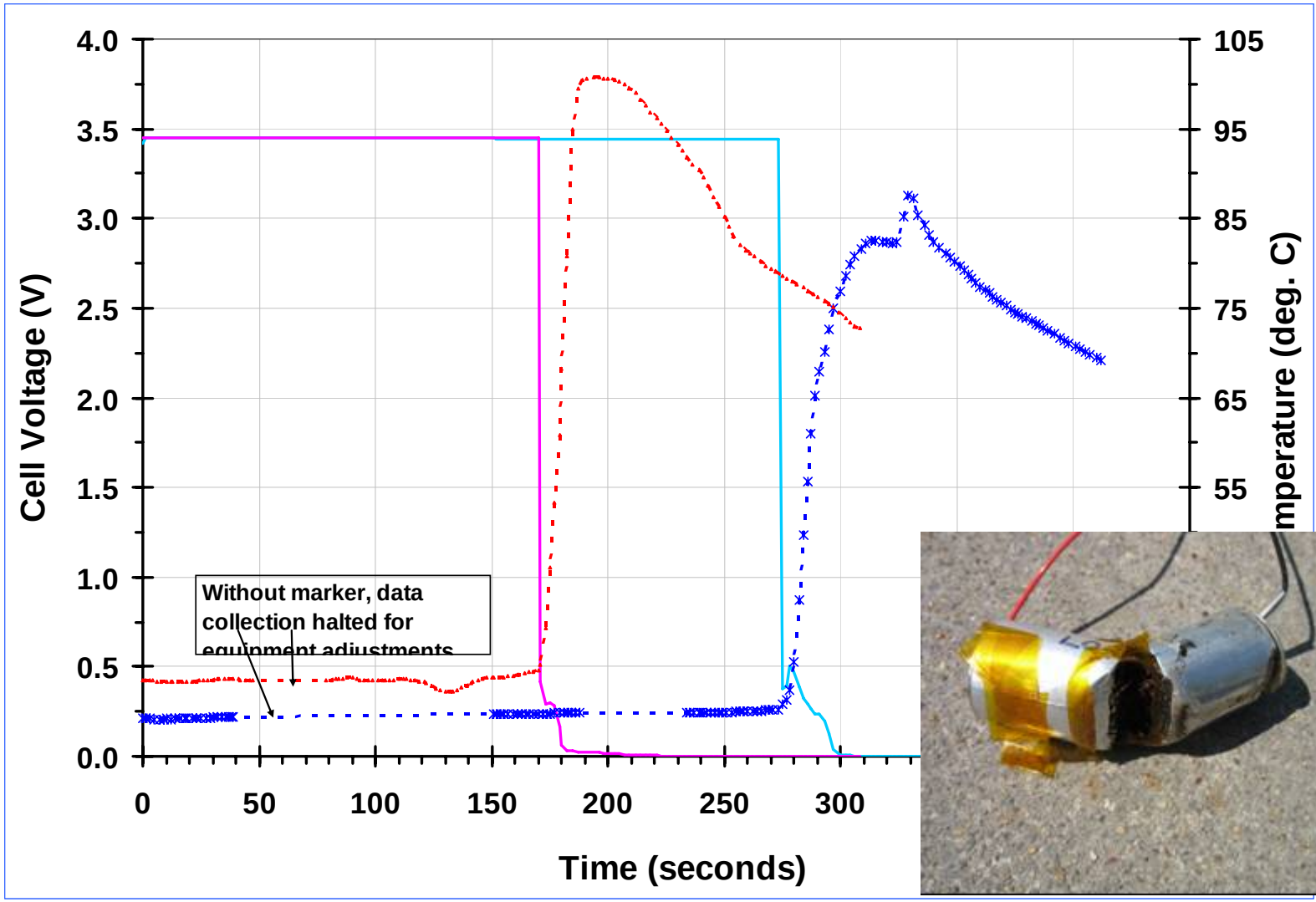
Vent and Burst Test

- **Cell Vent: approx. 320 to 340 psig**
- **Cell Burst: approx. 425 psig**

Simulated Internal Short (Crush)



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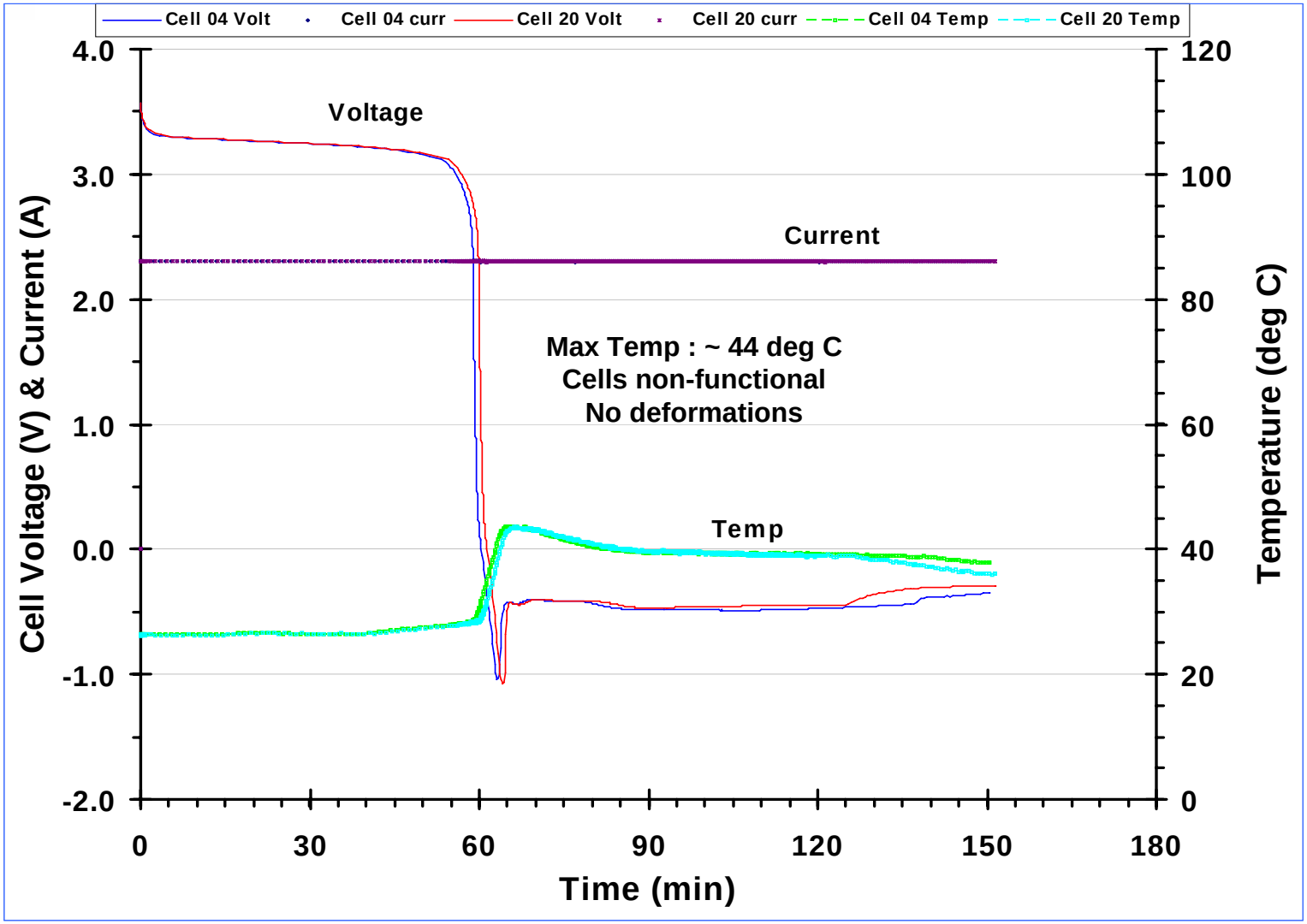
Overdischarge into Reversal



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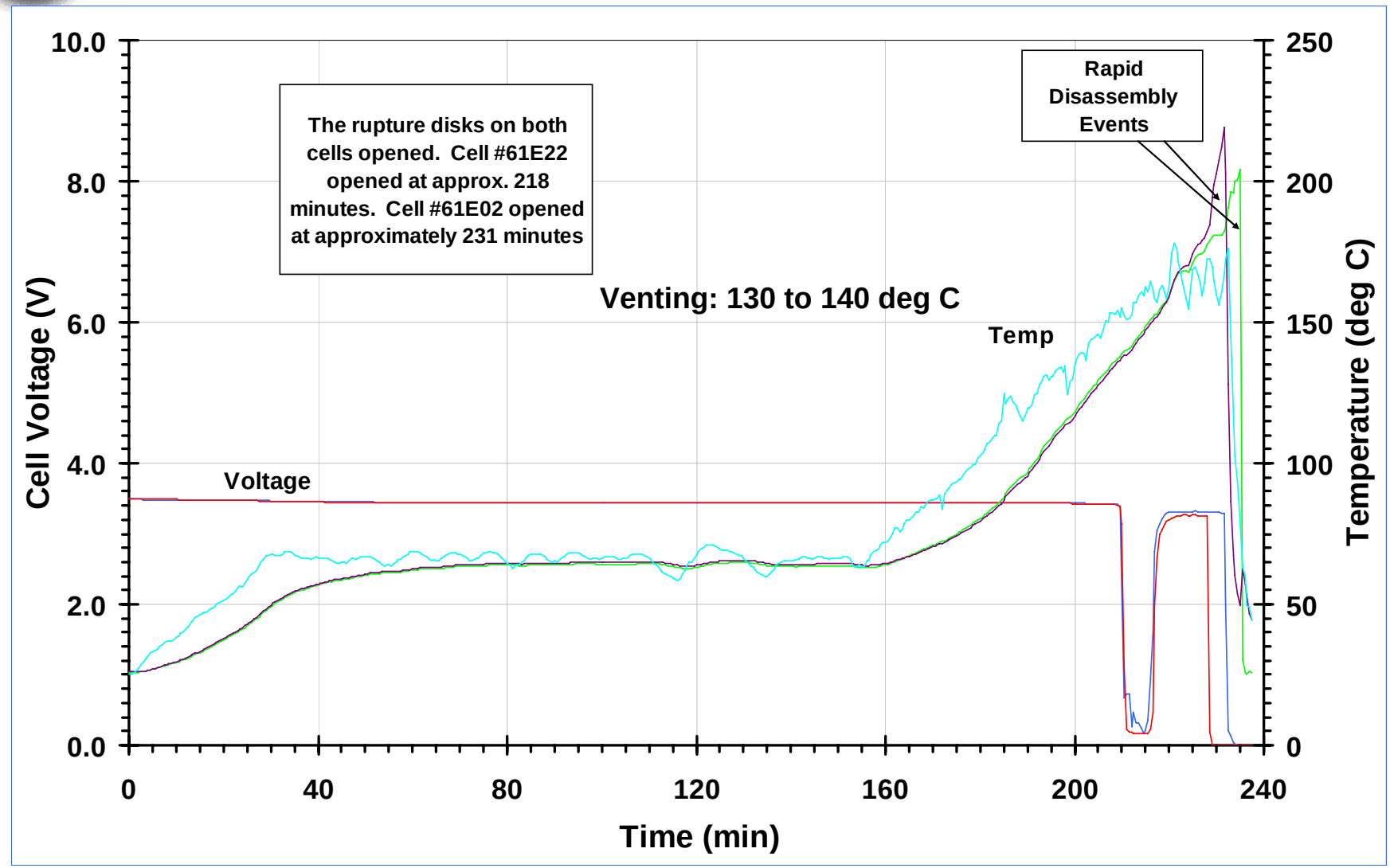
Heat-to-Vent Test on A123 Cells



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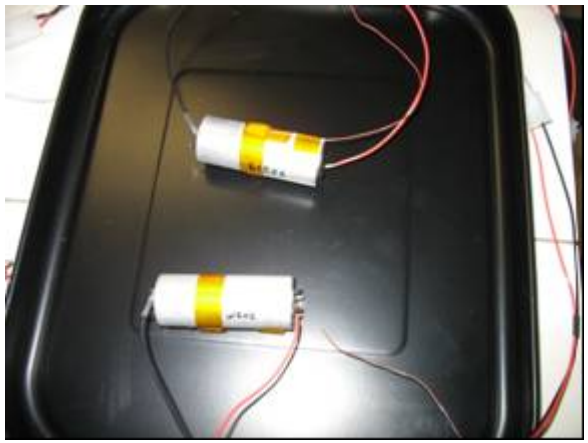
Heat-to-Vent Test



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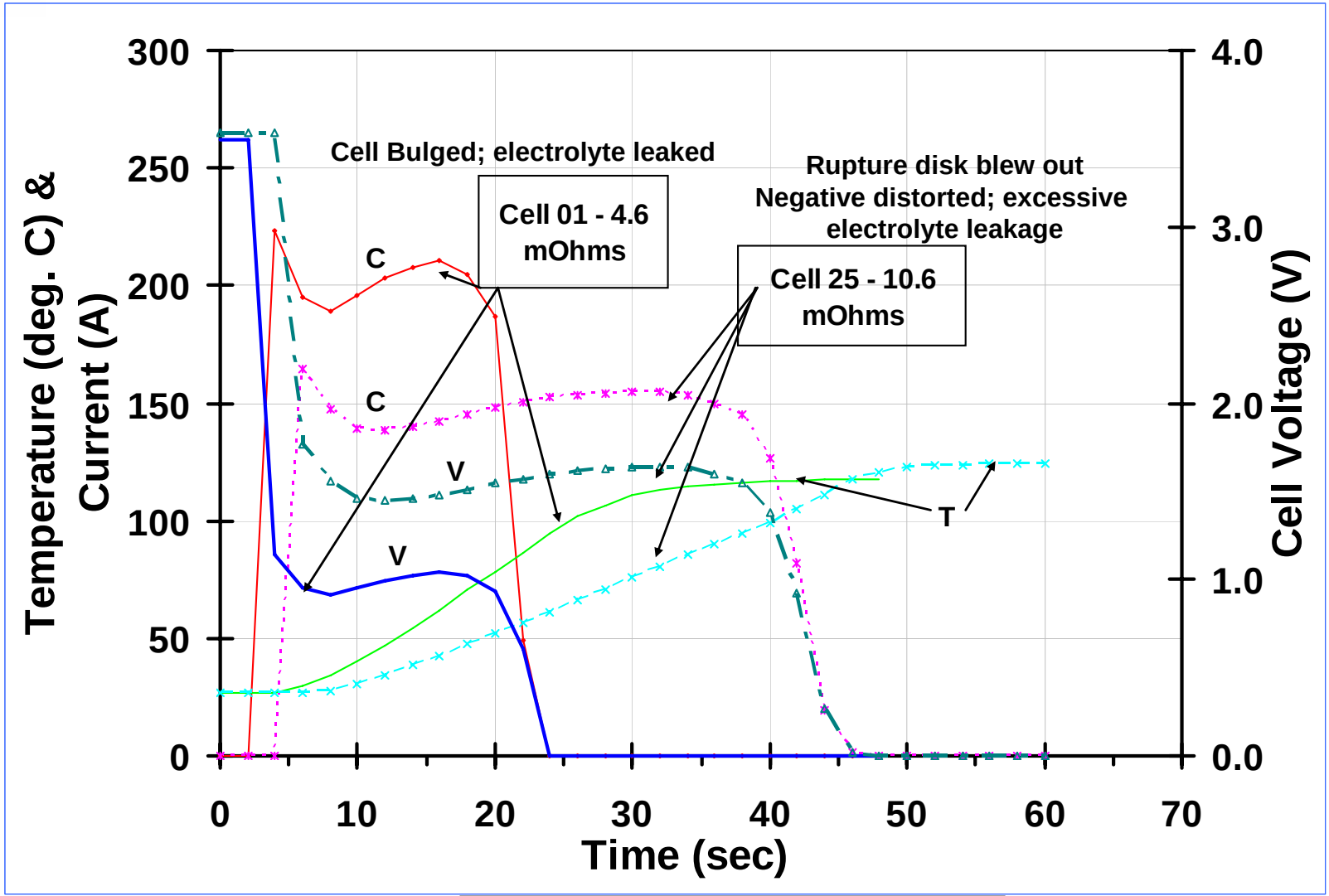
External Short Circuit Using Two Different Loads



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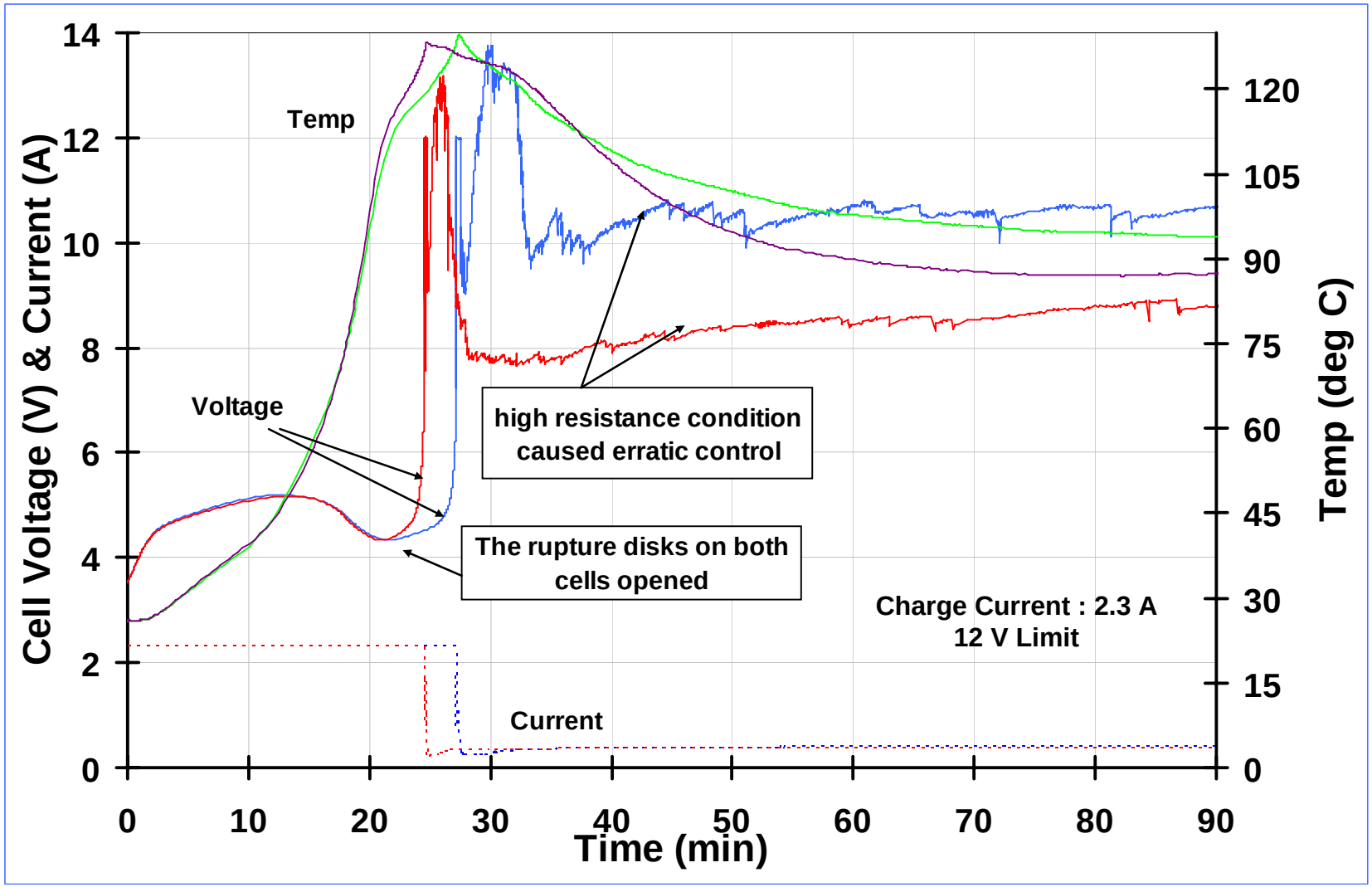
Overcharge Test at 1C Rate to 12 V



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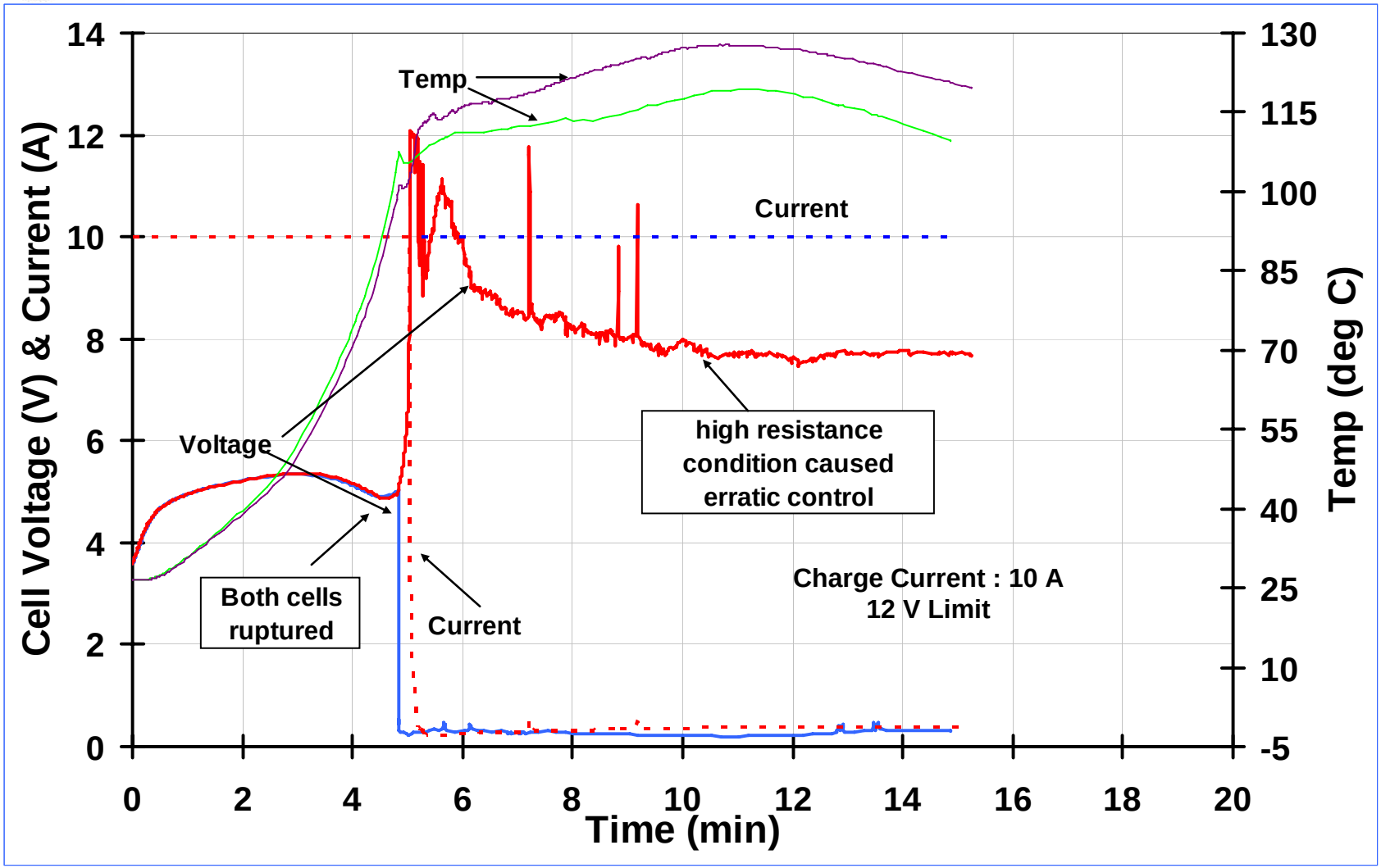
Overcharge at 10A Rate to 12 V



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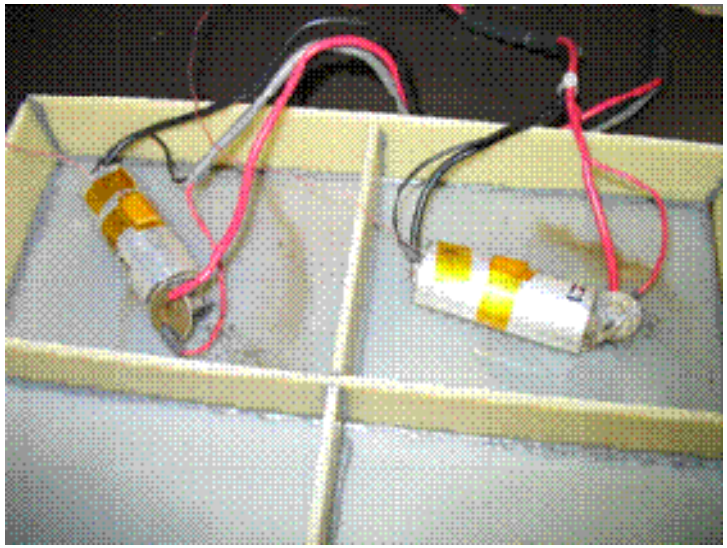
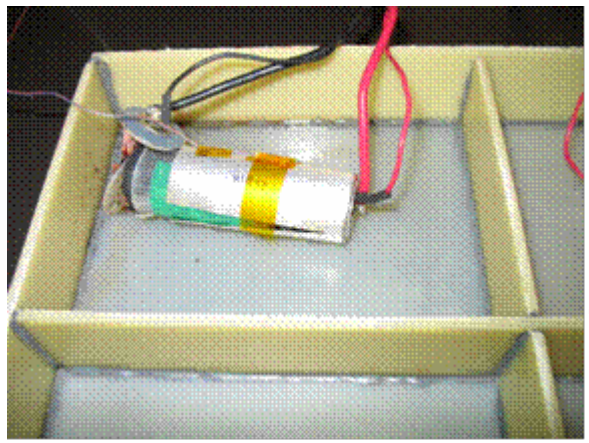
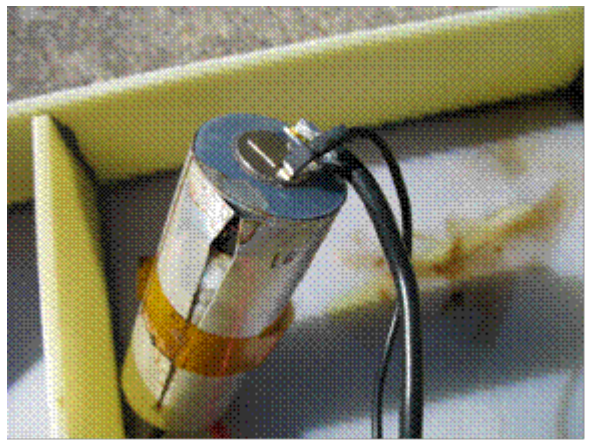
Overcharge Test



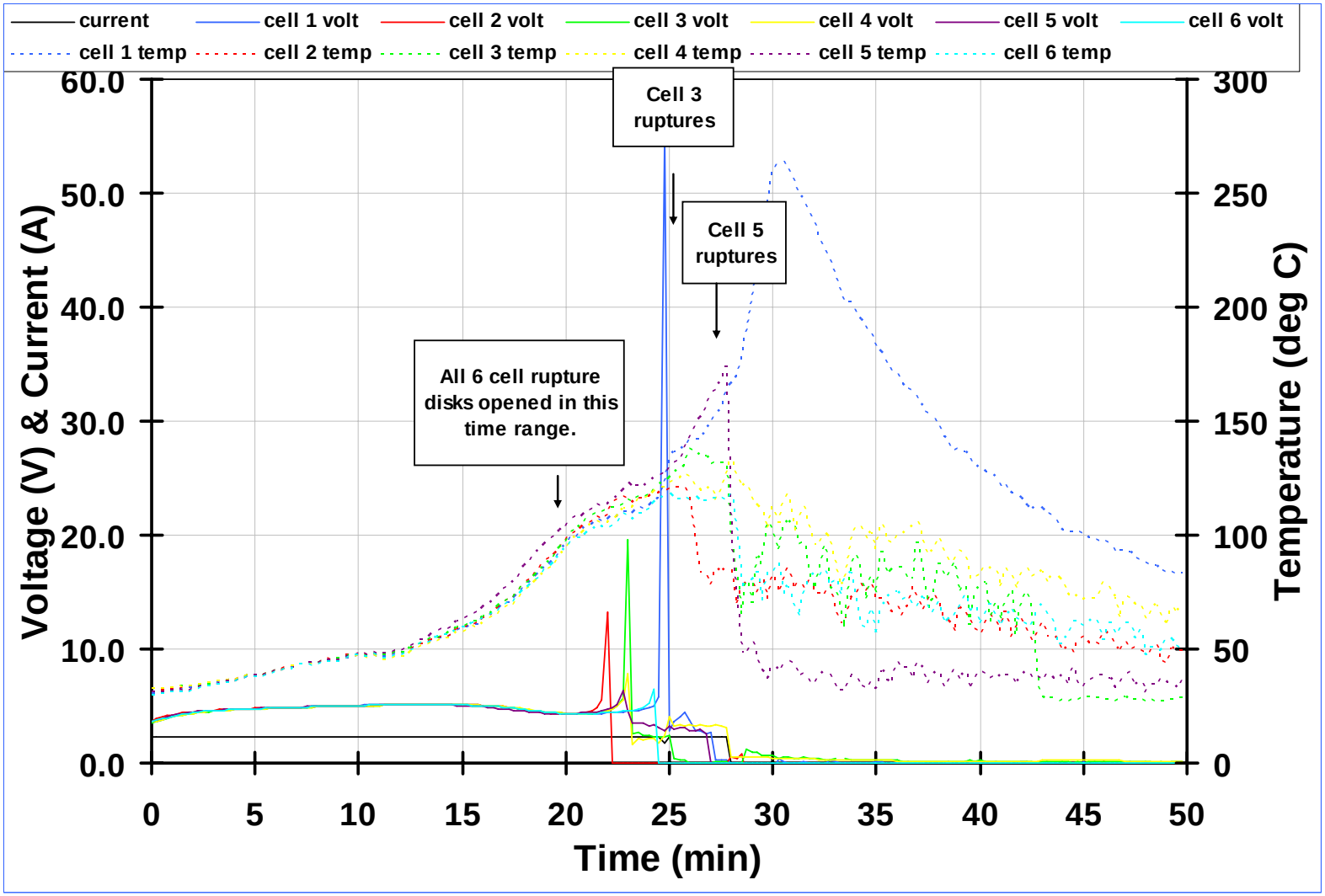
2.3 A Overcharge



10 A Overcharge



Overcharge at 1 C Rate on a 6-Cell Series String



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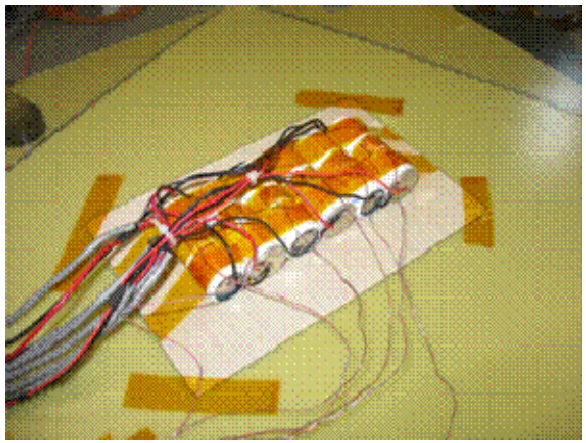
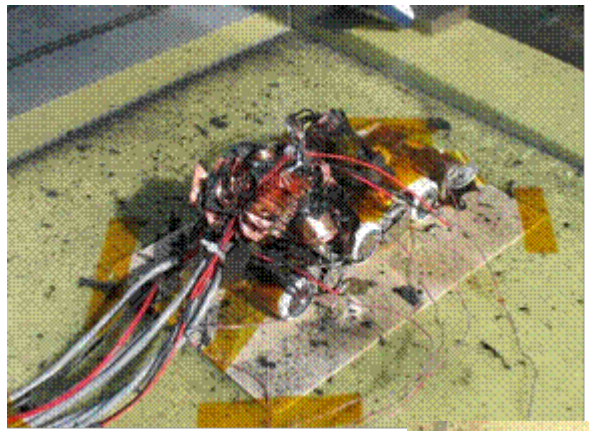
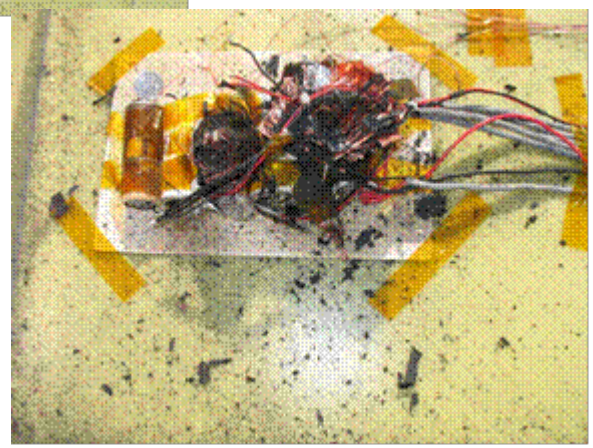
Six-Cell String Overcharge Test







Conclusions

- Performance tests of the A123 under different load currents and at different temperatures have been performed
- Cells have shown excellent performance under the conditions tested except for the -30 °C
- Cells have fast charge and discharge capability as well as high rate pulse capability in excess 130 A
- Cells warm up under fast charge conditions as seen under the 10C charge rate capability test; good fast charge capability
- The safety tests indicate that the cells are tolerant to a simulated internal short circuit and overdischarge into reversal; the cells bulge and leak electrolyte under external short circuit conditions; high temperatures with can splitting were recorded under overcharge conditions; cell disassembly under overcharge in a string configuration.

Acknowledgment

T/J Technologies/A123 : Les Alexander

SRI :Brad Strangways