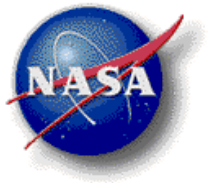


Performance and Safety Testing of Varta Li-ion Polymer Cells

Pranav Patel
MEI/NASA- JSC
Judith Jeevarajan
NASA-JSC

2009 NASA Battery Workshop

Outline

- Cell Characteristics
- Performance
- Safety
- Summary

Varta Cell Characteristics

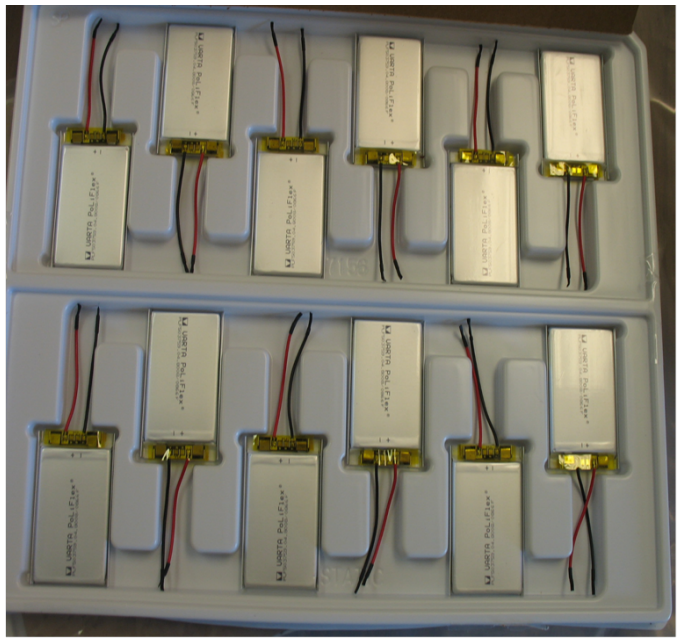
Voltage : 3.7 V

Capacity : 1.21 Ah

Dimensions : 5mm X 37mm X 38.5 mm

Mass: 23g Energy Density: 195 Wh/kg

MOSFET switches for Overvoltage, Undervoltage and overcurrent control



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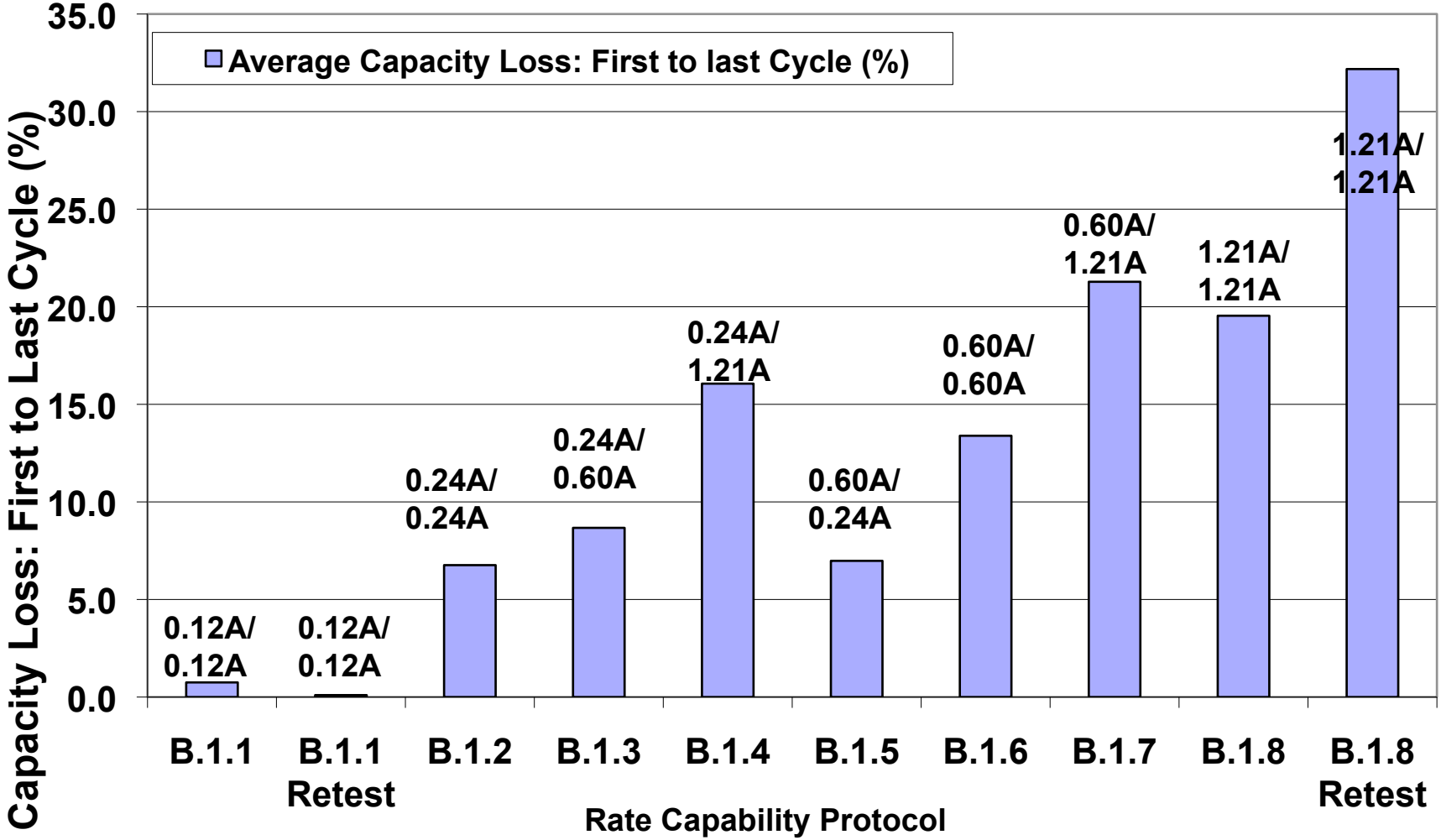
Performance

- Rate Capability
- Vacuum Cycling
- Temperature Cycling
- Internal Resistance

Rate Capability Test for Varta Li-ion Polymer Cells

Average Capacity Loss (%) vs Rate Capability Protocol (N = 3 Cells)
(Except for B.1.8 Retest, N = 2 Cells)



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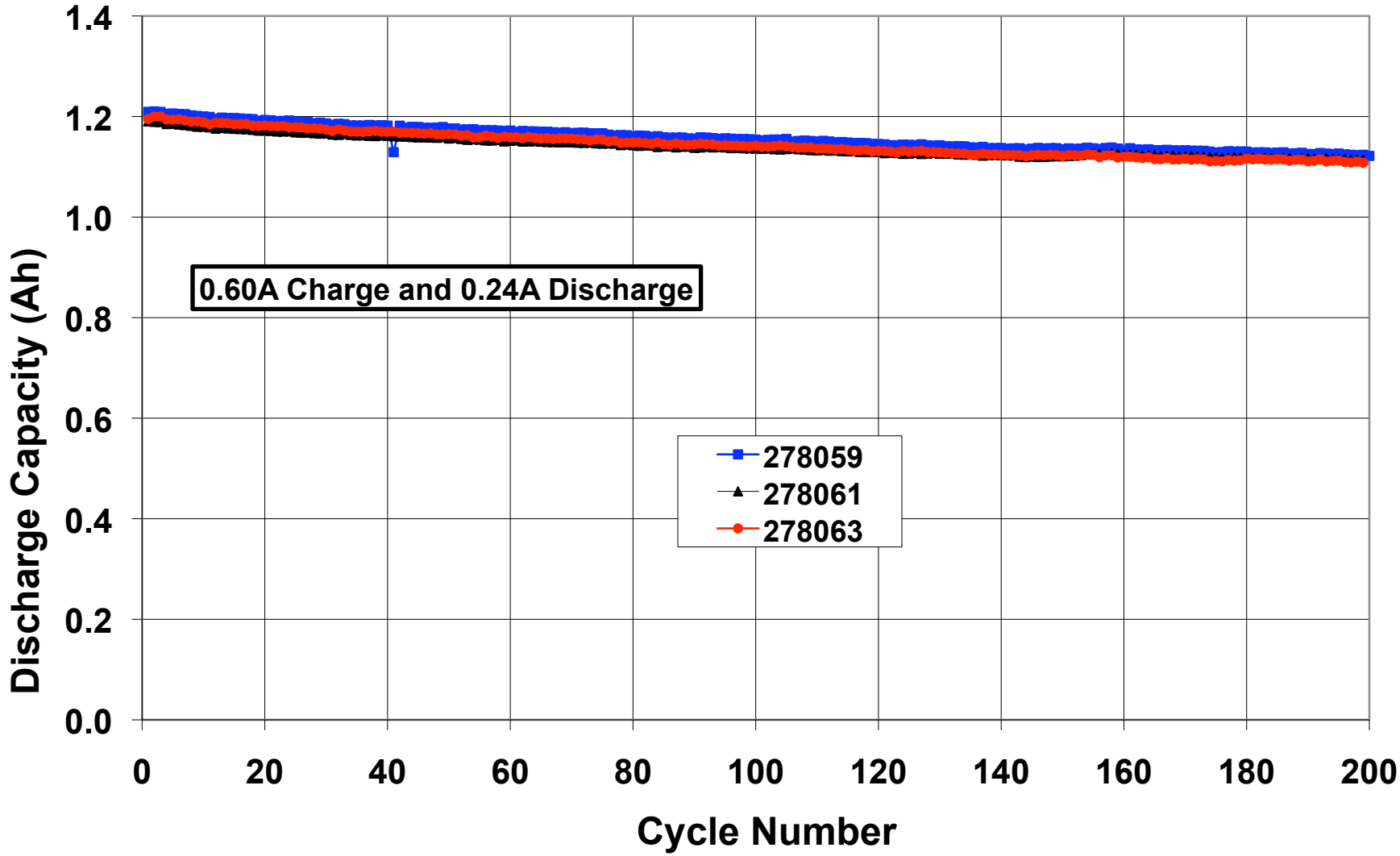
Rate Capability Protocol B.1.5 for Varta Li-ion Polymer cells



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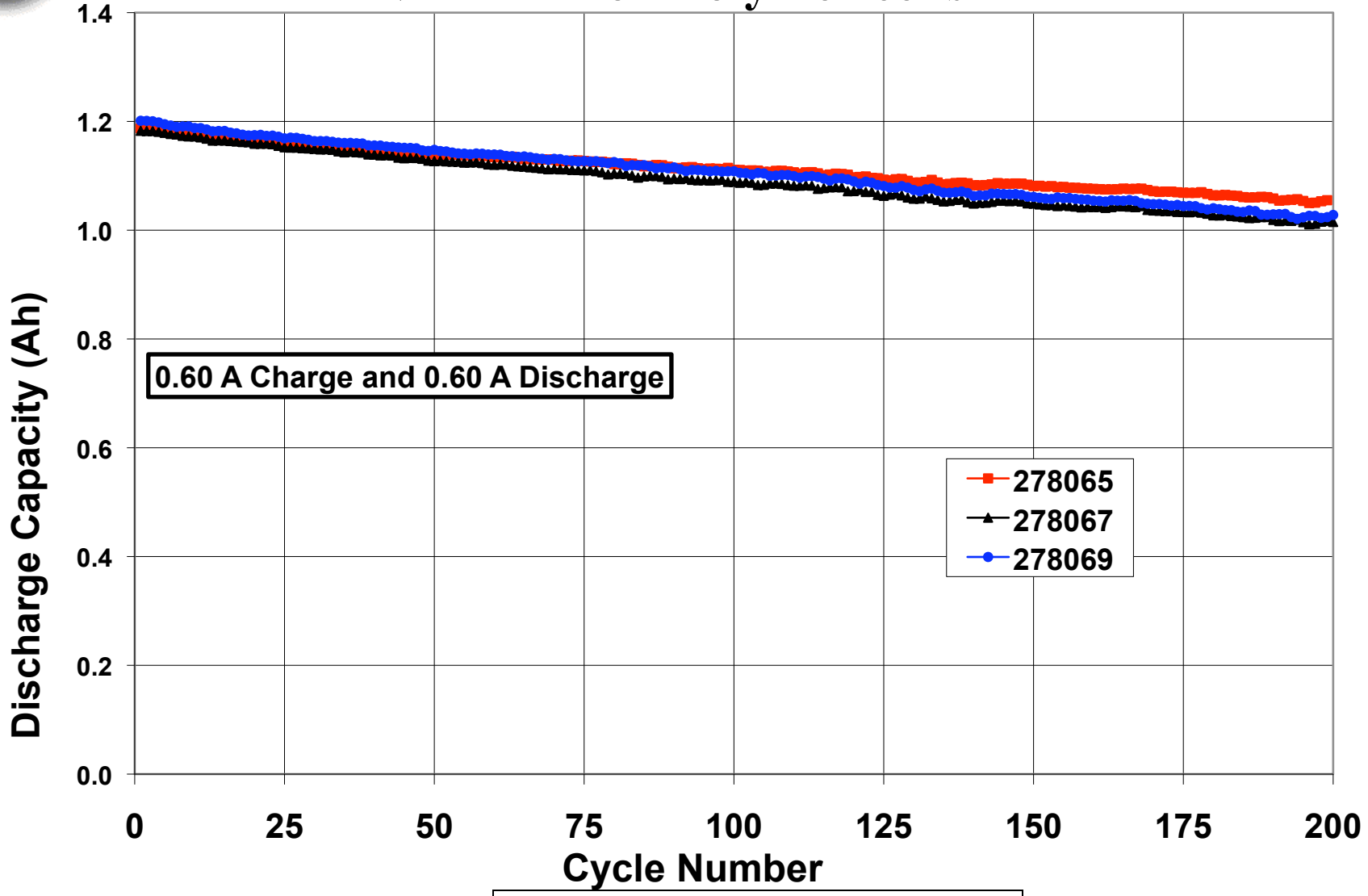
Rate Capability Protocol B.1.6 for Varta Li-ion Polymer cells



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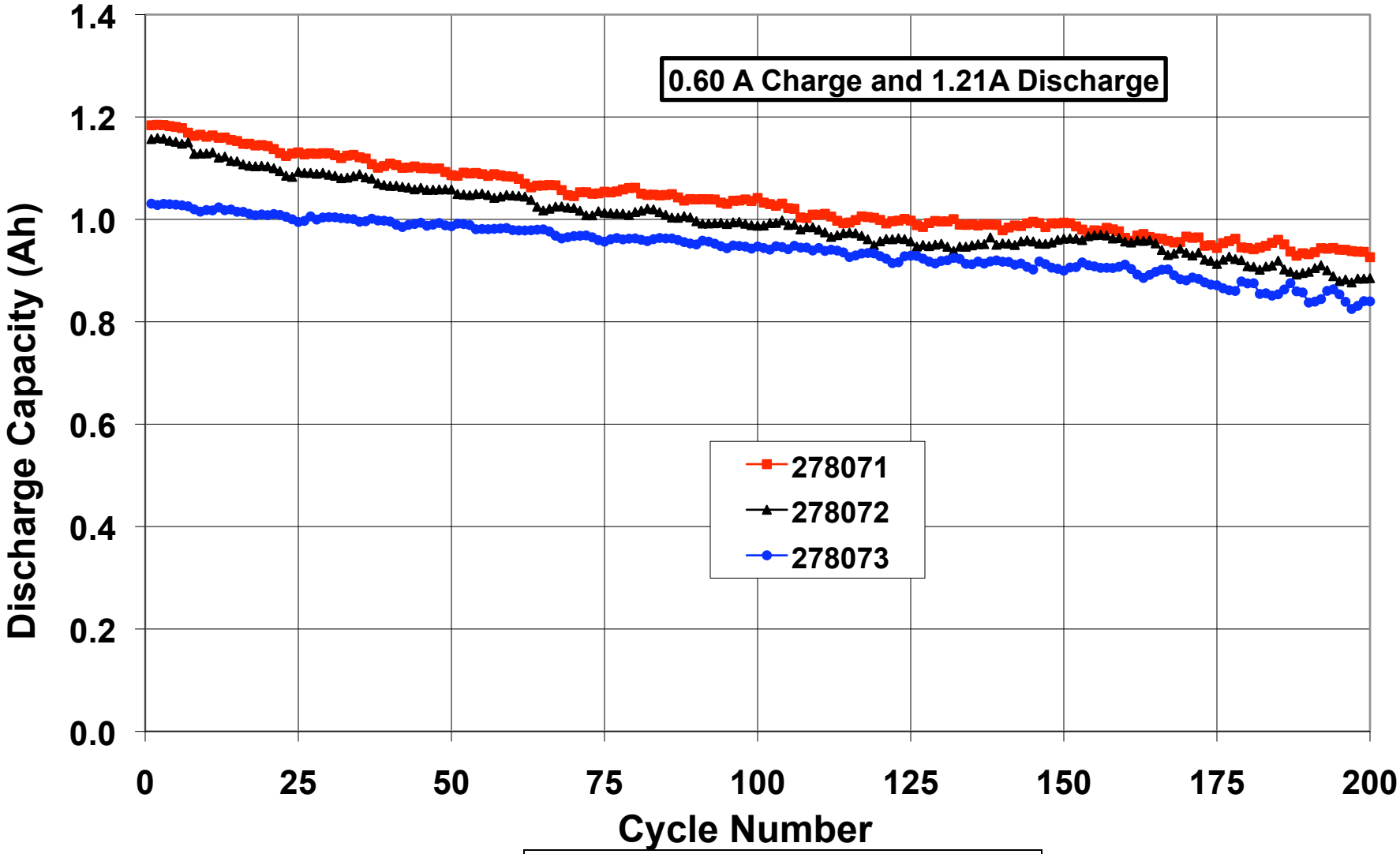
Rate Capability Protocol B.1.7 for Varta Li-ion Polymer cells



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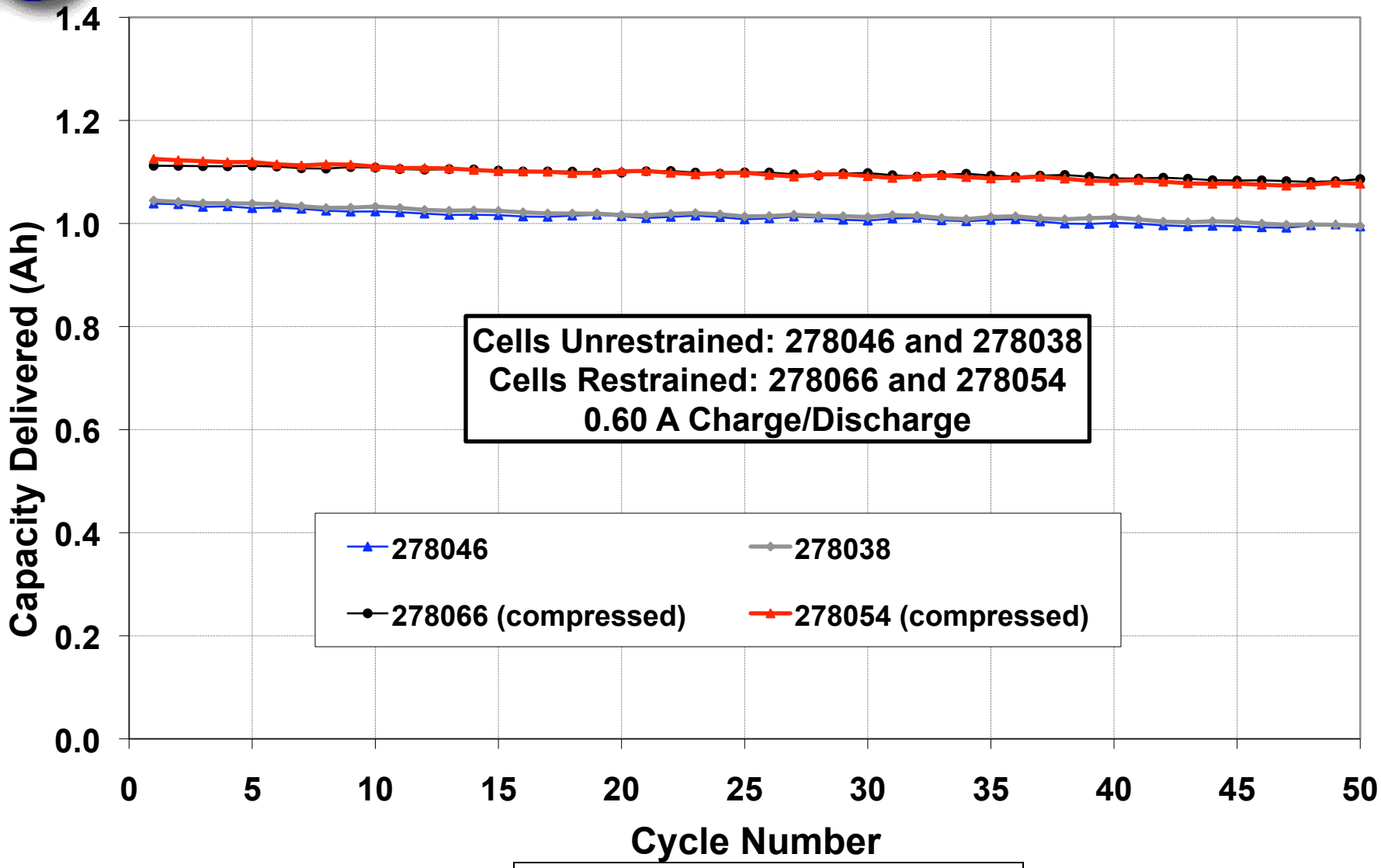
Cycling under Vacuum Conditions for Varta Li-ion Polymer cells



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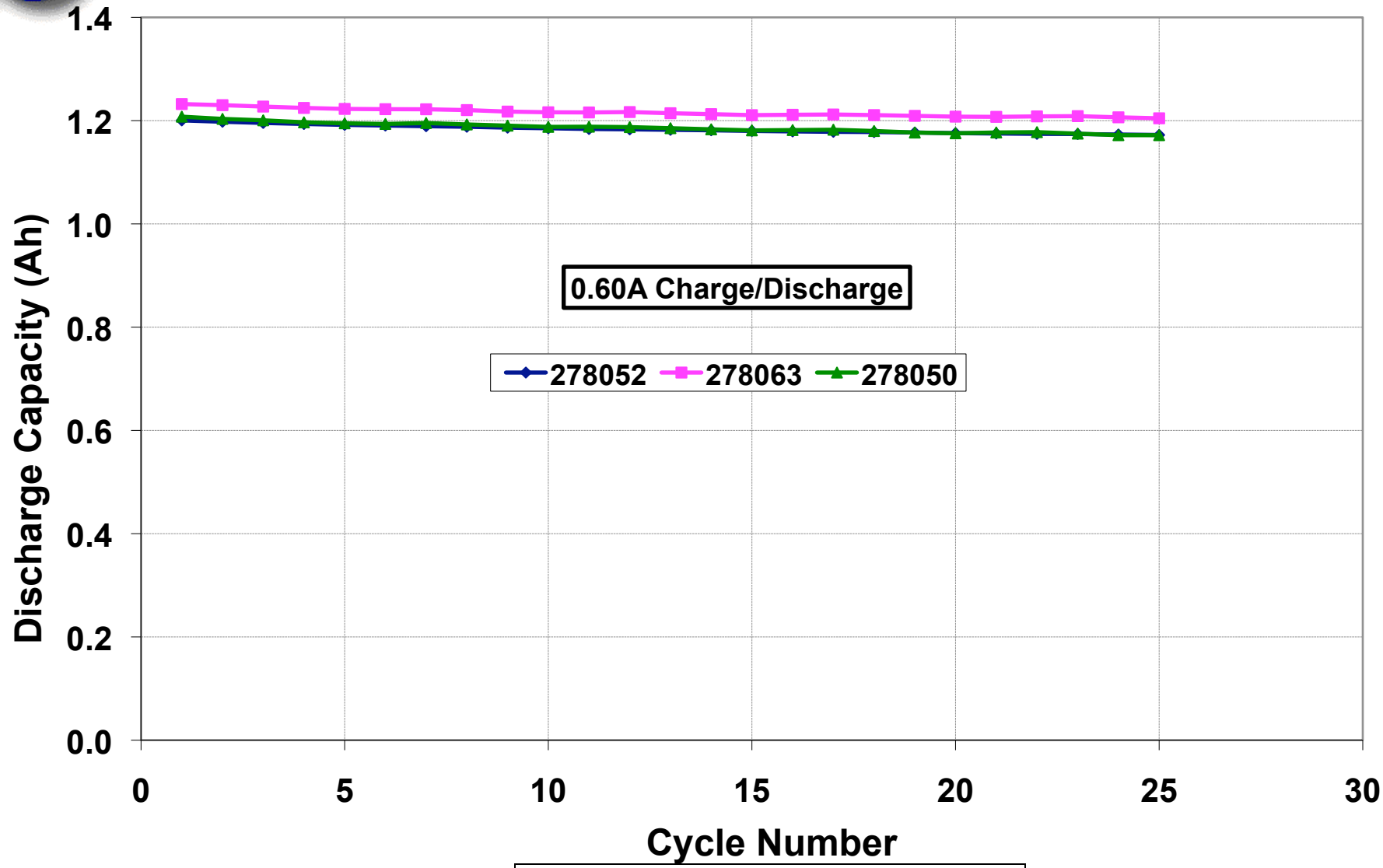
Cycling at 22 deg C for Varta Li-ion Polymer Cell



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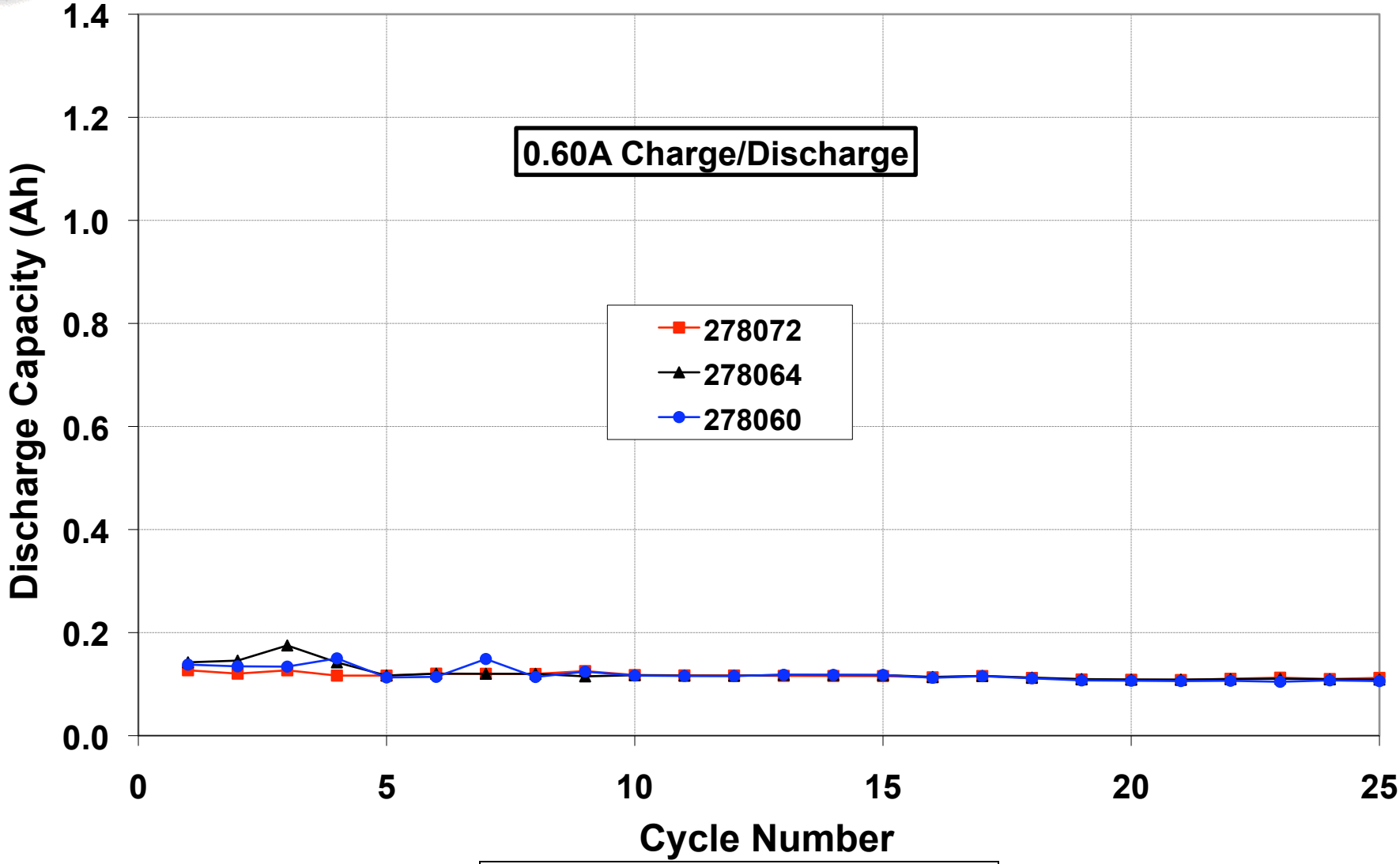
Discharge at -20 deg C for Varta Li-ion Polymer Cells



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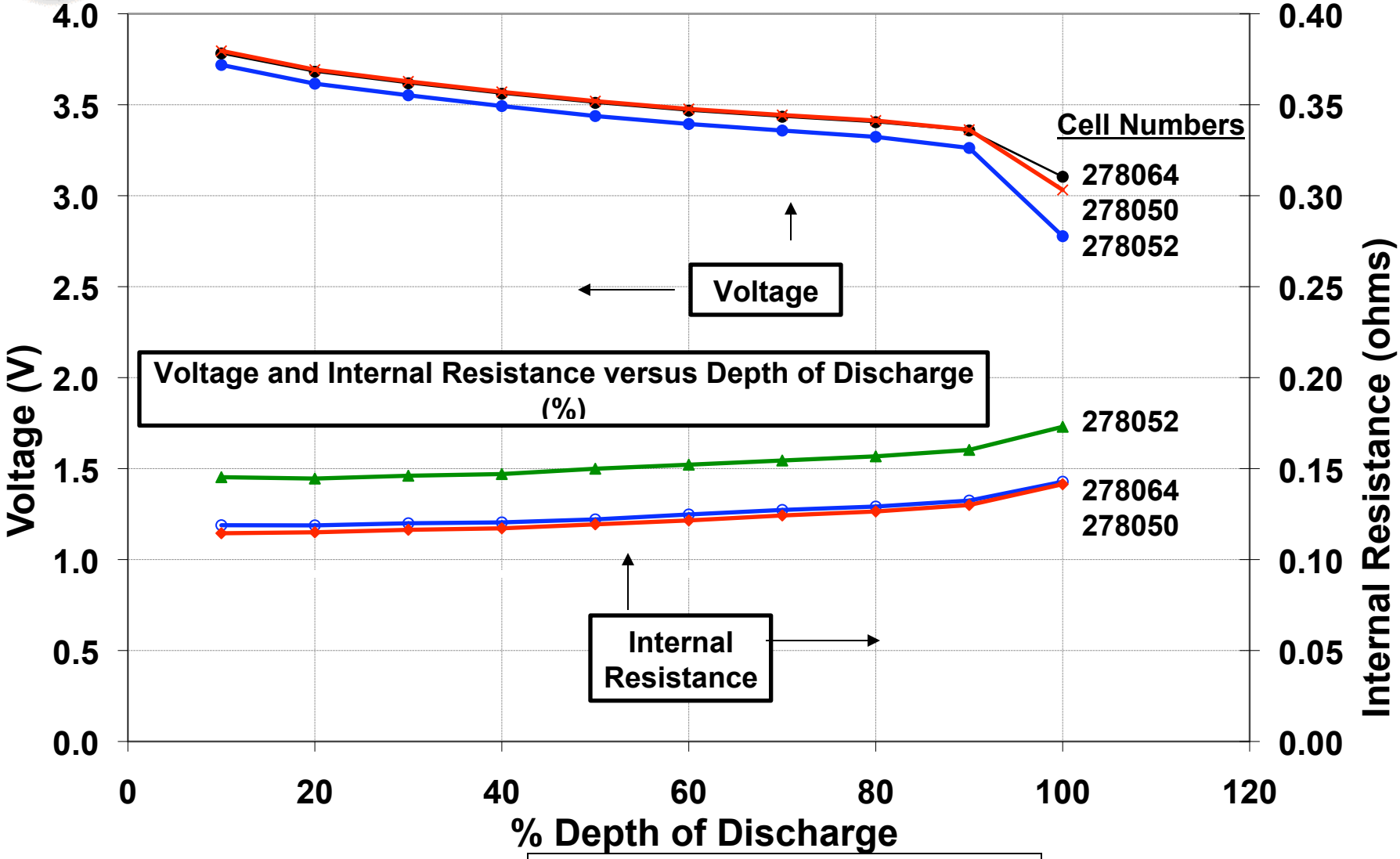
Internal Resistance Characteristic for the Varta Li-ion Polymer Cell



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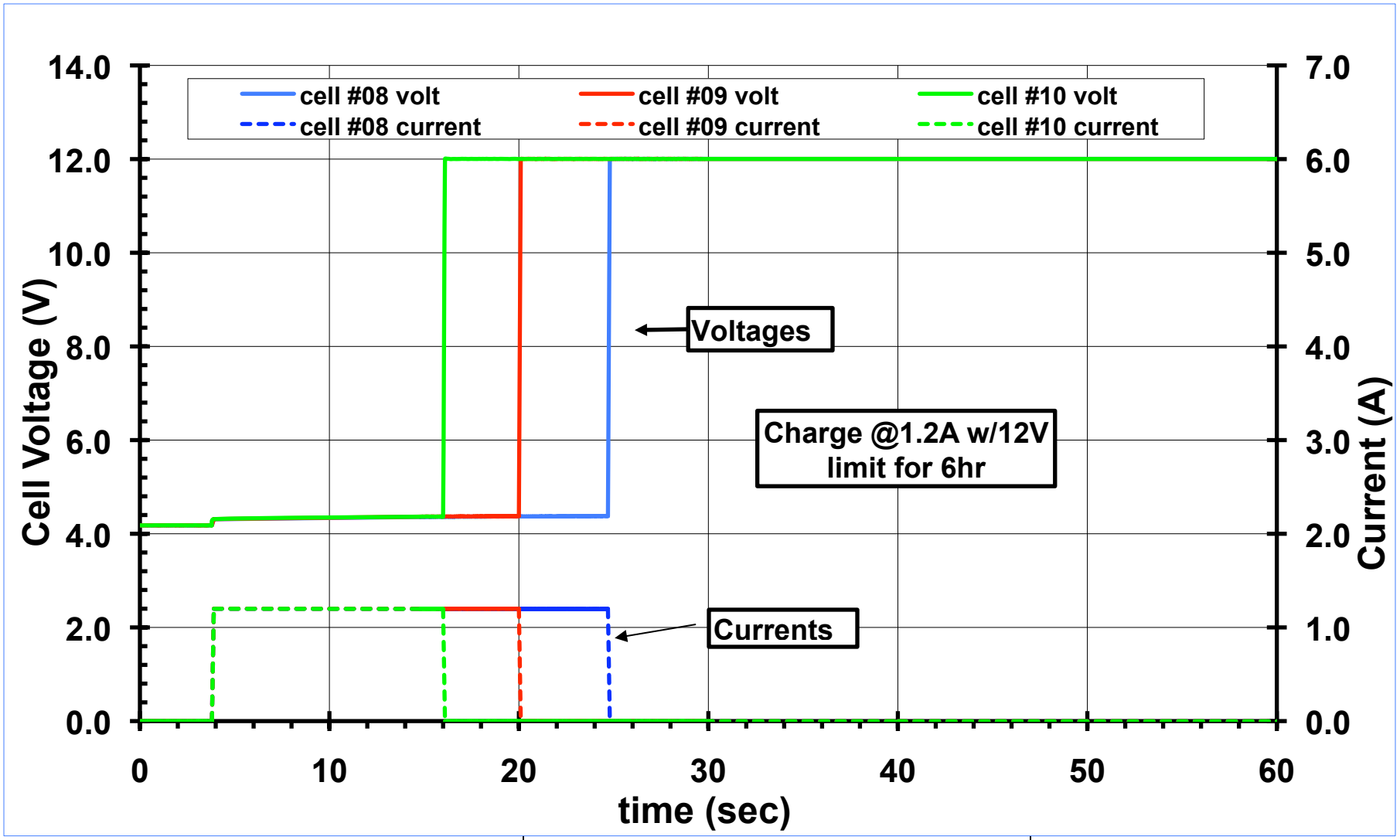
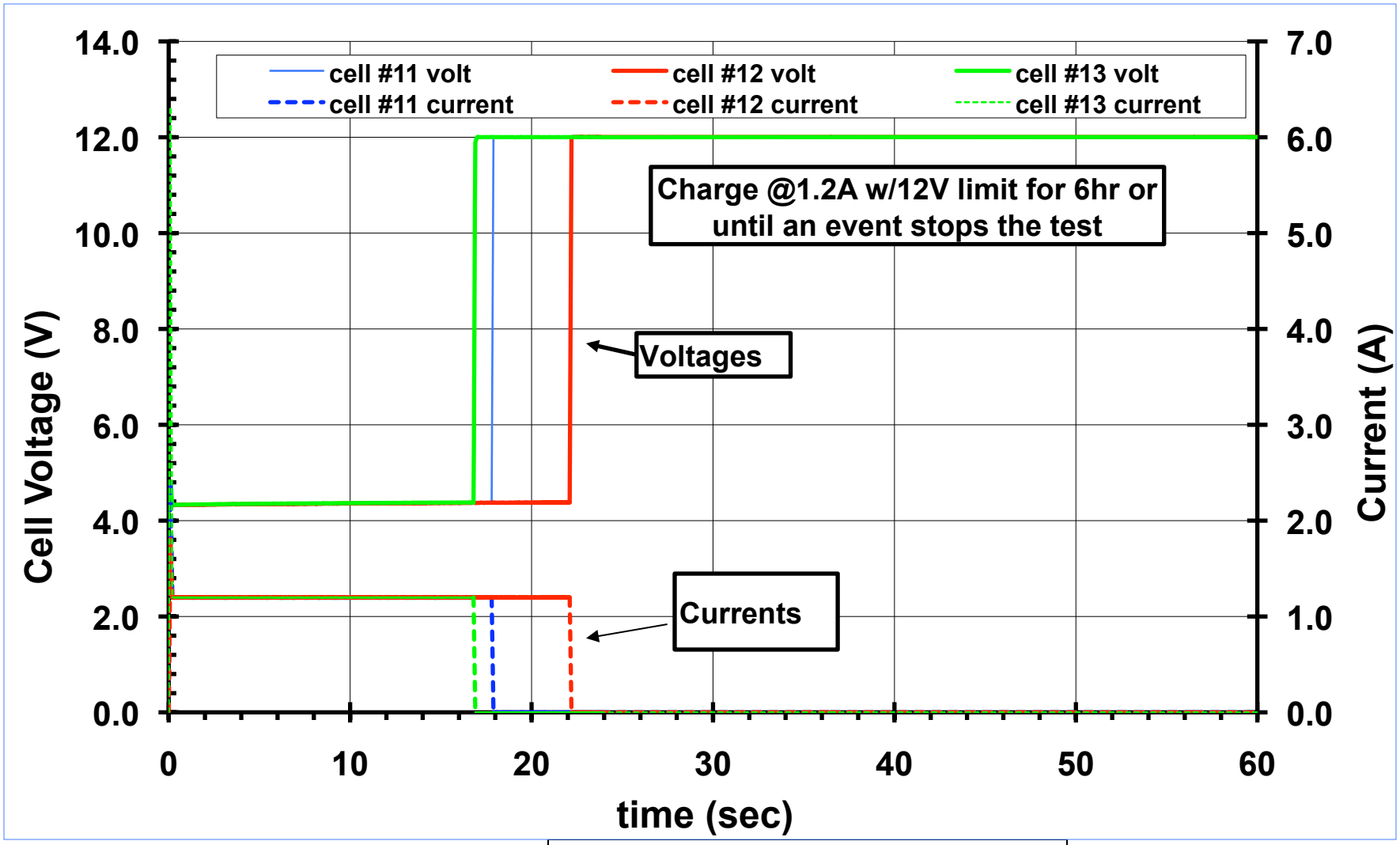
Safety / Abuse

- Overcharge
- Overdischarge
- External Short
- Internal Short
- Heat to Vent

Overcharge Test of Varta Li-ion Polymer Cell Unrestrained



Overcharge Test of Varta Li-ion Polymer Cells Restrained



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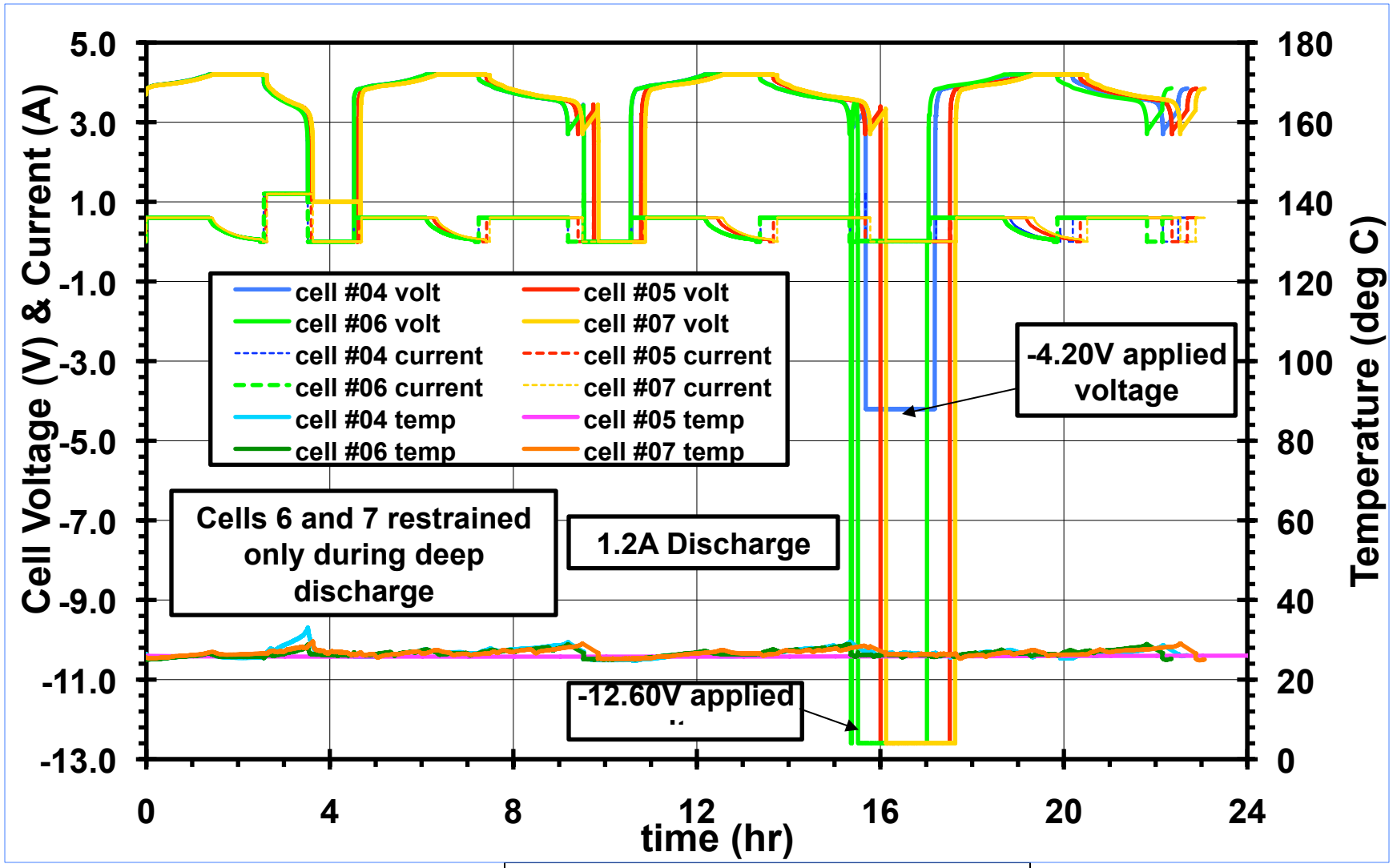
Overdischarge of Varta Li-ion Polymer Cell Unrestrained & Restrained



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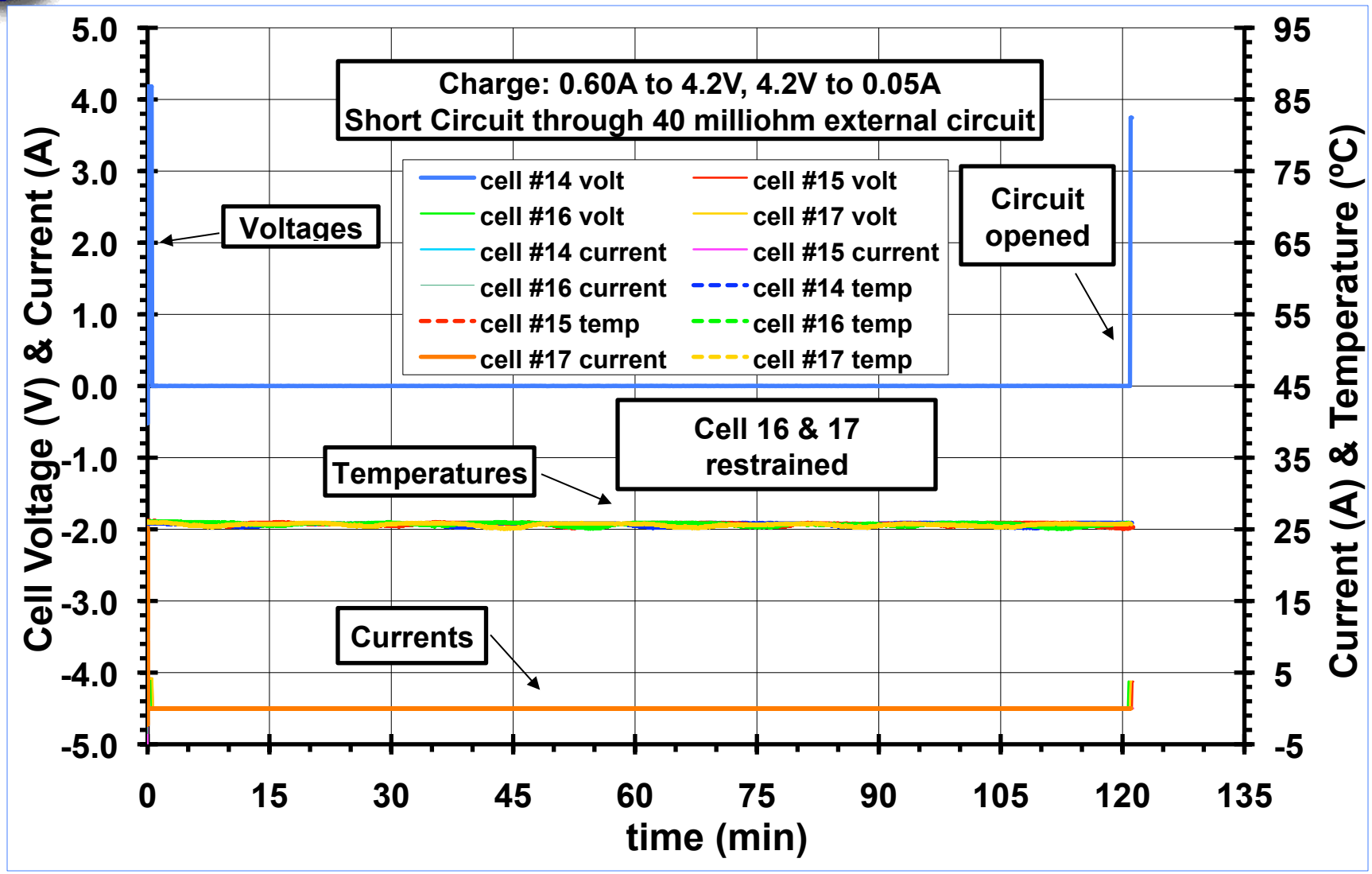
External Short Circuit on Varta Li-ion Polymer Cell : Unrestrained and Restrained



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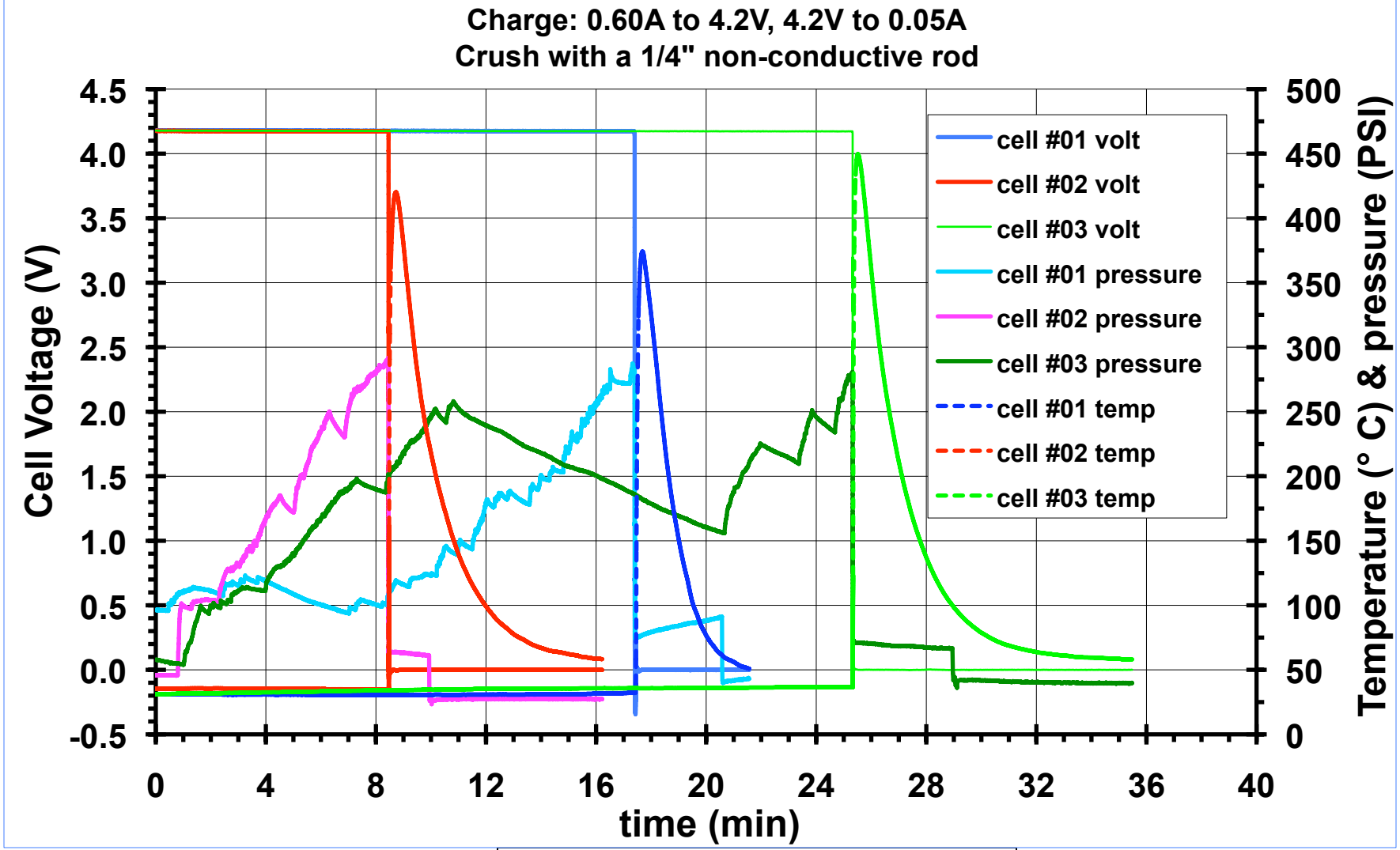
Simulated Internal Short



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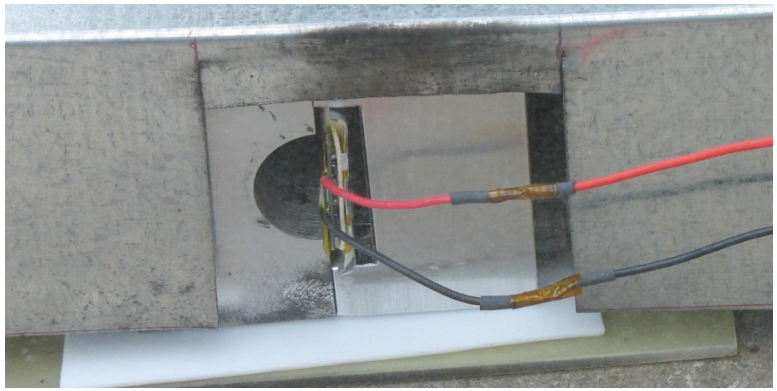
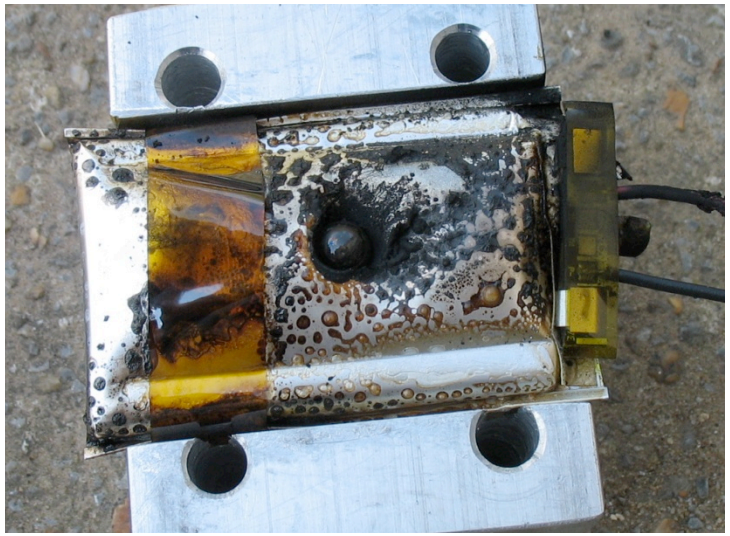
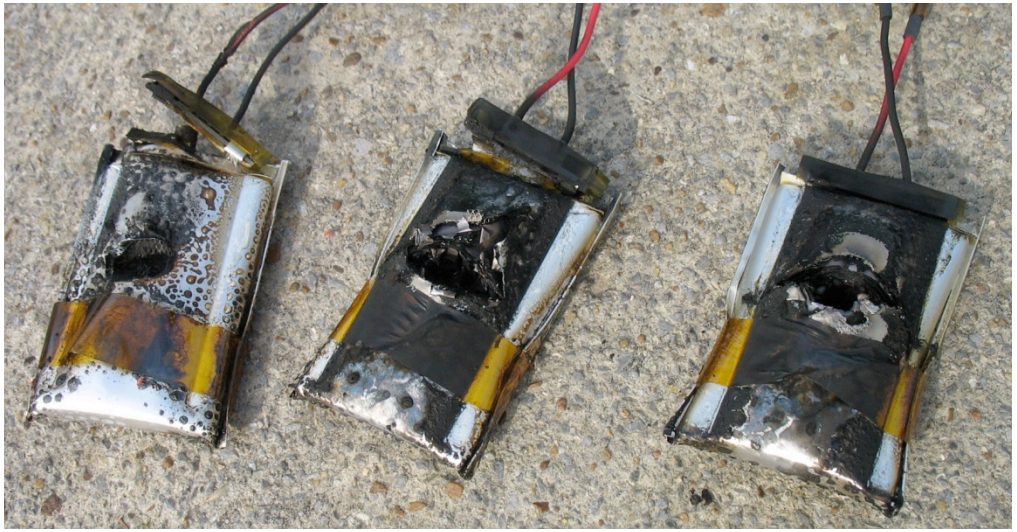
Simulated Internal Short

Test Setup



Test Results





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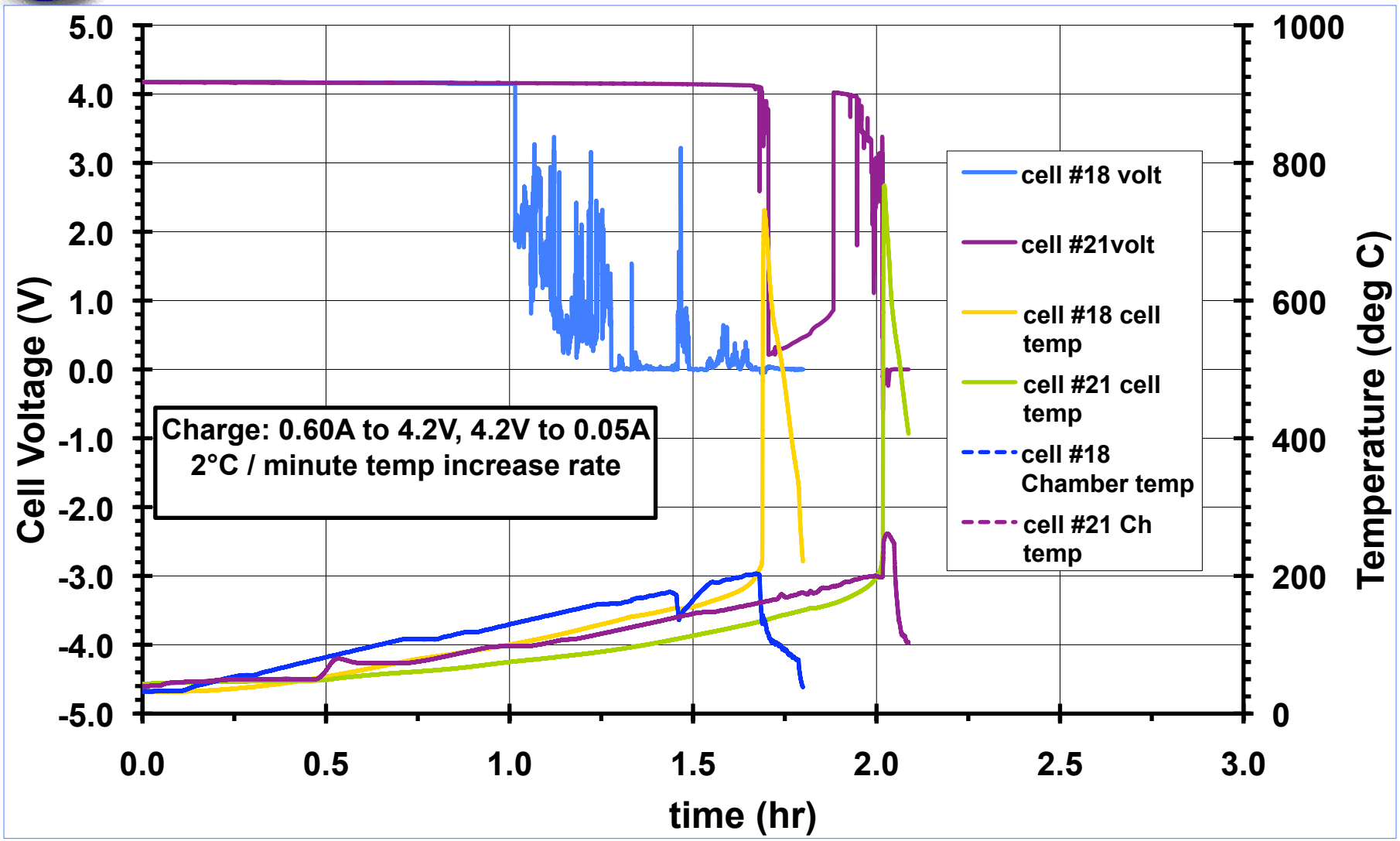
Heat-to-Vent on Varta Li-ion Polymer Cell Unrestrained



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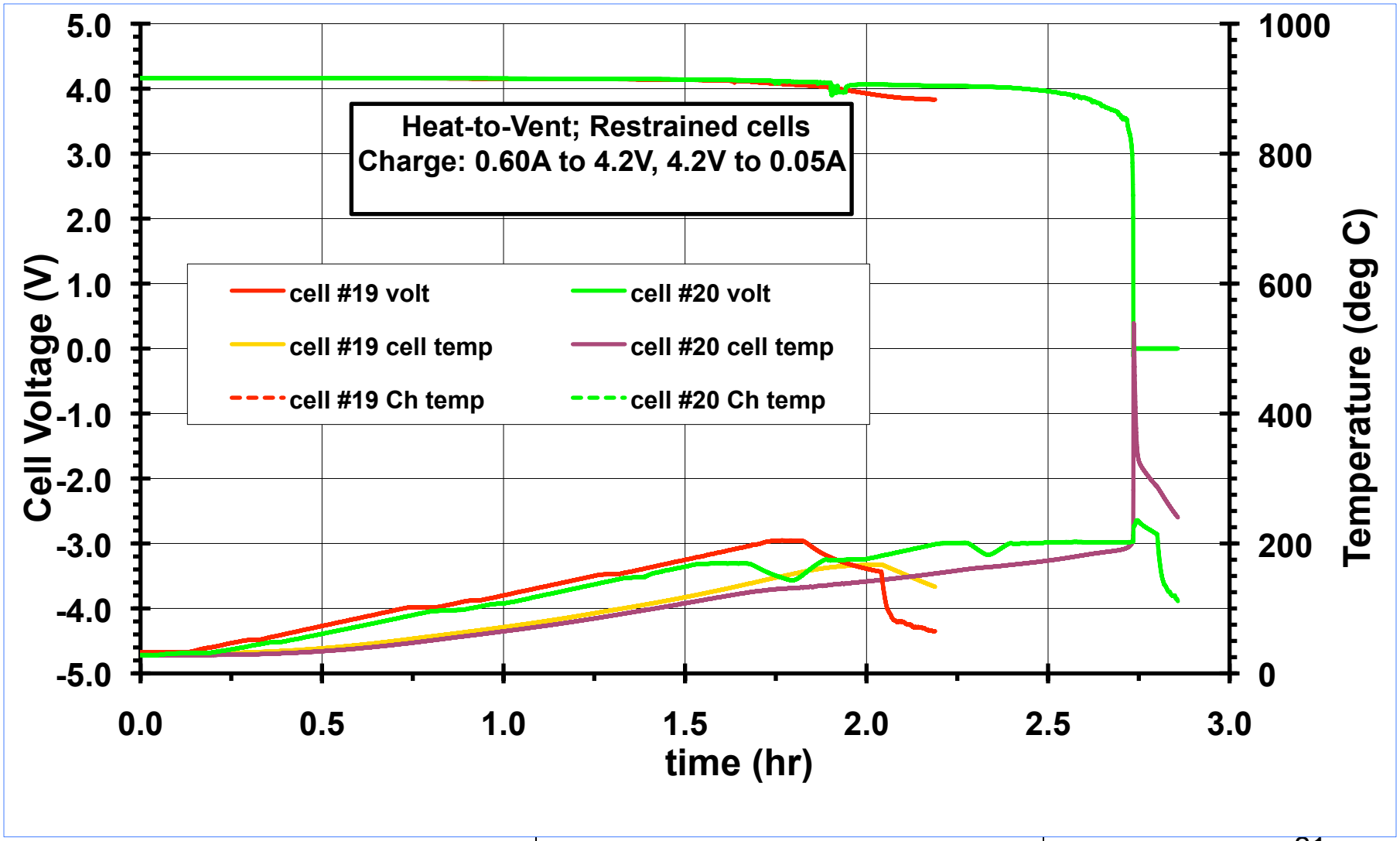
Heat-to-Vent Test for Varta Li-ion Polymer Cell Restrained



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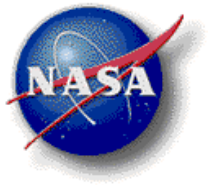

Summary

- Performance
  - Good low rate data, poor high rate
  - High Re due to PCB
  - Capacity decreases with increased discharge current
- Abuse
  - Circuit protection highly effective
  - No flames
  - Cell restraints helped in some cases
    - Heat to Vent
    - Vacuum Cycling

Acknowledgements

Vicki McLaren – Clyde Space

Joe Bytella – BAE Systems

Tim Nelson/Brad Strangways - Symmetry Resources Inc.