



Thermal Characterization and Analysis of A123 Systems Battery Cells, Modules and Packs

**Cooperative Research and Development
Final Report**

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In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

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CRADA Title: Thermal Characterization and Analysis of A123 Systems Battery Cells, Modules and Packs

Parties to the Agreement: A123 Systems, Inc.

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NREL Shared Resources
Year 1	\$ 115,000.00
Year 2	\$ 55,000.00
Year 3	\$ 30,000.00
TOTALS	\$ 200,000.00

Abstract of CRADA work:

In support of the A123 Systems' battery development program with USABC/DOE, NREL provided technical support in thermal characterization, analysis and management of batteries. NREL's effort was part of Energy Storage Project funded by DOE Vehicle Technologies Program.

The purpose of this work was for NREL to perform thermal characterization and analysis of A123 Systems cells and modules with the aim for A123 Systems to improve the thermal performance of their battery cells, modules and packs.

Summary of Research Results:

A123 provided several baseline MI 26650 cells and newer 32113 power cells along with charge algorithms and T/V/I limits. NREL developed a test plan and initiated the electrical and thermal testing. Capacities were measured using C/1 rate and the power was obtained using the USABC HPPC method. The heat generation measurements were obtained using NREL calorimeter at various power profiles and temperatures. Heat capacity measurement using calorimeter at two temperatures was performed. NREL obtained infrared thermal images of the cells at room temperature at various power profiles. The results were reported to the A123Systems, USABC and DOE at various USABC/DOE quarterly review meetings from 2008-2011. A123Systems used the data to improve the thermal performance of their next generation of cell. We also performed thermal characterization of A123 prismatic pouch cells.

NREL also performed thermal evaluations of USABC deliverable battery modules and packs. The purpose of this activity is to measure the thermal performance of the USABC Program deliverable module/pack designs with cell designs under various profiles to see how well the USABC Deliverable performs under realistic ambient conditions. The activities included developing a test plan agreed on by all parties, performing thermal tests according to the test plan, performing thermal testing to measure the temperature distribution and pumping power for deliverable modules, and seeing how they thermally perform under realistic conditions According to the test plan. A123Systems sends us several modules and one pack for thermal evaluation An HEV module with 26650 MI cells, an HEV module using 32113 cells that are being developed for the USABC Program, an HEV module using prismatic pouch developed under the USABC Program, a tested PHEV-10 pack using 32112 cells. The results were reported to the A123Systems, USABC and DOE at various USABC/DOE quarterly review meetings from 2008-2011. The results provided insight to the USABC/DOE on how the prototypes perform, and also provided information to A123 to improve the thermal management system.

Subject Inventions listing: None

Report Date: November 2011

Responsible Technical Contact at Alliance/NREL: Ahmad Pesaran

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