Liquid Organic Battery Development

Cooperative Research and Development Final Report

CRADA Number: CRD-14-540

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In accordance with Requirements set forth in Article XI. Reports and Abstracts A.(3), of the CRADA agreement, 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.

Parties to the Agreement: EIC Laboratories and Chemtura Corporation

CRADA Number: CRD-14-540

CRADA Title: Liquid Organic Battery Development

Joint Work Statement Funding Table Showing DOE Commitment:

Estimated Costs	NREL Shared Resources
Year 1	$310,896 .55
Year 2	$310,896 .55
TOTAL	$621,793.10

Abstract of CRADA Work:

Battery electric vehicles (BEV) have the potential to significantly reduce consumption of gasoline and emission of greenhouse gases. However, the commercial success of mass-market, long-range BEVs requires battery technology with a challenging combination of technical metrics – specific energy, safety, fast recharge capability, cycle life, and cost. The NREL team proposes a robust, liquid-phase battery design utilizing a high-energy organic redox couple capable of decoupling these metrics via electrode exchange to provide the necessary combination of performance characteristics. The overall objective of this project is to demonstrate a functioning prototype and determine its ability to meet RANGE performance targets in large-scale production. Three main tasks described below will work towards this goal with the individual objectives of (1) identifying a robust, high-performance redox couple-solvent-additive combination, (2) designing and demonstrating a functional cell, and (3) analyzing the concept's potential performance and cost in future mass-production scenarios.

Summary of Research Results:

Several full cells were built and tested, utilizing liquid organic anolytes and catholytes. An all organic cell was constructed that provided an average discharge voltage of approximately 1.6 V over more than 100 cycles. Redox compound concentrations have been kept to low levels to minimize the impact of poor cell conductivity across the membrane and enable faster cycles with smaller overpotentials. Were the cell conductivity substantially improved to test higher concentration chemistries, it is possible that 100 Wh/kg and 120 Wh/L could be exceeded. While these values still fall short of project goals, they still offer improved potential for grid applications and could prove suitable for automotive use.

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Subject Inventions Listing:

High Energy Density Liquid Organic Battery with Quick-Replaceable Electrodes, NREL ROI: ROI-13-00038

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05/23/2016

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