



ADVANCED BATTERY MANUFACTURING

Enabling the New Electric Infrastructure for Mobility & Power in North America

April 15-17, 2009 | Almas Temple Club | Washington, D.C.

Technical Briefing

Assembling a North American Lithium Ion Supply Chain

April 15, 2009, 9AM-4:30 PM

A lithium ion battery integrates a number of different ingredients from a variety of suppliers. The challenge of creating a manufacturing base in the US and Canada for advanced batteries involves nurturing an entire food-chain of companies, expertise, and commodities. This Technical Briefing will feature a series of presentations from industry experts profiling the current supply chain players and components, opportunities for venture investment along the supply chain, and commercializable breakthroughs from private companies, national labs and universities.

Draft Agenda

- 8:00—9:00 Continental Breakfast and Registration
- 9:00—9:15 **Chairman's Introduction**
Richard Baxter, Senior Vice President, ARDOUR CAPITAL INVESTMENTS
- 9:15—9:45 **US DOE Basic Energy Research – Recap of Study on Basic Research Needs for Electrical Energy Storage**
Richard Kelley, Ph.D., Program Manager, Materials Chemistry, Division of Materials Sciences and Engineering, U.S. DEPARTMENT OF ENERGY
- 9:45—10:15 **Lithium - Raw Materials**
Lithium is currently recovered from pegmatites and continental brines. For the most part, it is brine-based lithium that is used in the production of lithium chemicals, including lithium carbonate, chloride, and hydroxide. If lithium batteries can be successfully adapted for electric vehicles and hybrid electric vehicles, the global market for lithium could increase substantially. In that case, consumption of lithium carbonate from continental brines could increase to the point of concern about long-term sustainability of production; however, there are other sources of lithium carbonate. The increased value of the lithium chemicals would have to be high enough to make recovery

of lithium carbonate from pegmatites economical. In addition, other potential sources of lithium carbonate are geothermal brines, oilfield brines, and hectorite clays. Lithium carbonate recovery costs have not been developed for other potential sources, but work is being done on the feasibility of recovering lithium from hectorite clays and geothermal brines.

Brian Jaskula, Ph.D., *Lithium, Gallium and Beryllium Commodity Specialist, U.S. GEOLOGICAL SURVEY*

10:15—10:45 Morning Networking Break

10:45—11:15 **Comparison of Manufacturing in Asia versus in North America**
Asian countries have developed deep expertise and supply chain strengths in Lithium Ion cell manufacturing. The US has traditionally been the source of much of the IP, but is weak in other respects. This presentation will present an overview of the different components of the battery economy, and how they stack up against a planned Lithium Ion industry in North America. Factors to be discussed include: near term capacity, alliances, supply chain, IP, work-force, environmental and government incentives.

Ric Fulop, *Vice President, Business Development, A123 SYSTEMS*

11:15—12:15 **Panel Discussion: Lithium Ion Cell Manufacturing Overview**
In a context of jump-starting Li-On production in North America, battery makers may be competitors on the market, but will arguably need each other just as much to grow a “business eco-system” that supports common needs—encompassing tools, commodities, components and expertise. This panel of Li-On Battery makers and supply chain vendors will explore a range of practical issues around what it takes to establish a domestic manufacturing capacity for lithium ion cell packs. They will address supply chain challenges, integration, facility siting considerations, and investment and finance needs.

Panelists

Ric Fulop, *Vice President, Business Development, A123 SYSTEMS*

Barry Misquitta, Ph.D., *Vice President, Energy Storage Materials, NOVOLYTE TECHNOLOGIES*

Marc Juzkow, *Vice President of Product Development, MOBIUS POWER INC.*

Ryan Wartena, Ph.D., *Chief Technology Officer, ICEL SYSTEMS INC.*

12:15—1:45 Group Luncheon

1:45—2:15

Lithium Ion Batteries: They are Not All the Same

This talk will provide a brief overview of the different electrochemical systems and types of cells that are grouped under the general term "lithium ion." Common materials used in positive and negative electrodes and electrolytes will be reviewed. Differences and improvements in performance among the various systems will be summarized. The availability of certain basic raw materials, such as lithium will also be assessed.

James Barnes, Ph.D., Research and Development, Office of Vehicle Technologies, U.S. DEPARTMENT OF ENERGY

2:15—2:45

North American Lithium Ion Battery Manufacture: The Supply Status of Critical Chemicals and Raw Materials

The critical components (chemicals and raw materials) for North American manufacture of lithium-ion batteries are the cathode materials, the electrolyte and electrolyte salts, the anode carbon (currently) and the separator. At the present time almost all lithium-ion batteries (18650's) are made in China, Korea, Japan, Malaysia, and Taiwan. Therefore the current customer base (lithium-ion battery manufacturers) is usually too small to support a robust critical secondary raw materials supplier base. The manufacture and supply of these critical chemicals and raw materials will be discussed with respect to where we are and what will be needed to achieve a total North American manufactured supply of these critical items. This is necessary for the establishment of the North American lithium-ion battery industry-required both for defense, automotive and overall economic growth long term.

Novis Smith, Ph.D., Vice President, Technology, LITHCHEM ENERGY

2:45—3:15

Afternoon Networking Break

3:15—3:45

Battery Chemistry Strengths and Weaknesses

Going beyond laboratory testing and comparative numbers, this presentation discusses the practical aspects of employing various lithium-ion chemistries in real-world applications. Enhanced electrochemical safety is a primary focus of promotional efforts by some manufacturers, but potential users may be unaware of the operational tradeoffs associated with achieving safety improvements at this level. The presentation also discusses battery design issues such as control electronics, system architecture and qualification, and how these aspects can be influenced by the choice of chemistry.

Jim McDowall, *Business Development Manager*, SAFT

3:45—4:15

Packaging / Module Development

Once cells have been manufactured, the next step is to select the right technology for the application and develop a solution that integrates and interfaces the power solution to the application. This presentation will briefly discuss pack design considerations for modules, the building blocks of large format advanced batteries, components of effective pack design within the application envelope, the state of the domestic supply chain and case studies.

Ralph Wise, *Director of Technology*, ULTRALIFE CORPORATION

4:15—4:30

Chairman's Closing Notes