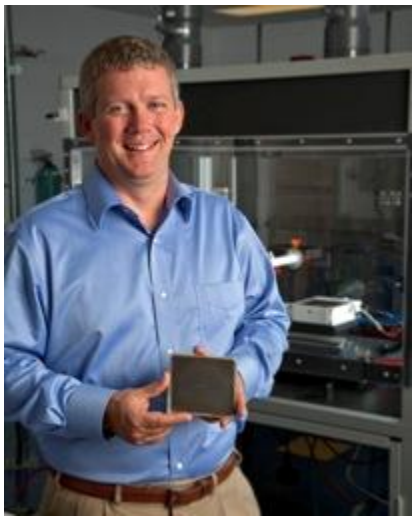
TechJournal SOUTH

Development of new battery technologies vital

July 23rd, 2010

By Scott Faris



Scott Faris, founder and CEO of Planar Energy, holds a cathode layer for an advanced energy cell created through the company's breakthrough SPEED materials deposition process.

ORLANDO, FL – With relentlessly gushing oil having spread into the Gulf of Mexico for months, public discourse has rightly ramped up about the need to reduce U.S. dependence on oil, and attention is increasingly being paid to the potential role that electric cars can play in solving related serious economic and security challenges.

While hybrid vehicles that have both gasoline and electric power engines, such as the Toyota Prius, have been available since 2001, fully electric vehicles are just reaching the market. For example, the Nissan Leaf is due out this year and the Chevy Volt is expected in 2011, with consumers already lined up to reserve these vehicles.

And in late June of this year, California-based Tesla Motors, which began making electric-powered roadsters in 2008 and has reportedly sold some 1,100 vehicles worldwide, issued an IPO that raised more than $24 million.

Viability of electric cars uncertain

However, the viability and likely market traction of plug-in electric cars is far from certain, as success in the electric-vehicle market is inextricably tied to the state of power storage; that is, the battery.

In some cases, batteries are projected to account for a third or more of a vehicle's costs depending on government subsidies. The cost, for example, of the 16kWh-capacity battery pack, using traditional li-ion technology, planned for Chevrolet's first generation "plug-in" hybrid-electric Volt, is estimated to be $10,000-$15,000, depending on which research report you read.

The overall base vehicle retail price is expected to be around $40,000, prior to a $7,500 federal tax credit, and will include an eight-year warranty to overcome the lack of consumer confidence in battery lifetime. For mass market electric vehicles to be profitable for the automobile industry, the battery cost needs to be less than $5,000 and the batteries need to work as promised in real world conditions for 10 years.

DOE report addresses battery shortcomings

Traditional li-ion battery technology has matured and faces drawbacks that prevent it from solving the cost, performance and safety obstacles to viable electric vehicles. Li-ion batteries have not proven "suitable or cost-effective for use in cars with plugs," according to John Petersen, former director Axion Power International, citing a December 2008 U.S. Department of Energy (DOE) report that addressed several li-ion shortcomings:

- ***Cost****- The current cost of Li-based batteries is approximately a factor of two too high on a kW basis. The main cost drivers being addressed are the high cost of raw materials and materials processing, the cost of cell and module packaging, and manufacturing costs.*
- ***Performance*** *– The barriers related to battery performance include a loss in discharge power at low temperatures and power fade over time and/or when cycled.*

The underlying problem facing the power-storage industry is that it's been trying to make traditional liquid chemistry li-ion batteries scale to a size and performance threshold that does not make sense – from safety or economic perspectives. It is analogous to efforts to scale traditional glass-tube TV sets beyond the 30" screen.

The costly and rare raw materials that are required, along with expensive materials processing, make for steep barriers to overcome when it comes to powering electric vehicles. While li-ion batteries are adequate to deliver 70 Wh of energy that is standard for laptop computers, the technology fails to economically scale for producing the 15-20kWh battery that a typical plug-in electric vehicle requires for a 40-mile range.

Practical impact of this challenge

Liquid electrolyte li-ion technology presents safety issues, too. Because traditional li-ion batteries require liquid electrolytes, each cell is essentially a chemical reactor that suffers from thermal, chemical and mechanical degradation each time the battery is charged and discharged.

The practical impact of this challenge has been seen in the many recalls of cell phone and laptop batteries that have caught on fire. Each automotive cell stores 10-20 times more energy than a laptop cell requiring dramatically more sophisticated electronics and packaging to make them safe. This adds further cost, weight and complexity to automotive batteries.

An unpublished DOE report prepared late in 2009 called the need for new advanced batteries "essential for the development of electric drive, high-efficiency, light-duty, and heavy-duty vehicles," and the energy department has been proactive with grants and technical support to encourage innovation in the area.

In Part II of this series, I will examine the DOE's efforts and some of the most promising technologies on the horizon.

Scott Faris is founder and CEO of Orlando-based Planar Energy, the developer of large-format, solid-state, high-performance and low-cost batteries.

Original article and readers' comments can be viewed at
http://www.techjournalsouth.com/2010/07/development-of-new-battery-technologies-vital/