



Lithium-ion batteries

PREPARE TO TAKE A GIANT LEAP FORWARD

Boston-Power's Christina Lampe-Onnerud discusses lithium-ion batteries, their life cycles, and their role in the environment.

SINCE THE INTRODUCTION IN 1991 of the first lithium-ion battery, battery-energy density has increased by a factor of about two. During the same period, silicon-computation power, following Moore's Law, has increased by several orders of magnitude. Lithium-ion batteries clearly are ripe for an innovative approach. Christina Lampe-Onnerud, PhD, a 20-year veteran of the industry and founder and chief executive officer of lithium-ion-battery vendor Boston-Power (www.boston-power.com), is at the forefront of the next generation of lithium-ion batteries.

The basic formulation of lithium-ion batteries has changed little since 1991, and Lampe-Onnerud estimates that the basic lithium-ion battery's energy density reached its current level, its maximum, in 2004. "The biggest problem that the industry faces is the commoditization of the technology," she says. "Instead of having a battery that services the application, the applications have to go to one type of battery that services different types of applications. The result is that laptop batteries routinely experience shortfalls: A laptop might run for four hours the first day, and, two months later, it runs for two hours, and, four months later, it runs for barely an hour. And then you have to throw that battery away."

Depending on the manufacturing process and the supply chain for that battery, that scenario could have users discarding PVC (polyvinyl chloride) and harmful chemicals, such as arsenic, and toxic metals. Lampe-Onnerud wants to make a long-lived, safe, fast-charging battery with minimal harmful environmental aspects. "We are all living, breathing things on this planet, and we owe it to ourselves," she says.

For most users, the energy density of a laptop battery is sufficient, allowing them to watch a movie on a cross-country flight or crank through endless PowerPoint presentations. The long

recharge after the flight, the increasingly shorter battery life, and the possibility that a battery could catch fire frustrate users, however. Lampe-Onnerud formed Boston-Power to attack these problems. She knows that any company that solved these problems would take a key position in the battery industry because laptop computers are the pacing application for lithium-ion-battery-pack technology.

Lithium-ion batteries comprise approximately 50 active and inert chemicals. To maximize efficiency, you must stabilize the electrochemical reactions and minimize side effects. Boston-Power

responding to roughly three years of use—a tripling of the life-cycle capacity of current lithium-ion batteries. The battery also boasts a faster charge time: 30 minutes versus two hours for charging a laptop to 80% of capacity, 10 minutes to charge it to 40%.

You can expect to see some changes in electronic applications with safe, long-life, fast-charging batteries. Lampe-Onnerud says that, although Boston-Power's first product, the Sonata battery, targets use in laptops, the company's road map calls for developing higher-energy-density batteries that can serve a number of emerging applications. "Our vision is to tailor our battery to the application, not to have the application [forced] into existing battery solutions. I think you'll see that we are on the verge of an electronic revolution, with portability no longer a luxury, but a necessity. Batteries have always been important, but they will be one of the key enablers for the future."

Lampe-Onnerud earned a doctorate in inorganic chemistry and a bachelor's



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fine-tunes cobalt and manganese on the cathode with graphite on the anode. Operating in the voltage window the company has targeted, Boston-Power has minimized inefficient side reactions, resulting in a four-times-greater life cycle than that of other lithium-ion batteries. This increase translates to approximately 1000 charge-and-discharge cycles, cor-

degree in chemistry and calculus from Uppsala University in Sweden. Before founding Boston-Power, she was one of the youngest partners at Arthur D Little, where she ran its battery labs, defined strategies for clients, and directed market evaluations. She also served as a director and senior scientist at Bell Communications Research. —Margery Conner