

**Serving The Chemical, Life Sciences, and Laboratory  
Worlds**

## **Dell Recalls Lithium Batteries**

**Energy-packed chemical reaction can lead to fire  
under certain conditions**

[Alex Tullo](#)

Following a half-dozen incidents in which laptop computers overheated and burst into flames, computer maker [Dell](#) is recalling 4.1 million lithium-ion batteries made with cells manufactured by Sony and shipped with its laptop computers from April 2004 to July 2006.

As a lithium-ion battery is charged, lithium ions migrate from the lithium cobalt oxide ( $\text{LiCoO}_2$ ) cathode and insert themselves (intercalate) in the lithium-intercalated carbon ( $\text{LiC}_6$ ) anode. Charge-balancing electrons also move to the anode but travel through an external circuit in the charger. On discharge—meaning when the battery is used to provide power—the reverse process occurs and electrons flow through the device being energized.

Forrest Norrod, vice president of engineering at Dell, says metal particle impurities, introduced into the cell via the crimping of metal housing during manufacturing, can cause failures in two different ways.

In one case, the metal impurities can plate a surface in a battery, forming long dendrites that puncture the thin membrane separating the battery's anode and

cathode and create a short circuit. In the other, a particle can mechanically breach the membrane and cause a short circuit.

If a short circuit occurs near the edge of the cathode, the resulting heat can cause the lithium cobalt oxide of the cathode to decompose and release oxygen needed for combustion, Norrod says.

"If you have a contaminating particle, you have a latent failure in the cell," Norrod says, noting that Sony has been working to fix the problem. "[Sony](#) has done a good job greatly reducing the number of impurities."

Kuzhikalail M. Abraham, a lithium battery consultant with [E-Kem Sciences](#), says the computer industry's drive to increase battery capacity can test the limits of sensitive components such as the membrane separator, a polyethylene or polypropylene film that is only 20-25  $\mu\text{m}$  thick. He points out that the energy density of lithium-ion batteries has more than doubled since they were introduced in 1991. "When you pack the battery with more and more material, the separator can undergo stress," he says.

The Dell recall isn't the first of its kind, but it is the largest. During the past decade there have been numerous recalls of lithium-ion batteries in cellular phones and laptops owing to overheating problems. Last December, Dell pulled about 22,000 batteries from the U.S. market. In 2004, Kyocera Wireless recalled about 1 million batteries used in phones.

Some companies offer alternatives to the lithium-ion battery. Austin, Texas-based [Valence](#) Technology is marketing batteries based on lithium magnesium iron phosphate chemistry. "The phosphate anion is quite stable to decomposition, and its decomposition temperature is much higher than what can be generated by the internal energy stored in a phosphate cell," Valence CEO James Akridge says.

Valence is not targeting its batteries at the laptop market, but it does offer an external backup battery for laptops and batteries for larger applications such as hybrid vehicles and Segway scooters.

Norrod says Dell constantly evaluates alternative battery chemistries.

Chemical & Engineering News ISSN 0009-2347 Copyright © 2006 American Chemical Society