Primary Lithium Cells Run Hot, Go Deep

Jon Titus, Senior Technical Editor

Not all lithium-chemistry batteries go into consumer electronics or portable equipment. Primary lithium batteries, which users cannot recharge, pop up — or down — in unusual applications. Electrochem Commercial Power manufactures primary lithium cells, some of which go "down hole" in oil and gas drilling equipment that on occasion can reach 200°C. "Most commercial lithium-ion cells would fail at 60°C, but our primary lithium batteries can work well at up to 200°C," said David Sugrue, Electrochem's Product Manager.
"We use a lithium thionyl-chloride or sulfuryl-chloride chemistry that produces about the highest energy density you can get," explained Bob Yetman, Customer Applications Manager at Electrochem. The company, which specializes in batteries for high-temperature and high shock-and-vibration applications, can customize its batteries to meet a variety of packaging and operating-environment conditions. (Figure B-1.)

"We make an annular cell that looks like a doughnut," said Yetman. "That battery goes in a tool designed for an oil driller who needed a power source that would go around a drill-tool string adjacent to a drill bit. The customer places four of these batteries together and drops them over a mandrel." (Figure B-2)

Figure B-2. These Bus-unique primary lithium batteries for pressure-tolerant that ships down an oil or gas well Source Tools. Courtesy of Electrochem Commercial Power

Another customer needed to monitor the integrity of a pipeline where ambient temperature can drop to -60°C. The monitor does not need much energy, but it must operate at that temperature for short periods. "The monitor's battery required a different chemistry from that used in the down-hole battery, which had to supply high-current pulses at temperatures above 100°C," said Sugrue.
To specify the right battery, engineers must answer questions such as, what does the discharge curve look like, what is the load, does the application need frequent or infrequent current pulses, and what type of duty cycle will the battery experience? "We can design a battery for high power, high energy, high temperature or low temperature," explained Sugrue. "But if engineers do not know what they want, it becomes difficult to determine the type of battery they need."

Engineers like primary lithium batteries, but they also would like to recharge them instead of buy replacements. "Rechargeable batteries have come a long way, but generally they provide only one fourth the energy density available from a primary battery, said Sugrue. Many customers do not understand that aspect of rechargeable batteries.

Sugrue recommends engineers take a careful look at how manufacturers specify batteries to ensure comparisons take place on an equal basis. "Some US manufacturers list cells specifications at 25°C but Japanese manufacturers qualify their batteries at 20°C. The five-degree difference can affect the specifications. In general, a warmer battery will discharge better than a cold one. In a cold climate, for instance, it is more difficult to start a car because a cold battery cannot deliver a pulse of energy sufficient to turn over the engine.

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