Title

Miniature hybrid fuel cells power mobile devices.

Annie Lindstrom

As mobile devices become more feature rich and more critical when disaster strikes, the capacity of the batteries used to power them is of growing concern for public safety officials. Power outages caused by natural disasters or failures on the grid can last for days, and public safety workers need to communicate to do their jobs. The last thing they need to be concerned about is finding a place to “plug in” their mobile devices to charge their batteries and stay in contact with each other.

“Demand for power is growing 10 to 20 percent each year and neither lithium ion batteries or power management schemes may be able to keep up with that growth in demand,” says Tom Pack, Motorola’s Early Stage Accelerator (ESA) project champion.

To bridge the growing gap, researchers have been exploring a host of different options, including:

- **Increasing batteries’ energy density**
- **Making it possible to charge batteries more quickly**
- **Managing energy demand**

- **Generating power for charging batteries using alternative energy sources such as fuel cells**

In June 2005, the Motorola ESA Hybrid Fuel Cell Battery Project was funded to develop and build a prototype hybrid fuel cell battery for a two-way public safety radio. Motorola and partner Tekion have been working together to create a concept using Tekion's Formira formic acid fuel cell technology to charge conventional lithium ion cell packs. Motorola and Tekion completed their first concept hybrid fuel cell battery in September 2007.

How It Works

Simply put, the fuel cell is used as a small charger for the mobile device's lithium ion batteries. The fuel cell generates electricity via an electrochemical reaction combining hydrogen from the formic acid and oxygen from the air to create water. The electricity produced is up-converted to charge the lithium ion cells. Instead of changing the battery in the mobile radio, the end user swaps in a fresh fuel cartridge to generate more power. While the technology isn't new, its miniaturization is a newly explored area. Initially demonstrated in 1839, the technology's first widespread use occurred during the space missions of the 1960s. Today, submarines and NASA's Space Shuttles use fuel cells for lasting power.

A particular challenge faced by the innovators was choosing the best fuel. The choices included hydrogen, metal hydrides, butane, methanol and formic acid. In the end, formic acid offered the most advantages. Interestingly, formic acid is the substance that stinging ants inject into the skin of their victims, he explains. However, Vancouver-based Tekion does not cultivate the formic acid for its fuel cells from ants. It is produced commercially for the company by BASF through a formal partnership. "Formic acid is the ideal fuel due to its high power capability, its non-flammability and its simple chemistry," says Neil Huff, CEO of Tekion. "This allows us to integrate inside mobile devices."

The challenge involved with using formic acid is that today it is not as widely distributed around the world as it would need to be for general commercial use. However, butane cigarette lighter companies have distributed their products to the far reaches of the world, so it is feasible to do the same thing for formic acid.