Bugs Build Batteries

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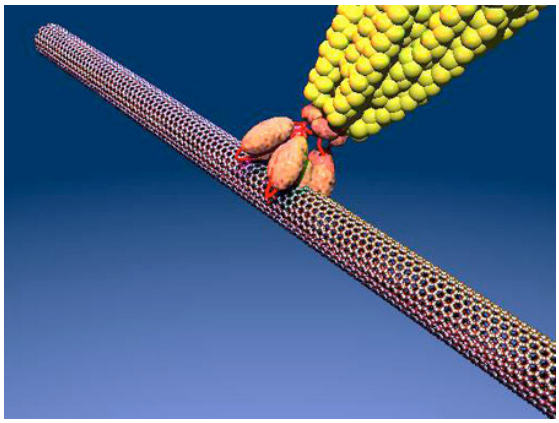

Green technology just went viral. Researchers have used viruses to create rechargeable batteries similar to those found in hybrid cars and laptops. Until now, batteries like this were made in chemically intensive, high-heat processes. The results could herald a low-energy, environmentally friendly alternative.

Most commercial rechargeable batteries pass a lithium ion from the anode, the negatively charged terminal, to the positively charged cathode and have to be made at high temperatures. Materials chemist Angela Belcher of the Massachusetts Institute of Technology in Cambridge and her colleagues decided to try making a better battery by using biological processes. This approach is logical, Belcher says, because some of the materials in batteries, such as phosphate and iron, are present in living systems and can be easily manipulated by organisms.

The team first created an anode by genetically engineering the M13 virus, a common parasite of bacteria, to attract cobalt oxide and gold to its outer shell and then assemble into films and sheets (Science, 12 May 2006, p. 885).

The next step was to tackle the positively charged cathode, which is more challenging because it needs to be highly conductive. The team engineered the M13 viruses to accumulate ions of iron phosphate and to latch onto a highly conductive network of carbon nanotubes. Electrons could travel quickly through this system and boost the cathode's capacity. In fact, Belcher's battery had the same power performance as commercially available lithium ion batteries and could be charged and discharged at least 100 times without wearing out, the team reported online yesterday in Science.

The virus-built technology may provide the first biological method for producing batteries. Belcher notes that the entire system, with the exception of the carbon nanotubes, is created at room temperature and uses only water as a solvent. And when the batteries die and degrade, they don't leave behind toxic chemicals. "This is definitely a very clean approach," Belcher says.

However, she cautions that the technology isn't yet useful as a commercial application. Because the virus battery only matches the capacity and power performance of those available on the market, "we're not going to scale up this material," says Belcher. "It wouldn't gain us anything in terms of performance."

Other experts agree that Belcher's discovery isn't going to change the face of the battery industry overnight. "It is of scientific curiosity," says M. Stanley Whittingham, a chemist at the Institute for Materials Research at Binghamton University in New York state. To change battery technology, he says, the researchers need to build a higher capacity cathode.

Image: Power up. A genetically programmed virus sporting a metallic coat grabs onto carbon nanotubes, creating a high-powered wiring system that could be the basis for new, green batteries.

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