Virus-Built Wearable Batteries Could Power Military

Batteries, built by viruses, could someday be sprayed onto military uniforms as wearable power sources.

Teams of researchers, one from MIT, one from the University of Maryland, have used two different viruses to create the cathode and anode for a lithium ion battery.

If the Maryland research pans out, the parts for lithium ion batteries could be grown in and harvested from tobacco plants. The MIT research, meanwhile, could produce lithium ion batteries that could be woven into clothing to power a wide range of electronic devices, from unmanned aerial vehicles to cell phones.

"Typical soldiers have to carry several pounds of batteries. But if you could turn their clothing into a battery pack, they could drop a lot of weight," said Mark Allen, a postdoc in Angela Belcher's lab at MIT. "The same could be true for frequent business travelers, the road warriors."

As anyone with a bad case of the flu knows, viruses are amazingly efficient at breaking into cells, hijacking their machinery, and then using that machinery to make new copies of themselves.

For centuries doctors have done everything in their power to stop or slow viruses. Now scientists are turning viruses' extraordinary ability to produce large amounts of identical, microscopic structures to the benefit of humanity.

Scientists can already build similar structures, but not as quickly or as efficiently as viruses.

"Normally it takes some top-down process like lithography to produce these structures," said James Culver, a scientist from the University of Maryland and co-author of a recent paper in the journal ACS Nano, which details the creation of a silicon anode for a li-ion battery.

"We have a solution of the virus, we let it sit overnight, and the virus does everything."
The MIT and Maryland scientists used two viruses that are harmless to humans. The MIT scientists used M13, a virus that infects bacteria. The Maryland scientists used the tobacco mosaic virus (TMV), a common pathogen of tobacco plants. The viral hosts might be different, but the shapes of each virus are similar; long, thin and cylindrical.

As Allen reported at this week's meeting of the American Chemical Society in Boston, M13 can be tweaked to produce an iron fluoride cathode for a lithium ion battery.

Allen and his colleagues eventually hope to scale up their battery-part production so they can spray on lightweight, rechargeable and long-lasting lithium ion batteries that could power everything from unmanned aerial vehicles used by the military to cell phones carried by civilians.

The new cathode, which builds on the MIT group's earlier work building a battery anode and cathode, is also environmentally friendly because it happens at room temperature and in water. The MIT research is green in name, but the University of Maryland research could literally be green.

"For our purposes now, we do everything with the virus in growth chambers in the lab," said Culver. "But growing them in the field, that's the whole idea. That's something that would be cheap and relatively easy to do."

Farmers won't harvest battery parts anytime soon, said Culver, but their new anode is already powerful. The silicon-based lithium ion battery anode showed a nearly 10-fold increase in capacity over existing graphite anodes, said Culver.