A new generation of power: Hi-tech rechargeable batteries developed for military

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High-performance batteries could soon be woven into fabrics such as military uniforms to provide rechargeable clothing. Credit: Craig DeBourbon

Scientists reported progress today in using a common virus to develop improved materials for high-performance, rechargeable lithium-ion batteries that could be woven into clothing to power portable electronic devices. They discussed development of the new materials for the battery's cathode, or positive electrode, at the 240th National Meeting of the American Chemical Society (ACS), being held this week.

These new power sources could in the future be woven into fabrics such as uniforms or ballistic vests, and poured or sprayed into containers of any size and shape, said Mark Allen, Ph.D., who presented the report. He is a postdoc in Angela Belcher's group at the Massachusetts Institute of Technology (MIT). These conformable batteries could power smart phones, GPS units, and other portable electronic devices.

"We're talking about fabrics that also are batteries," Allen said. "The batteries, once woven into clothing, could provide power for a range of high-tech devices, including handheld radios, GPS devices and personal digital assistants. They could also be used in everyday cell phones and smart phones."

Batteries produce electricity by converting chemical energy into electrical energy using two electrodes — an anode and cathode — separated by an electrolyte. At the ACS meeting, Allen described development of new cathodes made from an iron-fluoride material that could soon produce lightweight and flexible batteries with minimal loss of power, performance, or chargeability compared to today's rechargeable power sources.

Allen has extended ground-breaking work done last year by MIT scientist Angela Belcher and her colleagues, who were the first to engineer a virus as a biotemplate for preparing lithium ion battery anodes and cathodes. The virus, called M13 bacteriophage, consists of an outer coat of protein surrounding an inner core of genes. It infects bacteria and is harmless to people.

"Using M13 bacteriophage as a template is an example of green chemistry, an environmentally friendly method of producing the battery," Allen said. "It enables the processing of all materials at room temperature and in water." And these materials, he said, should be less dangerous than those used in current lithium-ion batteries because they produce less heat, which reduces flammability risks.

The Belcher Biomaterials group is in the beginning stages of testing and scaling up the virus-enabled battery materials, which includes powering unmanned aerial vehicles for surveillance operations. Making light-weight and long-lasting batteries that could result in rechargeable clothing would have several advantages for both military personnel and

civilians, Allen added.

"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. The same could be true for frequent business travellers — the road warriors — who lug around batteries and separate rechargers for laptop computers, cell phones, and other devices. They could shed some weight."

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