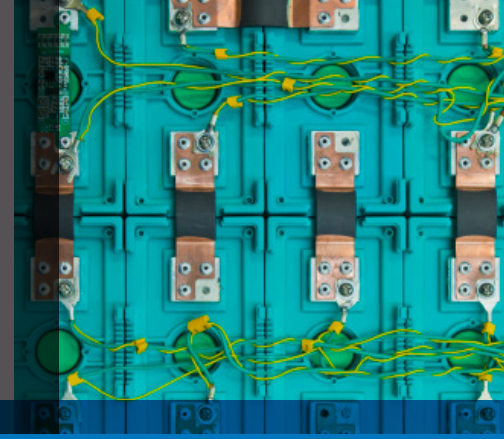


CONFORMAL BATTERY TECHNOLOGY



USABILITY AND FUNCTIONALITY LEAD THE WAY WHEN BATTERY SHAPE IS NOT THE PRIORITY

Imagine the possibilities of a product being designed primarily on ease of use and functionality rather than the shape of the battery. Battelle's conformal battery has translated that possibility into reality. The battery integrates into the device structure, reducing overall weight while maintaining or improving function.

OUR TECHNOLOGY

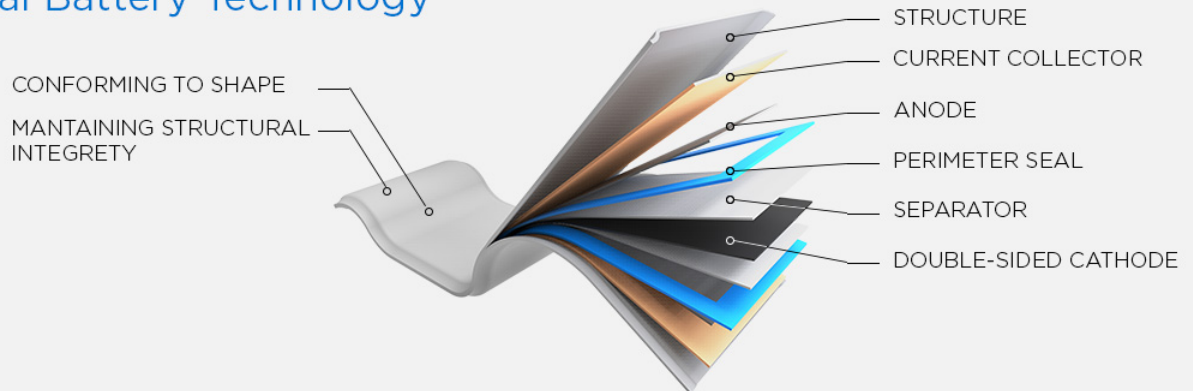
Battelle's conformal battery technology has two key elements. The first uses the current collectors as the outer packaging of the cell, instead of having a separate metalized polymer. A perimeter seal is added between these outer current collectors to provide hermetic sealing of the battery. This requires the outer electrodes to have the same polarity. The second is laminating the separator to the anode and cathode, after the battery has been shaped into its final geometry. This allows the battery to be conformable but not flexible.

These elements allow Battelle's battery to have a thinner profile and be shaped in many different geometries. This opens the design space for products by allowing devices to be designed for function and ease of use, instead of designed to fit the shape of a standard battery.

Key advantages for device applications include:

- Using the current collectors as the packaging eliminates the need for outer packaging that is standard in batteries, making the battery lighter. Our test results to date have shown the overall battery mass can be reduced by 20% or more, effectively increasing the energy density of the battery.
- Laminating the separator to the electrodes provides rigidity to the battery that is otherwise lacking. This allows the battery to be directly incorporated into cases or other structural components without introducing slip planes or other failure modes.
- Using the metal current collectors as the outer packing improves the bonding between the battery and the host matrix, enhancing its integration into the structural components.

Conformal Battery Technology



CURRENT STATE

The conformal battery technology was developed using commercially available materials with established supply chains, enabling a seamless manufacturing process. It has been manufactured at the prototype scale using standard battery manufacturing techniques. It was created to fit seamlessly in current composite material fabrication processes for ease of implementation into final consumer products and beyond.

FUTURE OPPORTUNITIES

Battelle started down the conformal battery path after being asked by a military client to find a way to incorporate batteries into the structure of objects. After successfully coming up with a solution to the original challenge, we began to look at other ways a conformal battery would provide benefit.

The possibilities are nearly endless. In today's technology-powered world, so many of the products we touch every day have a battery.

The conformal battery technology could be applied to:

- Electric-powered vehicles
- Power tools

<p>MEDICAL</p>  <p>Conformed to body Thinner profile</p>	<p>CONSUMER GOODS</p>  <p>Designed for function and use More powerful and lighter</p>	<p>MILITARY</p>  <p>Integrated design Less weight for soldiers</p>
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Every day, the people of Battelle apply science and technology to solving what matters most. At major technology centers and national laboratories around the world, Battelle conducts research and development, designs and manufactures products, and delivers critical services for government and commercial customers. Headquartered in Columbus, Ohio since its founding in 1929, Battelle serves the national security, health and life sciences, and energy and environmental industries. For more information, visit www.battelle.org.

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