Flat battery? Try a bit of paper power.

- Story Highlights
- Nano-engineered battery looks like a piece of paper
- Potential applications include space program, health and electric airplanes
- New invention hybrid battery and supercapacitor could be used in electric cars

By Mairi Mackay for CNN

LONDON, England (CNN) -- It would be easy to mistake the latest innovation in energy storage for a humble piece of paper.

But researchers at Rensselaer Polytechnic Institute in New York State say their nano-engineered battery of the future could revolutionize everything from air travel to healthcare.

It's no accident that the battery resembles a piece of paper. Cellulose - the same plant cells used in news print, photocopier paper and books - makes up more than 90 percent of the device.

"It's essentially a regular piece of paper, but it's made in a very intelligent way," said Professor Robert Linhardt, one of the co-authors of a paper outlining the discovery.

The mechanism is engineered at a molecular level from particles no larger than a virus. Carbon nano-tubes embedded on one side of the cellulose give the battery its black color and act as electrodes. Lithium oxide on the other side of the sheet works as an electrolyte.

Having integrated components makes the battery stronger and more flexible than a conventional battery.

"If you cut the battery in half it would be like cutting a piece of paper in half. It functions no matter how many times you cut it because it is molecularly integrated," Linhardt told CNN.

Not only can you cut the battery - you can roll it, fold it or mould it. The batteries can also be stacked like a ream of printer paper, which multiplies energy output.

As well as outputting low amounts of energy steadily over a long period, the mechanism can also be built as a supercapacitor, emitting a massive burst of energy in less than a second.

And a completely new invention, a hybrid device, can do both. Potential applications for the new battery and supercapacitor device include hybrid cars. Combining the work of two separate engine components at molecular level makes it 25 percent more efficient.

Its flexibility means it could be shaped into pieces of the car -- like inside door panels -- that wouldn't normally be associated with batteries. Looking into the future, if the device can be successfully scaled up it could be used to power electric aircraft and boats.

The device will work well in extreme conditions because it contains no water, so there is nothing to freeze or evaporate, according to Linhardt, like in the space program or the North Pole.

Unlike conventional batteries, this one contains no toxic chemicals. The paper is highly bio-compatible, so the batteries could be used to power devices implanted in the body, like pacemakers. The team made batteries without electrolytes and found that naturally occurring electrolytes in human sweat, blood and urine can be used to activate the device. Potential applications include powering prosthetic limbs or applying electric charges to the brain to treat blindness, Parkinsonism and even to bring people out of comas.

Right now, the future of the battery is highly speculative. Although the materials required to make the battery are inexpensive, the team has not yet developed a way to mass produce the batteries inexpensively.

"When we get this technology down, we'll basically have the ability to print batteries and print supercapacitors," said Pulickel M. Ajayan, professor of materials science and engineering at Rensselaer, one of the co-authors of the paper.

So the next time you pick up a piece of paper, just think: in 20 years something this size and weight could be powering your car, cellphone or even an airplane.

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