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FASTCAP

Introduction Script

How many devices do you own that use batteries? Flash lights, cell phones, cameras, remote controls, smoke detectors, laptop computers, even automobiles are powered by batteries of different sizes and design. The particular battery chosen for an application must take into account the amount of energy the device will need and the maximum power that must be provided- as well as size, shape, weight and cost.

Batteries date back to the 1800s when the Italian scientist Alessandro Volta built the first electrochemical cell using zinc and copper electrodes in a sulfuric acid electrolyte. Whether "wet" or "dry" cells, all batteries developed since that time produce electricity through chemical processes that also limit the rate at which electrons can move and produce wasted heat. Capacitors, on the other hand, store energy in an electric field with no chemical reaction involved. Capacitors can provide quick bursts of energy and be quickly recharged thousands of times. But capacitors can only store a small amount of energy and so they have not been seen as competitors for batteries until recently.

Ultracapacitors, developed in the last half of the 20th century, can store more energy than traditional capacitors, but it's still not enough to power all-electric cars and to store the energy produced by solar cells and wind turbines. How can the energy storage capacity of these devices be increased? Replacing traditional activated carbon electrodes with carbon nanotubes greatly increases electrode surface area, more efficiently storing electric charge. These tiny tubes of carbon are just a few nanometers in diameter. Grown on metal electrodes, the tiny tubes stand upright like tightly packed blades of grass. Nanotechnology powered ultracapacitors are already replacing batteries in some of today's most demanding technologies and may one day power the car in your garage as well.