Supercapacitors hailed as potential answer to greener public transportation

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(Phys.org)—Imagine a bus that uses electrical storage that costs much less than traditional batteries, can fully charge each time the bus stops, and has enough power to easily get to the next stop. The supercapacitor, once used to power robots and as a backup power source for computer memory, is now being hailed as such an energy source that could be the key to greener public transportation.

In an article written by well-known science writer Philip Ball for the Energy Quarterly feature of *MRS Bulletin*, researcher Yury Gogotsi posits that the supercapacitor has the potential to become a big player in the global search for reliable green energy. This is particularly true for transportation, based on experience with the use of supercapacitors in Germany.

Supercapacitors are allowing trams in Mannheim, Germany, to use 30 per cent less energy than their equivalents in other cities. In a recent 24-hour speed race at Le Mans, Toyota put their faith in a hybrid TS030 car that used "supercaps" for energy-capture during braking. In China, supercapacitor technology has been embraced so fervently over just the past four years that tens of thousands of supercap buses are now on the roads.

So what are supercapacitors and just what do they bring to the power party? Gogotsi, professor of materials science and engineering at Drexel University in Philadelphia, explains supercapacitors as power-storage devices that can supply onboard electrical power in hybrid vehicles.

Whereas batteries store energy in chemical form-in substances that can react to release electrical energy-capacitors store it by simply piling up electrical charge on two electrodes. The larger the electrodes and the closer they are, the more energy can be stored.

Unlike batteries, supercapacitors can be charged and discharged in seconds and can withstand many hundreds of thousands of such charging cycles. This is ideal for energy-saving applications that capitalize on transient opportunities for recharging, such as energy capture during braking, and other actions that require power to be delivered in short bursts. They can help with acceleration, restart engines that cut out, drive air conditioning, and power automatic windows and passenger doors. In some aircraft, they are entrusted with powering emergency actuation systems for doors and evacuation slides.

Supercapacitor technology is now deployed on Spanish and French trains and hybrid buses all over the world, on construction equipment such as cranes, and on garbage-collection trucks in the US. On buses, it can reduce carbon-dioxide emissions by around 30%. The Munich-based heavy-vehicle manufacturer MAN estimates that their supercapacitor-fitted coaches each save around $4,500 a year on fuel costs.

The take-up of the technology looks set to expand, as both energy-saving and low-emission technologies become more necessary and as the technical capabilities of supercapacitors improve.

"There is no single perfect energy-storage solution, no 'one size fits all,'" said Gogotsi. "A 'battery of the future' may well be a battery-supercapacitor hybrid which combines the long lifetime, fast charging, and high power of a supercapacitor with the high energy density of a battery."

With a huge variety of potential uses, supercapacitors are one of the few

electronic components that have had a steadily growing market over recent years with rapid growth widely expected.

More information: A copy of the article can be found at journals.cambridge.org/MRSEQ201209

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