

Supercapacitors offer quicker energy storage

Are traditionally designed batteries under threat?

- Supercapacitors, which are also known as Electrochemical Double Layer Capacitors (EDLC) or ultracapacitors, are a type of capacitor that has a high energy density, when compared with a standard capacitor. Typically, the energy density of a supercapacitor is thousands of times greater than a standard capacitor. While the supercapacitor is not a traditional battery design, the technology has the potential to be used instead of a conventional battery.
- The supercapacitor has a relatively large number of charge and discharge cycles before the end of its useful life, compared with conventional batteries.

Supercapacitor Construction

- In supercapacitors, there are no disposable parts and the item itself is solid-state. Carbon nanotubes, selected conductive polymers or carbon aerogels are used in the manufacture of supercapacitors. Carbon nanotubes, which are tubes within a tube, possess relatively high capacitance values. They may be used because they have properties which enable nanospace for polymers to reside. This space acts as a dielectric/insulator and therefore offers a method to construct supercapacitor structures.

Market Structure

- For supercapacitors, the market size has expanded fairly vigorously since the mid-1990s. Growth in the market has been underpinned by advances in applicable materials and through development of existing technology. This has led to improved material performance and a reduction in per unit cost.
- With governments, businesses and consumers more focused now towards energy efficiency, supercapacitors ability to absorb energy quickly could enable them to be ideal candidates for green energy and green storage applications. For example:
 - in electric and hybrid cars because of the quick charging potential
 - in regenerative braking to provide additional energy to trains
 - in road based public transport
 - in existing renewable energy applications to enhance the availability of energy
 - in industry for power quality using supercapacitors to manage power surges and short-term power loss

- In monetary terms, the size of the worldwide supercapacitor market seems elusive. This observation is based on the fact that market observers offer a range of total market size figures. For example, in 2005, the market has been estimated at USD \$238 million, growing to USD \$560 million by 2011. Also, the size of the US and European market has been estimated at USD \$1.2 billion in 2005, growing to USD \$2.4 billion by 2009. This broadly points to a doubling of demand between 2005 and 2009. On the other hand, the world market for carbon nanotube has been forecast to reach US \$5 billion, by 2010.

Applications

Using information drawn from the Trends group at: <http://groups.diigo.com/groups/trends>, it is possible to highlight a range of supercapacitor applications, as follows:

- A development in energy storage called the nanoflower supercapacitor which could enable light rail lines to gain more power through regenerative braking and travel through short sections of track without connecting to overhead wires
- Introduction of supercapacitors which can be partially recharged by solar panels on the roof a car.
- Aerogel supercapacitors capture kinetic energy from regenerative braking in order that an experimental vehicle called the Velomobile becomes a human-electric hybrid vehicle. The wheel hub motor has 3 modes which are drive, coast and generate.