Chemists invent new supercapacitor materials

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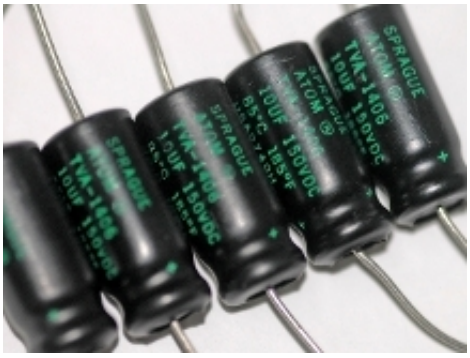

Credit: University of Amsterdam

Dr David Eisenberg and Prof. Gadi Rothenberg of the University of Amsterdam's Van 't Hoff Institute for Molecular Sciences have invented a new type of supercapacitor material with a host of potential applications in electronics, transportation and energy storage devices. The UvA has filed a patent application on this invention.

Eisenberg and Rothenberg discovered the supercapacitor material during sideline experiments as part of the Fuel Cells project of the Research Priority Area Sustainable Chemistry. Originally, the materials were developed as solid catalytic electrodes for fuel cells. By modifying the surface of these materials the scientists created a highly porous yet well-structured compound, with ample sites for fast redox reactions, inspiring the successful testing for supercapacitance.

The new material combines several practical advantages: It is light, cheap, and non-toxic, and it can be prepared easily on a large scale. This last aspect is crucial for industrial applications, according to Eisenberg: 'Companies making electronic devices look for low-cost, highly reproducible materials with a low environmental impact. The literature abounds with reports of high-performance electronic materials, but these will only be applied if they can be made cheaply in large quantities'.

Supercapacitors are energy storage devices that combine the properties of capacitors and batteries. Batteries have a high energy density (they can store large amounts of energy), but their power density is low (they charge and discharge slowly). Conversely, capacitors enjoy a high power density (they can take and deliver energy quickly) but their energy density is low.

A battery uses its whole bulk for charge storage, while a capacitor uses its surface. Supercapacitors use charge separation through fast ion adsorption, and very fast redox reactions with surface-bound molecules. They have a higher energy density than regular electrolytic capacitors, and also a much higher power density than batteries.

Typically, supercapacitors are used in situations requiring many rapid charge/discharge cycles. Examples include protecting electronic circuits against power surges, regenerative breaking in cars and elevators, and burst-mode power delivery in camera flashes.

Provided by University of Amsterdam