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enterprise

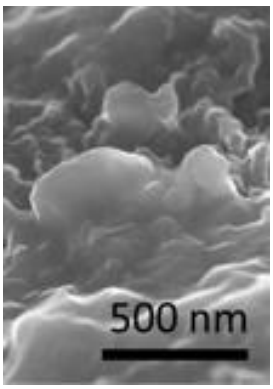
Reduced graphene oxide as a conductive binder for supercapacitors

Powerful innovation in energy storage

Researchers in the Department of Engineering, University of Cambridge, have developed a new material for supercapacitor electrodes using activated carbon and reduced graphene oxide. This is expected to enable a new generation of supercapacitors. The team is now keen to license the technology to a suitable partner for development. Possible applications include supercapacitors for new electric vehicles.

Key Benefits

- 25-30% improvement in specific capacitance including high scanning rate
- Low cost, standard production processes and solvents
- Up to 400% improvement in power density and discharge rate
- Test cells achieve 80% capacitance retention over 20000 cycles



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What problem does this material solve?

Supercapacitors are gaining attention for complementing or replacing batteries due to their potential for high power, rapid charge and discharge capabilities and long cycle life. They are desirable in applications where both high power and rapid charging are necessary, for example, in electric cars. The binding material in conventional supercapacitors limits the conductivity of the electrode and therefore the performance of the supercapacitor. Current materials show decreased capacitance at high scanning rates (Fig. 1). The new composite material of activated carbon and reduced graphene oxide has an improved maximum capacitance of 25-30% over state-of-the-art supercapacitors with little extra cost. The test cells show 80% capacitance retention after 20000 cycles. Additionally, the discharge rate is improved by up to 400% compared to current technology (max 3 seconds, depending on current density).

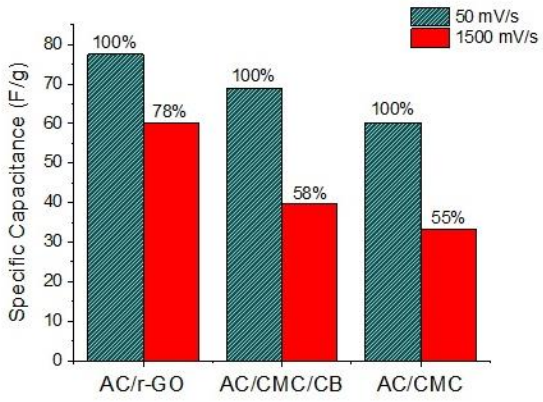

Figure 1: Our material (AC/r-GO, on the left) has better retention of capacitance (78%) when changing from low to high scanning rate (hatched to solid)

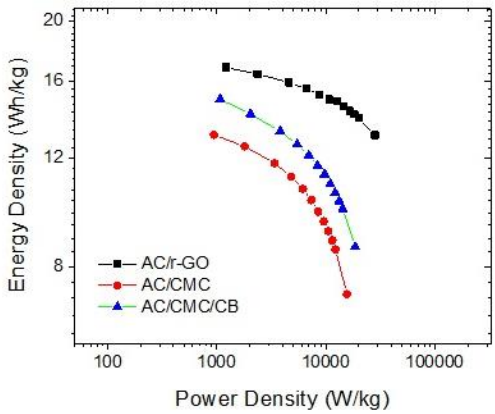

Figure 2: Our material (AC/r-GO, black squares) shows increased power density compared to existing materials

Applications

The improved performance from this composite material means that enhanced supercapacitors may be developed for a range of commercial applications. There is growing demand for charging packs that can deliver enough power to charge a battery in a couple of minutes, for example, mobile phones or bicycle lights. Supercapacitors are also of interest to the developing electric vehicle market, as they would allow considerably faster charging of electric vehicles without sacrificing the distance they can be driven between charges.

Production of the new composite material

In addition to exceptional performance, our composite material is easily produced:

- Starting material is readily available high quality graphite
- AC/r-GO mixture is made using simple in situ thermal processing
- Easy to exfoliate with standard solvents

Next steps

This technology is protected by a PCT patent application, number WO2017021705. We are now looking for partners to help us develop the material for applications in supercapacitors. Please contact us to explore this opportunity further.