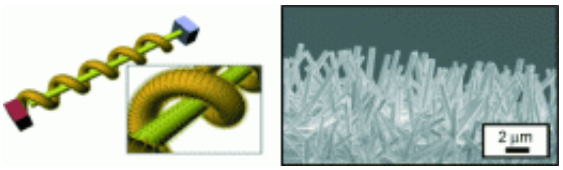
# T-Shirt replaces battery: Fiber-based electrochemical micro-supercapacitor

18 January 2011




Will we soon be plugging our mobile phone into our t-shirt instead of putting in a battery? This vision is not totally out of reach: the first steps in this direction have already been taken.

Now a team led by Zhong Lin Wang at the Georgia Institute of Technology (Atlanta, USA) and Jong Min Kim of Samsung Electronics in South Korea is introducing a prototype for a flexible energy storage device that can be worked into textiles. As the scientists report in the journal *Angewandte Chemie*, this supercapacitor is made of a very special arrangement of zinc oxide nanowires grown on conventional fibers.

Although smaller, lighter components are constantly being developed, most devices for energy generation and storage are much too bulky and heavy for increasingly miniaturized electronic devices of the future. Supercapacitors are an interesting alternative to batteries and rechargeable batteries for energy storage. They can be recharged almost endlessly and extremely fast; however, previous examples have not been flexible or light enough.

The research team has now developed a prototype for a high-efficiency fiber-based electrochemical micro-supercapacitor that uses zinc oxide nanowires as electrodes. The substrate for one of the electrode is a flexible, fine plastic wire; for the other electrode it is a fiber made of Kevlar. Kevlar is the material used to make bulletproof vests. The researchers were able to grow zinc oxide nanowires on each of these substrates. Additional coatings with materials like gold and manganese oxide could further improve the charge capacitance. Using tweezers, the researchers then wrapped each of the plastic wires with a Kevlar fiber. This assembly was then embedded in a solid gel electrolyte that separates the two electrodes and allows for the necessary charge transport. A bundle of these fibers could be processed to form a thread.

Zinc oxide has special advantages over conventional supercapacitor materials,: it can be grown on any desired substrate in any form at low temperature (below 100 °C) and it is both biocompatible and environmentally friendly.

A particularly intriguing application would be the use of these new charge-storage media in combination with flexible fiber nanogenerators, which Wang and his team have previously developed. The wearer's heartbeat and steps, or even a light wind, would be enough to move the piezoelectric zinc oxide nanowires in the fibers, generating electrical current.

In the form of a "power shirt" such a system could deliver enough current for small electronic devices, such as mobile phones or small sensors like those used to warn firemen of toxins.

**More information:** Zhong Lin Wang, Fiber Supercapacitors Made of Nanowire-Fiber Hybrid Structures for Wearable/Flexible Energy Storage, *Angewandte Chemie International Edition*, dx.doi.org/10.1002/anie.201006062

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