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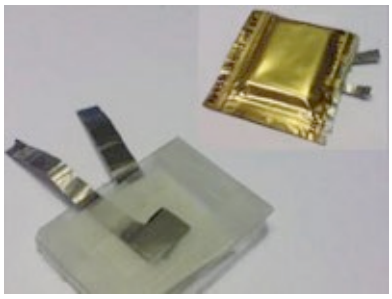

Thin-film salt and paper battery

18 Sep 2009

A new thin-film paper battery that holds great promise for applications in areas where conventional Li-ion batteries are not the perfect choice has been developed at Uppsala University, Sweden.

The aqueous-based battery is much easier and cost-efficient and can be integrated into cheap large-scale devices, flexible energy storage devices, textiles or packaging. Furthermore, it has an environmentally friendly design.

The research group led by Prof. Maria Stromme made this flexible battery using cellulose and salt, two common and inexpensive ingredients that keep manufacturing costs low. The novel cellulose composite material cellulose fibers individually coated with thin layers of the conductive polymer polypyrrol is mechanically robust, lightweight, flexible, and can be molded into various shapes. Thin composite sheets rolled in on themselves can be used to make very compact energy storage devices. Additionally, and particularly attractive, the material is fully recyclable.

To form the rechargeable flexible battery, thin pieces of the cellulose composite a nanostructured high-surface area material were used as electrodes, which were separated by a filter paper soaked in a salt solution made of sodium chloride that acts as electrolyte. Two platinum foils were used as current collectors. Total thickness of this cell was measured ~2 mm.. To avoid evaporation of water from the electrolyte additional encapsulation in needed.

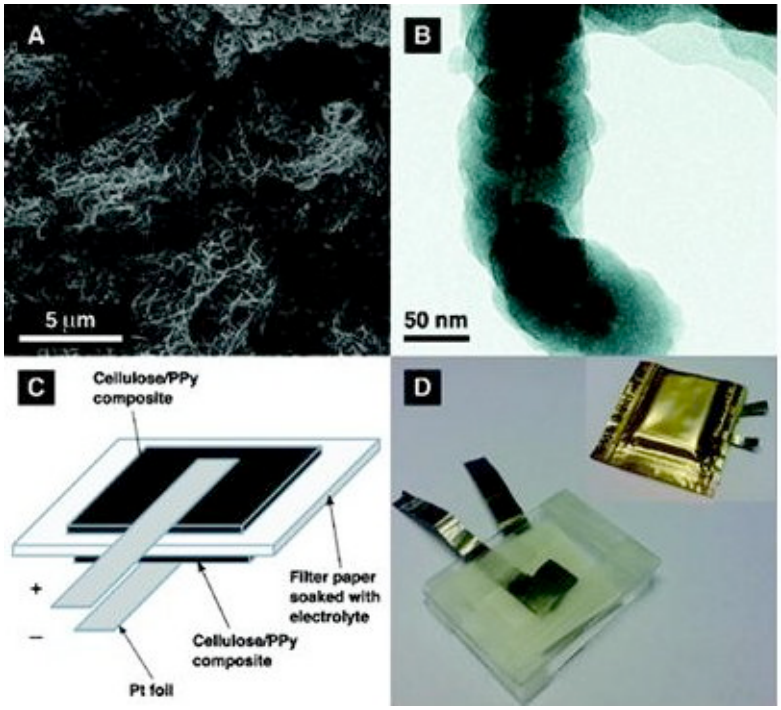

Fig 1. The cellulose-polypyrrol conductive paper composite (a) SEM micrograph taken with a magnification factor of 10 000, (b) TEM image of the cellulose composite fiber, (c) schematic image, and (d) photograph of the composite paper battery cell before and after sealing it into a polymer coated aluminum pouch.

Stromme says, "*You don't need advanced equipment to make the batteries, so they could be made on site in developing countries*." Still, there is further development needed until the salt and paper battery becomes interesting for commercial use.

In comparison with Lithium batteries, that can deliver 4 volts and show energy densities of 200 to 300 milliwatt-hours per gram, a single paper cell delivers 1 volt and stores up to 25 milliwatt-hours energy per gram.

However, the team is already working on optimizing the battery's characteristics, and thinking about stacking of multiple cells and in-series connection to increase the voltage. Stromme is confident that the battery could already be produced commercially within three years.

Thin-film batteries have a long shelf life, retaining their charge after being stored for many years, and they can be charged and discharged tens of thousands of times, says Raghu Das, CEO of IDTechEx and expert on printed electronics, "*enabling wireless sensors that can last for decades with an appropriate energy harvester attached*."

The novel paper-salt-battery has high potential to be an ideal replacement for lithium thin-film batteries, which usually have solid electrolytes and need longer recharging cycles, especially in low-power portable devices.

For more attend Printed Electronics Asia 2009 or Printed Electronics USA 2009.

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