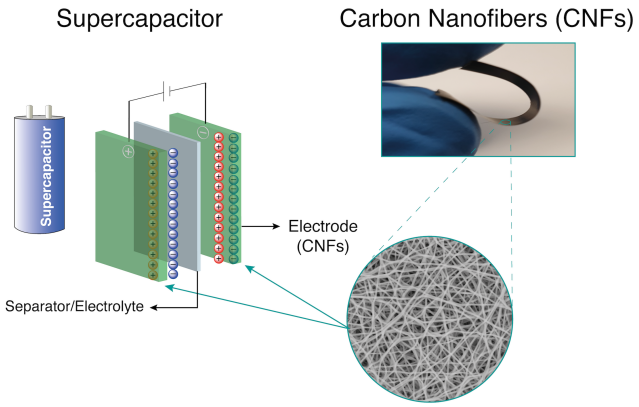
Textile supercapacitors based on carbon nanofiber fleece as flexible, lightweight and robust energy storage devices

The world of energy storage technology has become increasingly important in recent decades due to the wide range of possible applications that offer plenty of scope for interdisciplinary research approaches.

One area on the growth market is represented by smart textiles and wearable electronics. Textiles and fashion predict that 238 million smart garments will already be produced by 2021. These garments of clothing are always dependent on a suitable energy supply, which today is usually ensured by conventional batteries. Among electrochemical energy storages devices are supercapacitors. They are used, where energy must be stored or released very quickly.
Unlike batteries, electrochemical capacitors have high power-density, a very long cycle life and due to simple charge storage mechanism, they produce very low amount of thermochemical heat. The only drawback is that such capacitors have low energy density. New carbon-based nanostructured fibrous materials due to their high surface area can allow more ion-loading during charging, even which can be enhanced by making them porous and at the same time activating them through different surface treatments. Such materials can be prepared as self-supporting structures through electrospinning and they act as 100% active materials without the need of conductive agents, current collectors, and binders.

For smart wearables, textile-based energy storage device could offer a higher degree of integration of electronics into a textile. Besides, automobiles are increasingly powered by electricity instead of gasoline. The suitable storage of electricity is one of the major challenges for automobile manufacturers. On the other hand, the manufacturers of auto textiles face new requirements since the usage scenarios of the interior are changing fundamentally. But also see opportunities, as there are large textile surfaces in a car (e.g., seat covers, roof liner, door liners etc.) and these large surfaces can be used for the integration of textile-based energy storage devices.

This research project in collaboration with Hochschule Reutlingen, aims to develop flexible electric double layer supercapacitor for the application in smart textiles and automotive sector. The electrodes of supercapacitor will be made from highly conductive, and porous carbon nanofibers (CNFs) through carbonization of electrospun polyacrylonitrile (PAN) nanofibers. These highly conductive and self-supporting electrodes will be tailor-made in a way that maximum Ion-loading can be achieved.



Project Information:

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