Docket #: S15-096

Bamboo-like Carbon Nanofibers for Flexible Supercapacitors

Using bamboo inspired carbon nanofibers, Stanford researchers at the Yi Cui Lab have created a freestanding, flexible and elastic electrode for energy storage devices. This mechanically durable membrane has excellent mechanical and electrochemical properties, and provides a high surface area accessible to the electrolyte and low ion-transport resistance, key attributes in flexible energy storage for flexible electronics. Without the need for extra support, the volumetric energy and powder densities based on the whole device surpass state-of-the-art devices. Even under continuous dynamic operations of forceful bending (90°) and twisting (180°), the as-designed device still exhibits stable electrochemical performances with 100% capacitance retention. Such a unique supercapacitor holds great promise for high-performance flexible electronics

Figures

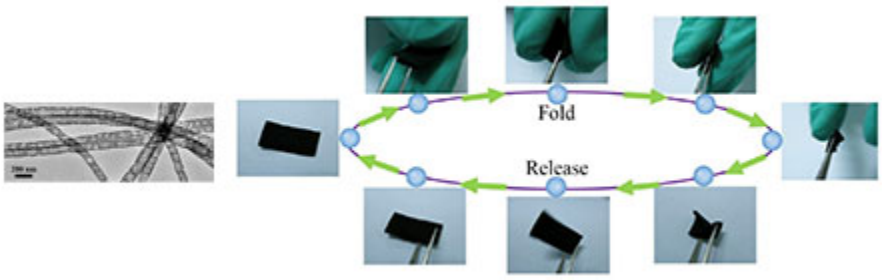


Figure description - Left (TEM image of the nanofibers) Right (Nanofiber web network under folding and releasing)

Stage of Research

- Researchers bent, twisted, and tested the nanofiber network supercapacitor electrode with excellent results. The electrode recovered its initial state easily even 3-folded manipulation.
- Under bending (90°) and twisting (180°), the as-designed device still exhibits stable electrochemical performances with 100% capacitance retention.

- Carbon nanofiber web exhibited superior mechanical durability and can work as a superior free-standing electrode for flexible all-solid-state supercapacitors

Applications

- **High-performance supercapacitor electrode** for portable flexible electronics and optoelectronics
- Electrode for Lithium-ion batteries
- Multifunctional textiles (Textiles embedded with energy storage devices)
- Sensors and other energy devices (Wearable sensors powdered by flexible energy storage devices, flexible current collector for lithium ion batteries)

Advantages

- **Freestanding, flexible and elastic**
- **High specific surface area** up to 1700 m^2 g^{-1}
- **Good electrical conductivity**
- **Stable electrochemical performances** with 100% capacitance retention under forceful bending (90°) and twisting (180°)
- **Superior design** employing carbon nanofiber with a well-balanced macro-, meso-, and microporosity, enabling excellent mechanical flexibility, foldability, and electrochemical performances

Publications

- Sun, Yongming, Ryan B. Sills, Xianluo Hu, Zhi Wei Seh, Xu Xiao, Henghui Xu, Wei Luo et al. "A Bamboo-Inspired Nanostructure Design for Flexible, Foldable, and Twistable Energy Storage Devices." *Nano letters 15, no. 6* (2015): 3899-3906.

Patents

- Published Application: 20170125174
- Issued: 9,842,707 (USA)

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