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Stretchable Supercapacitors Based on Buckled Single-Walled Carbon Nanotube Micro-Films

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Intellectual Property Status

Patent pending

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Background

Recently, the discovery of flexible and stretchable electronics has brought about the potential for many new applications previously unattainable with rigid electronics. The lone inhibitor to the advancement of this technology is the lack of a formidable flexible and stretchable power source. Considering all possible power sources, supercapacitors have the most promise because of their high power and energy densities compared to lithium-ion batteries and conventional dielectric capacitors, respectively. Currently, the primary research in supercapacitors revolves around electrode materials, such as carbon nanotubes (CNT), that have sufficient power and energy densities for these systems and are lightweight, miniature in size, and somewhat flexible.

Invention Description

Researchers at Arizona State University have developed a manufacturing method for stretchable supercapacitors with electrodes comprised of periodically wavy single-walled carbon nanotubes (SWNT). The use of polydimethylsiloxane (PDMS) as an elastomeric substrate enables these supercapacitors to sustain their electrochemical performance while being submitted to significant tensile strain and mechanical deformation. The supercapacitors may be used in flexible and stretchable electronics, as well as in other structures/systems that require some degree of mechanical flexibility.

Potential Applications

- Portable Electronics
- All-Electric Vehicles
- UAVs
- Plug-In Hybrids
- Wearable Energy Source

Benefits and Advantages

- **Universal Method** can be used for other conducting, porous materials used as electrodes in supercapacitors
- **Stable Electrochemical Performance** when 30% applied tensile strain is introduced as well as during cyclic stretching and releasing
- **Similar Power and Energy Densities** to supercapacitors with pristine SWNT macro-films as electrodes
- **High Surface Area for storing charge, efficient electrolyte interaction, nanoscale dimensions, and high electrical conductivity**