Enzyme/Redox Polymer Supercapacitor Device

Published date: Aug. 5, 2016

Technology description

Invention Summary

U-6166 is a hybrid enzyme redox polymer supercapacitor bio-battery capable of generating a capacitance on the order of 300±100 F/g when multi-walled carbon nanotubes are used in conjunction with redox polymers. When multi-walled carbon nanotubes only are used, a capacitance on the order of 102 F/g is obtained; therefore, the inclusion of redox polymers leads to a two to three fold increase in capacitance. Conduction polymers are usually used in supercapacitors to fill in the void space between the multi-walled carbon nanotubes but the conduction polymer does not allow for ion transfer. This results in a smaller capacitance increase than observed when only multi-walled carbon nanotubes are used. Redox polymers allow ion transfer making them an ideal replacement for conduction polymers. This technology would have the potential to be used in multiple different markets including implantable medical devices, phones and any application that uses a supercapacitor. Currently, the main issue with supercapacitors is the fact that they do not have the energy storage capacity that rivals lithium ion batteries.

Market Opportunity

A typical customer for U-6166 would be medical device manufactures of pacemakers, ICDs, and spinal cord stimulators. The total number of implantable devices that sold reached 715,000 units in 2014 and it is expected that 816,000 units will be sold in 2020, with a CAGR of 1.9%. Overall, the number of units sold of pacemakers and ICDs remained constant over this time, but the number of spinal cord stimulators sold increased with a CAGR of 7.9%. Each of these implantable devices that are sold contains a lithium ion battery. U-6166 is a completely new technology that is meant to replace the lithium ion batteries contained within an implantable medical device. Supercapacitors that can deliver the required voltages cost $150 on the low end4. Assuming that U-6166 would be able to sell for $150 and a 10% adoption rate, 81,600 devices would be sold with revenue of $12.2 million.

Advantages

Increased capacitance when compared to equivalent supercapacitors

Operate at near neutral pH and ambient temperature

Charges like a capacitor but discharges over a longer period of time like a battery

Institution

The University of Utah

Inventors

Carol Curchoe
Krysti Knoche Gupta
Postdoc
Chemistry
Shelley Minteer
Professor
Department of Chemistry