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A Flexible Super-Capacitive Solid-State Power Supply for Miniature Implantable Medical Devices

A customizable, thin-film, supercapacitor power supply uses wireless radio frequency (RF) charging to provide continuous and reliable local power for size-reduced medical devices in neural, ocular, and cardiovascular applications.

Rapid development in semiconductor, low-power integrated circuits, and packaging technologies has led to acceleration in the reduction of size and weight of autonomous electronic devices, such as wireless implantable devices and microelectromechanical systems. Current devices are inadequate because they suffer from poor charge/discharge rates, limited life cycle, and safety concerns. Electrochemical capacitors (supercapacitors) are now being studied as alternative power sources. Research efforts on micro-supercapacitors have focused on supercapacitance performance, but integration with other electronic circuitry components within a microsystem is still a challenge.

Researchers at Purdue University have developed a supercapacitive solid-state power supply for use in miniature wireless implantable devices. This novel device consists of a thin film that offers mechanical flexibility and a customizable size down to 1 square millimeter. The power supply uses wireless radio frequency (RF) waves to charge the supercapacitor and offers large specific areal capacitance, good rate capability, and excellent charge/discharge life cycle. The quality of wireless powering for implantable devices is sensitive to the position of those devices within the RF electromagnetic field. This high energy, local power supply provides continuous and reliable power to medical devices. This technology addresses a growing need in the medical device field for size reductions that are beneficial in a variety of areas including neural, ocular, and cardiovascular applications.

Advantages:

-Customizable size down to 1 square millimeter

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Category
Energy & Power Systems/Energy Storage
Materials Science & Nanotechnology/Nanomaterials & Nanostructures

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-Excellent charge/discharge life

-Capacitance density of better than 1 microfarad per square millimeter

TRL: 4

Intellectual Property:

Provisional-Patent, 2012-10-25, United States | PCT-Patent, 2013-10-25, WO | NATL-Patent, 2015-04-25, United States

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