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Non-Confidential Description - PSU No. 4261
"High Energy Capacitors with Improved Energy Storage Density"

Keywords:
capacitors, electric vehicles, medical devices

Links:
http://www.matse.psu.edu/directory/faculty/susan-trolier-mckinstry

Inventors:
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Background

High frequency capacitors are used in a variety of applications, ranging from industrial lasers to implantable medical devices, such as heart defibrillators. Improved energy storage dielectrics would allow for the further miniaturization of these devices.

Commercially available hybrid/electric vehicles also rely upon a series of capacitors and batteries, which are used in tandem to provide a sufficient lifetime and adequate power supply to the vehicle. Capacitors typically have a high power density and a relatively small energy storage density, while batteries provide a high energy storage component to the system. Increasing the energy storage density of capacitors can reduce the use of battery energy in the system, and improvements in the capacitors may be less technically difficult and less expensive than improvements in batteries.

Invention Description

A novel capacitor material has been developed based on the use of solution chemistry for the deposition of bismuth zinc niobate tantalite thin films. The deposition parameters for these films have been optimized, and devices have been fabricated. The film structure has been characterized, and the devices have been tested for energy storage density as a function of both frequency and temperature. This technology has been demonstrated to possess a high energy storage density across a range of temperatures and frequencies. The energy storage density value at 200°C exceeds current materials, and the room temperature energy storage density is the highest value reported for a lead-free dielectric material. This material has also demonstrated the ability to sustain high voltages of over 600 V.

Advantages/Applications

- high energy storage density across a range of temperatures and frequencies.
- Improved energy storage allows for the further miniaturization of medical and other devices
- Increased capacity for hybrid/electric vehicles without changes in battery technology
- Could be used in integrated circuits to integrate capacitors in the FR4 board and further shrink devices

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