

Antiferroelectric thin films have attracted blooming interest due to their potential application in energy storage areas. $\text{Pb}(1-3x/2)\text{La}_x\text{HfO}_3$ (PLHO- x , $x = 0-0.05$) thin films were fabricated on $\text{Pt}(111)/\text{TiO}_2/\text{SiO}_2/\text{Si}$ substrates via the chemical solution deposition method. The x-ray diffraction and high-resolution transmission electron microscopy results show that the ...

Faster thin film devices for energy storage and electronics Date: August 2, 2023 Source: Max Planck Institute of Microstructure Physics Summary: An international research team reported the first ...

Here, we review the properties of V_2O_5 thin films employed in energy storage and conversion systems, which were prepared with a variety of deposition options. Numerous works prior 2001 have

However, as power devices become smaller, there is a need for further increase in energy density for dielectric materials [[5], ... Controlling the crystallization of Nd-doped $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ thin-films for lead-free energy storage capacitors. J. ...

Presently, there are different kinds of energy storage devices like battery, electrolytic capacitor, fuel cells, etc. [1] ... To integrate these supercapacitors on a chip, efforts are also being made to fabricate thin-film-based device with high energy density. Morphology of the thin film has a great impact on the charge storage performance.

Here we demonstrate a novel nickel-carbonate-hydroxide (NCH) nanowire thin-film-based color-changing energy storage device that possesses a high optical contrast of ~85% at 500 nm and ...

Energy storage devices called ultracapacitors can be recharged many more times than batteries, but the total amount of energy they can store is limited. ... Micro ultracapacitor: This thin-film ...

Recently, miniaturized systems with multiple functionalities, such as flexibility, self-powering and sensing capability are urgently desired for the practical applications. In this work, we reported the fabrication of novel reduced graphene oxide and carbon nanotube based composite electrode on the flexible polyimide substrate and explored its physical and electrochemical ...

Faster thin film devices for energy storage and electronics. Max-Planck-Institut für Mikrostrukturphysik. Journal Nature Materials DOI 10.1038/s41563-023-01612-2. Keywords

Continuous advances in microelectronics and micro/nanoelectromechanical systems enable the use of micro-sized energy storage devices, namely solid-state thin-film m-batteries. Different from the current button batteries, the m-battery can directly be integrated on microchips forming a very compact "system on chip" since no liquid ...

Thin-film energy storage devices

In this Research Topic, we postulate if the breakthroughs in materials development and processing, structure and architecture designs for thin film technologies can be the primary enablers for the design and fabrication of next-generation batteries. High power and extended cycle life at high energy density are key benefits for energy storage ...

In this study, an innovative approach is proposed, utilizing an ultra-thin multilayer structure in the simple sol-gel made ferroelectric/paraelectric $\text{BiFeO}_3/\text{SrTiO}_3$ (BF/ST) system ...

Thin film energy storage technology has great potential in emerging applications. The concept of integrating a smart window and energy storage provides an ideally large area for a thin film battery and a structural power backup for an energy-efficient building. However, due to the limited number of candidate materials, there is still a significant challenge in optimizing the ...

Sain, S., Chowdhury, S., Maity, S. et al. Sputtered thin film deposited laser induced graphene based novel micro-supercapacitor device for energy storage application. *Sci Rep* 14, 16289 (2024) ...

In this work, an exceptional room-temperature energy storage performance with $W_r \sim 86 \text{ J cm}^{-3}$, $\eta \sim 81\%$ is obtained under a moderate electric field of 1.7 MV cm^{-1} in $0.94(\text{Bi}, \text{Na})\text{TiO}_3\text{-}0.06\text{BaTiO}_3$ (BNBT) thin films composed of super-T polar clusters embedded into normal R and T nanodomains. The super-T nanoclusters with a c/a ratio up to ~ 1.25 are ...

[1, 4-8] Recent studies focused on the enhancement of the energy-storage density of dielectric thin-film capacitors by using advanced materials and novel device architectures, [9, 10] employing also ferroelectric (FE), antiferroelectric (AFE), or relaxor-ferroelectric (RFE) materials.

Here we report record-high electrostatic energy storage density (ESD) and power density, to our knowledge, in $\text{HfO}_2\text{-ZrO}_2$ -based thin film microcapacitors integrated into ...

The PANI/MXene thin film demonstrates rapid charge transfer, as is evident from its lower R_{ct1} and R_{ct2} values compared to the PANI thin film (Table S1). This accelerated charge transfer in ...

Yang, B. et al. $\text{Bi}_{3.25}\text{La}_{0.75}\text{Ti}_3\text{O}_{12}$ thin film capacitors for energy storage applications. *Appl. Phys. ...* Center of Smart Materials and Devices, Wuhan University of Technology, Wuhan, China.

This research comprehensively investigates the structural, optical, and electrochemical properties of nickel oxide (NiO) nanoparticles, focusing on its potential applications in energy storage systems, particularly electrochemical double-layer capacitors (EDLCs). In a single-step hydrothermal process, two-dimensional (2D) NiO nanoparticles was ...

AFE thin films are being introduced in the energy storage application sectors as they exhibit excellent energy storage performance in their ceramic form [9], [10], [84], [122]. This mandates the importance of a deeper

Thin-film energy storage devices

level of understanding of the energy storage performance of pure ANO and NNO materials in the thin film form.

For these devices, the energy storage capacity will be determined by considering the required autonomy of the device and by balancing energy input and output. ... 1-10 mA \cdot h \cdot cm⁻² to meet practical requirements for energy storage devices and autonomy for the targeted electronic device applications. If a thin-film battery has a thickness of ...

Recently, paper-based electrodes have triggered large attention towards the fabrication of flexible energy storage devices owing to their lightweight, flexible nature and ease of integration with various electronic devices. ... Role of nitrogen doping at the surface of titanium nitride thin films towards capacitive charge storage enhancement. J ...

Ferroelectric-based dielectric thin films with large polarizability, high breakdown strength, and miniaturization potential hold promises for competitive integrated and discrete energy storage ...

2.1 Historical timeline of WO₃ based thin film electrodes. In 1841, chemist Robert Oxland pioneered procedures for preparing WO₃ and sodium tungstate, securing patents and laying the foundation for systematic tungsten chemistry [1]. The early 2000s saw pivotal studies on WO₃ electrochemical properties, crucial for energy storage devices [19, 34]. Flexible thin ...

Dielectric materials find wide usages in microelectronics, power electronics, power grids, medical devices, and the military. Due to the vast demand, the development of advanced dielectrics with high energy storage capability has received extensive attention [1], [2], [3], [4]. Tantalum and aluminum-based electrolytic capacitors, ceramic capacitors, and film ...

Recent significant technological developments for these energy storage devices include the use of thin film components, which result in increased capacity and reliability. Specifically, thin films with high integrity and uniformity are required in the electrolytes of solid-state Li batteries (SSLBs) and the dielectrics of electrostatic ...

Next, a zinc foil was positioned between the glass substrate and the PANI/MXene thin film, and the edges of both were taped with 3 M double-sided tape, which had a thickness of 1.0 mm. Ultimately, the gel electrolyte was injected to create an electrochromic energy storage device, where the positive electrode was the PANI/MXene thin film and the ...

Key Laboratory of Soft Machines and Smart Devices of Zhejiang Province, Zhejiang University, Hangzhou, Zhejiang, 310027 China ... Especially in the 1.5% Mn-BMT 0.7 film capacitor, an ultrahigh energy storage density of 124 J cm⁻³ and an ... cycles) fatigue properties. This work is expected to pave the way for the application of BMT-based thin ...

Thin-film energy storage devices

Traditional thin-film energy-storage devices consist of stacked layers of active films on two-dimensional substrates and do not exploit the third dimension. Fully three-dimensional thin-film ...

By introducing super tetragonal nanostructures into glassy ferroelectric with MPB composition, a giant energy storage density of 786 J cm^{-3} with a high energy efficiency ...

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