Magnetoelectric ultra-thin energy storage battery

The strain-driven interfacial coupling between the ferromagnetic and ferroelectric constituents of magnetoelectric (ME) composites makes them potential candidates for novel multifunctional devices. ME composites in the form of thin-film heterostructures show promising applications in miniaturized ME devices. This article reports the recent advancement ...

ARTICLE Ultra-compact dual-band smart NEMS magnetoelectric antennas for simultaneous wireless energy harvesting and magnetic eld sensing Mohsen Zaeimbashi 1, Mehdi Nasrollahpour 1, Adam Khalifa 2 ...

Electrostatic energy storage technology based on dielectrics is fundamental to advanced electronics and high-power electrical systems. ... The superparaelectric battery. ... D. H. L. Tjhe, J. L. MacManus-Driscoll, Lead-free relaxor thin films with huge energy density and low loss for high temperature applications. Nano Energy 71, 104536 (2020 ...

Here, we show an ultra-compact dual-band smart nanoelectromechanical systems magnetoelectric (ME) antenna with a size of 250 × 174 µm2 that can efficiently perform wireless energy harvesting and sense ultra-small magnetic fields.

As a common renewable energy source of the ocean, wave energy has the advantages of high energy density and wide distribution, but it is also characterized by time variability and ultra-low frequency, which makes it a challenging task to obtain. Here, by combining the quasi-zero adjustable stiffness (QZS) mechanism with magnetoelectric (ME) ...

DOI: 10.1016/j.polymer.2023.126141 Corpus ID: 259602438; PVDF based flexible magnetoelectric composites for capacitive energy storage, hybrid mechanical energy harvesting and self-powered magnetic field detection

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Enhanced energy-storage and magnetoelectric properties of Ba 0.95 La 0.05 Zr 0.4 Ti 0.6 O 3 /CoFe 2 O 4 multilayer thin films. Author links open overlay panel Minh D. Nguyen a b. Show more. ... The magnetoelectric effect of the CFO thin film by coupling a P(VDF-co-TrFE) piezoelectric layer. J. Appl. Phys., 124 (2018), Article 154102.

Herein, thin films of 0.85BaTiO3-0.15Bi(Mg0.5Zr0.5)O3 with columnar sub-grain structures are obtained by structural modification, which exhibit giant energy storage density 99.34 J/cm³, with ...

Exchange interaction is a well-known concept and used in many magnetic applications such as next generation storage ... The energy consumption is ultra-low, almost three orders of magnitude smaller than ... Quantification of strain and charge co-mediated magnetoelectric coupling on ultra-thin Permalloy/PMN-PT interface. Sci. Rep., 4 (2014), p ...

Recently, magnetoelectric (ME) antennas have become a hot topic in the field of antenna miniaturization in the very-low-frequency (VLF) band because their size can be reduced to one-ten-thousandth of the size of conventional electric antennas. However, they still suffer from narrow transmission/reception bandwidth and weak radiation intensity. To address ...

Gupta, R. & Kotnala, R. A review on current status and mechanisms of room-temperature magnetoelectric coupling in multiferroics for device applications. Journal of Materials Science 57, 12710-12737 (2022). Liu, S. et al. Self-biased magnetoelectric composite for energy harvesting. Battery Energy 2, 20230005 (2023).

Furthermore, AH-LLZO is handled/stored in ambient air and exhibits excellent Li metal wettability that enables an ultra-thin Li metal seeding layer to achieve high energy ...

This Review summarizes and discusses developments on the use of spintronic devices for energy-efficient data storage and logic applications, and energy harvesting based ...

Since the revival of multiferroic laminates with giant magnetoelectric (ME) coefficients, a variety of multifunctional ME devices, such as sensor, inductor, filter, antenna etc. have been developed. Magnetoelastic materials, which couple the magnetization and strain together, have recently attracted ever-increasing attention due to their key roles in ME ...

Magnetoelectric (ME) coupling, generally existing in magnetoelectric 1,2 materials combining ferroelectric and magnetic behaviors, where the electric polarization can be manipulated by magnetic ...

Multiphase magnetoelectric (ME) composites deposited on flexible substrates have been widely studied, which can respond to ambient mechanical, magnetic, and electric field excitations. This paper reports an investigation of flexible FeCoSiB/ZnO thin-film generators for low-frequency energy harvesting based on three substrates. Both hard substrate Si and ...

The EnerCera battery is an ultra-thin and ultra small Li-ion rechargeable battery. A semi-solid-state battery developed using NGK"s original crystal oriented ceramic plate as electrodes, EnerCera achieves features that were difficult to incorporate together in existing Li-ion rechargeable batteries, such as high capacity, high output, high heat resistance, and long ...

The P-E loops shows that the energy storage density of the BFO-PTO solid solution rises with increasing Nd

concentration up to 0.15 and then decreases. The maximum recoverable energy storage density (W rec) and efficiency (i) for the 0.15 composition are 4.54 mJ/cm 3 and 79 %, respectively. Conversely, as the concentration of Nd rises, the ...

In situ studies at metal oxide/ionic medium interfaces for electronics and electrochemical energy storage. ... as batteries, smart windows and fuel cells. ... magnetoelectric coupling on ultra ...

Capacitors based on dielectric materials offer distinct advantages in power density when compared to other energy storage methods such as batteries and supercapacitors, especially in scenarios requiring rapid charge and discharge [1], [2].However, their relatively limited energy capacity has constrained their applications in integrated electrical systems, ...

A solution to make the sensor nodes maintenance free is to use a combination of an electric energy storage with an energy harvester which captures power from the electromagnetic field around the ...

Self-biased magnetoelectric composite for energy harvesting. August 2023; Battery Energy 2(21) ... Battery Energy. 2023; ... thin/fil m heterojunc tions, and poly mer/ceram ic or multi ...

CoFe 2 O 4-BaTiO 3 core-shell-embedded flexible polymer composite as an efficient magnetoelectric energy harvester. Author links open ... The spin-coating technique was adopted to fabricate the ME composite film onto a metal-coated PET thin film, which ensures the direct transfer of magnetostriction from the magnetostrictive CFO core to the BTO ...

Over the past few decades, the design and development of advanced materials based on two-dimensional (2D) ultra-thin materials for efficient energy catalysis and storage have aroused much attention. 2D ultra-thin materials have emerged as the most promising candidates for energy catalysis and storage because of their unique physical, chemical, and electronic ...

The magnetoelectric effect of the CFO thin film by coupling a P(VDF- co -TrFE) piezoelectric layer ... The high-performance energy-storage dielectric capacitors are increasingly necessary for the ...

A team led by the Department of Energy"s Oak Ridge National Laboratory developed a novel, integrated approach to track energy-transporting ions within an ultra-thin material, which could unlock its energy storage potential leading toward faster charging, longer-lasting devices. Scientists have fo

Magnetoelectric (ME) materials and their thin-film heterostructures, in which two or more ferroic orders exist simultaneously, have attracted ever-increasing research interests. ... (MME) composite devices have been used in energy harvesting and magnetic field sensing applications due to their advantages including their high-performance, simple ...

Nan TX, Zhou ZY, Liu M, et al. Quantification of strain and charge co-mediated magnetoelectric coupling on ultra-thin permalloy/PMN-PT interface. Sci Rep, 2014, 4: 3688 ... data storage, energy conversion, etc. Yuan-Hua Lin is "Changjiang Scholar" distinguished professor of Materials Science at the School of Materials Science and ...

In recent years, advances in magnetoelectric and multiferroic materials now provide the basis for nonvolatile spin-based logic and memory elements that have a projected ...

Energy harvesting devices based on the magnetoelectric (ME) coupling effect have promising prospects in the field of self-powered devices due to their advantages of small size, fast ...

Furthermore, much of the power consumed in information storage and transmission is dissipated as heat. ... substrates at RT, which was increased to 85% by introducing an ultra-thin MgO(2.1 nm) layer between LSMO and PZT, as depicted in Fig. 5 (a-b). An external E-field was as well used to regulate the oxygen vacancy accumulation on either ...

Battery Energy is an interdisciplinary journal focused on advanced energy materials with an ... (11.73 µW cm -3) and comparable with that of a high-cost Metglas/(PMN-PZT) SFC multilayered thin-film cantilever energy harvester (333 mW ... energy storage units, power management modules, and ME device packaging still need to be ...

The experimental development of thin films that exhibit higher room-temperature low-field magnetoelectric (ME) sensing without compromising reliable electrical energy storage ...

Download Citation | On Feb 1, 2024, M.D. Nguyen published Enhanced energy-storage and magnetoelectric properties of Ba0.95La0.05Zr0.4Ti0.6O3/CoFe2O4 multilayer thin films | Find, read and cite all ...

The strain engineering effects induced by different means, e.g., the substrate lattice mismatch and/or chemical doping, on the functional properties of perovskite thin films have triggered interest in the use of these materials in different applications such as energy storage/generation or photonics. The effects of the film"s thickness and strain state of the ...

With the growing need for smart, compact, wearable, and stretchable electronic items, it is essential to develop suitable rechargeable energy storage devices that are inexpensive to manufacture, resulting in less pollution and increased safety [44, 45] ene displays an outstanding electrical conductivity and unique layered structure, enabling it as an attractive ...

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