Switchable ferroelectric photovoltaic effects in epitaxial

What is the photovoltaic effect of ferroelectric materials?
The photovoltaic effect of ferroelectric materials occurs in the entire material, which allows it to obtain an open-circuit voltage higher than its bandgap and exceeds the theoretical efficiency of traditional heterojunction theory by 34% .

What are the characteristics of ferroelectric photovoltaics (FPV)?
The fundamentally different mechanism endows ferroelectric photovoltaics (FPV) with unique characteristics, such as switchable photovoltaic outputs (4 - 7), above-bandgap photovoltage (2, 3, 8 - 10), and light polarization dependence (3, 4, 10, 11).

Can ferroelectric materials be used for photovoltaics?
Ferroelectric materials for photovoltaics have sparked great interest because of their switchable photoelectric responses and above-bandgap photovoltages that violate conventional photovoltaic theory. However,their relatively low photocurrent and power conversion efficiency limit their potential applicationin solar cells.

What is ferroelectric photovoltaic (fepv)?
Since the coupling of ferroelectric polarization and the photovoltaic effect was discovered in perovskite , , the research boom in the ferroelectric photovoltaic (FEPV) field has been set off, which has great application prospects in light energy conversion and light memory.

Why is ferroelectric polarization important?
These theories all explain that excellent ferroelectric polarization is an important way to enhance the performance of ferroelectric photovoltaics. In addition,the wide bandgap of ferroelectric materials,leading to low absorbance and small photocurrent,has hindered the development of ferroelectric photovoltaics.

When was photovoltaic effect discovered in ferroelectric materials?
The discovery of photovoltaic effect in ferroelectric materials can be traced back to more than 50 years ago(1 - 3). In contrast to classical semiconductor solar cells,photoexcited carriers in ferroelectric materials are spontaneously separated due to the inversion symmetry breaking.

Current-voltage hysteresis and switchable rectifying characteristics have been observed in epitaxial multiferroic BiFeO3 (BFO) thin films. The forward direction of the rectifying current can be reversed repeatedly with polarization switching, indicating a switchable diode effect and large ferroelectric resistive switching. With analyzing the potential barriers and their ...

Here, we present a new class of FPVs by demonstrating switchable ferroelectric photovoltaic effects using hexagonal ferrite (h-RFeO3) thin films having narrow band gaps of ~1.2 eV, where R denotes ...

This proposes a simple idea to enhance the switchable ferroelectric photovoltaic effect and provides a promising pathway for the development of photovoltaic devices. 2. ... Bulk photovoltaic effect at visible wavelength in epitaxial ferroelectric BiFeO 3 thin films. Adv. Mater., 22 (2010), pp. 1763-1766. Crossref View in Scopus Google Scholar

Download Citation | Abnormal capacitance-voltage and switchable photovoltaic effect of epitaxial Mn -doped BiFeO 3 thin film capacitor | Epitaxial BiFe0.95Mn0.05O3 (BFMO) film was deposited on ...

Ferroelectric photovoltaics (FPVs) have drawn much attention owing to their high stability, environmental safety, anomalously high photovoltages, coupled with reversibly switchable photovoltaic responses. However, FPVs suffer from extremely low photocurrents, which is primarily due to their wide band gaps. Here, we present a new class of FPVs by ...

Earlier studies have demonstrated a switchable PV effect in BFO films in ... K. & Liang, Y. C. Bulk photovoltaic effect at visible wavelength in epitaxial ferroelectric BiFeO 3 thin films ...

An epitaxial route to strain Strain can have a dramatic effect on the properties of materials. Zhang et al. introduced a large strain in the material PbTiO 3 by growing it epitaxially in a ...

ther words, the depolarization field weakens with increasing film thickness. According to the bulk photovoltaic (BPV) effect, on the contrary, Voc increases with the film thickness (or with the ...

BiFeO 3 (BFO) (R3c, a pc = 3.96 Å, ? pc = 89.4°, Fig. 1a) is a room temperature multiferroic and photoelectric material due to preeminent ferroelectric properties and a relatively narrow bandgap [10]. The enhanced ferroelectric of BFO has been carried out in some approaches, such as the epitaxial strain from SrTiO 3 [11] and LaAlO 3 [12] substrates, and the ...

1 Switchable Ferroelectric Photovoltaic Effects in Epitaxial Thin Films of h-RFeO3 having Narrow Optical Band Gaps Hyeon Hana, Donghoon Kima, Ji Hyun Leea, Jucheol Parkb, Sang Yeol Namb,c, Mingi Choid, Kijung Yongd, and Hyun Myung Janga,* aDepartment of Materials Science and Engineering, and Division of Advanced Materials Science, Pohang University of Science ...

This proposes a simple idea to enhance the switchable ferroelectric photovoltaic effect and provides a promising pathway for the development of photovoltaic devices. ... Polarization-enhanced bulk photovoltaic effect of BiFeO 3 epitaxial film under standard solar illumination. Physics Letters A, Volume 384, Issue 32, 2020, Article 126831.

switchable photovoltaic effect dominates over the unswitchable internal field effect arising from the net built-in potential. This work thus demonstrates a new class of FPVs towards high-efficiency ...

Switchable ferroelectric photovoltaic effects in epitaxial

The diode and photovoltaic effects of BiFeO 3 and Bi 0.9 Sr 0.1 FeO 3-? polycrystalline thin films were investigated by poling the films with increased magnitude and alternating direction. It was found that both electromigration of oxygen vacancies and polarization flipping are able to induce switchable diode and photovoltaic effects.

A polycrystalline BiFeO3 film on Pt/Ti/SiO2/Si was fabricated using the spin coating technique. The film shows diode-like characteristics with and without poling measured under dark conditions. However, it exhibits a switchable photovoltaic effect with light illumination under poled conditions. The measured photovoltaic effect revealed an open circuit voltage of ...

It is noted that the target device produced a negative V OC and positive J SC regardless of the upward-P or downward-P state, which is different from the general ferroelectric PV modulation showing switchable V OC and J SC with reversing poling direction due to the bulk PV effect [33]. This feature is ascribed to the coupling of polarization ...

Current-voltage hysteresis and switchable rectifying characteristics have been observed in epitaxial multiferroic BiFeO 3 (BFO) thin films. The forward direction of the rectifying current can be reversed repeatedly with polarization switching, indicating a switchable diode effect and large ferroelectric resistive switching.

Epitaxial BiFe0.95Mn0.05O3 (BFMO) film was deposited on (001)-oriented SrRuO3 (SRO) coated SrTiO3 (STO) substrate by radio-frequency (rf) magnetron sputtering. Indium tin oxide (ITO) was grown on BFMO/STO heterojunction to fabricate ITO/BFMO/SRO capacitor for investigating the ferroelectric and photovoltaic properties. The ITO/BFMO/SRO ...

DOI: 10.2139/ssrn.4116178 Corpus ID: 249170966; Switchable Ferroelectric Photovoltaic in the Low Bandgap Cobalt-Substituted Bifeo3 Epitaxial Thin Films @article{Ding2022SwitchableFP, title={Switchable Ferroelectric Photovoltaic in the Low Bandgap Cobalt-Substituted Bifeo3 Epitaxial Thin Films}, author={J.-C. Ding and Ruiqi Guo and Jingcong Hu and Guoqiang Xi ...

Switchable ferroelectric photovoltaic effects in hexagonal ferrite (<italic>h</italic>-RFeO₃) thin films having narrow band gaps are presented.

The fundamentally different mechanism endows ferroelectric photovoltaics (FPV) with unique characteristics, such as switchable photovoltaic outputs (4 - 7), above-bandgap photovoltage (2, 3, 8 - 10), and light ...

Herein, both the positive and negative thermal expansion effects in composite ferroelectric epitaxial films are investigated by use of high-repetition-rate ultrafast X-ray diffraction, along with ...

Switchable ferroelectric photovoltaic effects in epitaxial

We investigate the mechanism of a switchable diode behavior observed in ferroelectric SrRuO3/BiFeO3 (BFO)/SrRuO3 capacitors. We experimentally demonstrate that the switchable diode effect observed in the capacitors is induced by the polarization reversal in the BFO film. The conductivity in an Ohmic region in different oxidation states provides direct ...

Ferroelectric photovoltaics (FPVs) are being extensively studied owing to their anomalously high photovoltages, coupled with reversibly switchable photocurrents. However, FPVs suffer from their extremely low photocurrents, which is primarily due to their wide band gaps. Herein, we present a new class of FPV by demonstrating (i) a nearly optimum band gap of ~1.55 eV and (ii) the ...

The switchable photovoltaic effect would be ascribed to the reversible Schottky-to-Ohmic interfacial contacts modulated by polarization switching. ... Bulk photovoltaic effect at visible wavelength in epitaxial ferroelectric BiFeO 3 thin films. Adv. Mater., 22 (2010), p. 1763. Crossref View in Scopus Google Scholar [25]

Pb(Zr x Ti 1-x)O 3 (PZT) is a tetragonal ferroelectric material at room-temperature, exhibiting remarkable piezoelectricity and intricate domain structures. In this work, we explore the ferroelectric properties, photoelectric reactions, and efficient manipulation pathways of the unconventional superstructures in epitaxial (101)-oriented PZT ...

Here, we present a new class of FPVs by demonstrating switchable ferroelectric photovoltaic effects and narrow band-gap properties using hexagonal ferrite (h-RFeO 3) thin films, where R denotes rare-earth ions. FPVs with narrow band gaps suggest their potential applicability as ...

It is found that bulk electric conduction in ferroelectric monodomain BiFeO3 crystals is highly nonlinear and unidirectional. Unidirectional electric current flow, such as that found in a diode, is essential for modern electronics. It usually occurs at asymmetric interfaces such as p-n junctions or metal/semiconductor interfaces with Schottky barriers. We report on a diode effect ...

Anomalous photovoltaic effect and switchable photovoltaic output have propelled much recent research and development of ferroelectric photovoltaic (FE-PV) materials in solar cell, photodetection and optical-read nonvolatile memory fields.However, extremely small output photocurrent density in the order of nA/cm 2 or uA/cm 2 is the primary problem to limit ...

The ferroelectric photovoltaic (PV) effect has gained widespread attention in the past decade 1,2,3,4,5 because of its promising applications in solar energy harvesting 6,7,8, self-powered ...

This study presents a promising FPV based on hexagonal YbFeO3 (h-YbFO) thin-film heterostructure by exploiting its narrow Eg and demonstrates enhanced FPV effects by suitably exploiting the substrate-induced

film strain in these h-YBFO-based photovoltaics. Ferroelectric photovoltaics (FPVs) are being extensively investigated by virtue of switchable ...

Web: https://www.ekusenitours.co.za