The booming wearable/portable electronic devices industry has stimulated the progress of supporting flexible energy storage devices. Excellent performance of flexible devices not only requires the component units of each device to maintain the original performance under external forces, but also demands the overall device to be flexible in response to external ???

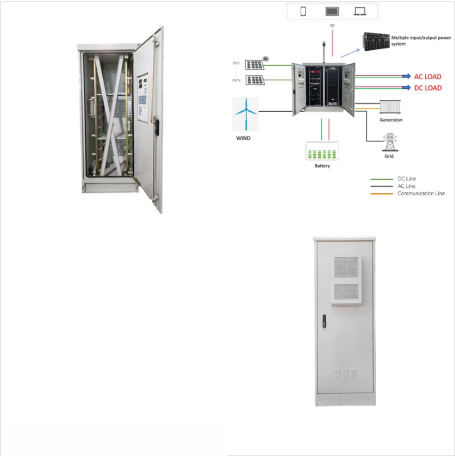
To date, numerous flexible energy storage devices have rapidly emerged, including flexible lithium-ion batteries (LIBs), sodium-ion batteries (SIBs), lithium-O 2 batteries. In Figure 7E,F, a Fe 1??? x S@PCNWs/rGO hybrid paper was also fabricated by vacuum filtration, which displays superior flexibility and mechanical properties.

Consequently, there is an urgent demand for flexible energy storage devices (FESDs) to cater to the energy storage needs of various forms of flexible products. FESDs can be classified into three categories based on spatial dimension, all of which share the features of excellent electrochemical performance, reliable safety, and superb flexibility.

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

The flexible energy storage devices based on an organic electrolyte have anxiety concerning toxic and flammable organic electrolytes under deformable states, which is directly connected to safety issues and environmental hazards [77, 78]. In this regard, aqueous electrolytes in a flexible system could be intrinsically non-flammable, eco

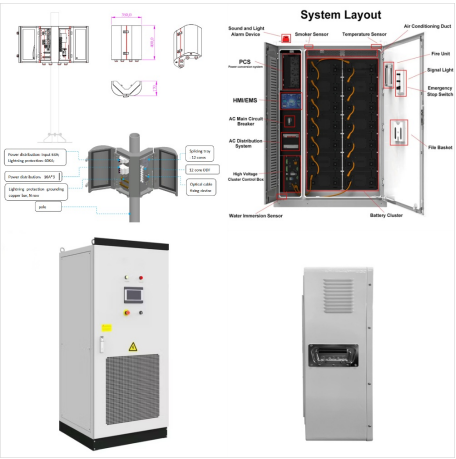
The emergence of multifunctional wearable electronics over the past decades has triggered the exploration of flexible energy storage devices. As an important component of flexible batteries, novel electrodes with good flexibility, mechanical stability and high energy density are required to adapt to mechanic Horizons Community Board collection: new trends in energy ???



A variety of active materials and fabrication strategies of flexible energy storage devices have been intensively studied in recent years, especially for integrated self-powered systems and biosensing. Lee G et al 2019 Single-layer graphene-based transparent and flexible multifunctional electronics for self-charging power and touch-sensing

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

1 Introduction. To catch up with the faster pace and higher quality demand in modern life, flexible, wearable, and multifunctional electronic devices are gaining increasing attention and have become a hot spot in the market of digital devices, [1-6] for example, smartwatches, [7, 8] bendable smartphones, [] flexible and foldable OLED panels, [10, 11] smart fibers, [12-16] e ???



With the boom of portable, wearable, and implantable smart electronics in the last decade, the demand for multifunctional microscale electrochemical energy storage devices has increased. Owing to their excellent rate performance, high power density, long cycling lifetime, easy fabrication, and integration, multifunctional planar microsupercapacitors (PMSCs) are deemed ???

Multifunctional devices integrated with electrochromism and energy storage or energy production functions are attractive because these devices can be used as an effective approach to address the energy crisis and environmental pollution in society today. In this review, we explain the operation principles of electrochromic energy storage devices including ???

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

A high-performance electrochromic-energy storage device (EESD) is developed, which successfully realizes the multifunctional combination of electrochromism and energy storage by constructing tungsten trioxide monohydrate (WO3?H2O) nanosheets and Prussian white (PW) film as asymmetric electrodes. The EESD presents excellent electrochromic ???

Flexible and stretchable electrochromic supercapacitor systems are widely considered as promising multifunctional energy storage devices that eliminate the need for an external power source. Nevertheless, the performance of conventional designs deteriorates significantly as a result of electrode/electrolyte exposure to atmosphere as well as mechanical ???

To develop electrolytes suitable for flexible energy storage devices, it is imperative to modify the physical state of the electrolyte to a solid or quasi-solid form, thereby preventing any leakage during mechanical deformation. SCs assembled using an AACP electrode and multifunctional GNP electrolytes demonstrate exceptional temperature

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

The articles can be sorted into three themes: 1) advanced energy storage devices, including batteries and supercapacitors; 2) energy harvesting devices, including photovoltaic cells, thermoelectric devices, and triboelectric nanogenerators; 3) multifunctional devices that integrate energy harvesting and storage for optoelectronic and biological

Carbon materials have an important impact on emerging multifunctional wearable integrated microelectronic systems (IMESs) [1,2,3].With the growing interest in bringing multifunctional IMESs to the field of flexible and wearable electronics, integrating the functionality of flexibility to electronic devices while maintaining high sensing and energy storage ???

Energy storage devices are arousing increasing interest due to their key role in next???generation electronics. Integration is widely explored as a general and effective strategy aiming at high performances. Recent progress in integrating a variety of functions into electrochemical energy storage devices is carefully described. Through integration at the level ???

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

This review concentrated on the recent progress on flexible energy-storage devices, including flexible batteries, SCs and sensors. In the first part, we review the latest fiber, planar ???

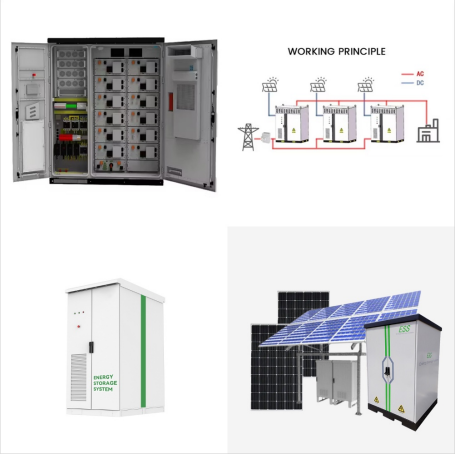
The hydrogel is a 3D elastic crosslinked hydrated polymer network that can hold high content of water. The mechanical properties (toughness, stretchability, and fluidity) of hydrogels can be modulated during synthesis, enabling the application of hydrogels to wearable ionic device [34].As a promising class of hydrogels, conductive hydrogels can be prepared by ???

The rational design and scalable assembly of nanoarchitectures are important to deliver highly uniform, functional films with high performance. However, fabrication of large-area and high-performance films is quite difficult because of the challenges in controlling homogeneous microstructures, interface properties, and the high cost of the conventional vacuum deposition ???

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

Flexible/wearable electrochromic zinc-ion battery (EC-ZIB) is considered as promising smart multifunctional energy storage devices that monitor the energy storing on the basis of the color variation.

Multifunctional ECDs, such as electrochromic energy storage devices (ECESDs), multi-color displays, deformable ECDs, smart windows, This concept clearly showed the possibility of designing a multifunctional flexible self-charging ECD, but the color switching speed needs to be further improved due to the current output limitation of PENGs



An electrochromic supercapacitor is a new type of multifunctional device. It can store energy, change its optical properties, and its color can intuitively reflect the energy storage of the device

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

Polymer-ceramic nanocomposite films using double perovskite ceramic phase offer promising prospects for developing multifunctional flexible films in general and energy storage system in specific. The manganese and iron-based double perovskite is emerging as potential system for various functional applications. In the present attempt, we explore the ???

In recent years, the growing demand for increasingly advanced wearable electronic gadgets has been commonly observed. Modern society is constantly expecting a noticeable development in terms of smart functions, long-term stability, and long-time outdoor operation of portable devices. Excellent flexibility, lightweight nature, and environmental friendliness are no ???

High-performance ion-conducting hydrogels (ICHs) are vital for developing flexible electronic devices. However, the robustness and ion-conducting behavior of ICHs deteriorate at extreme temperatures, hampering their use in soft electronics. To resolve these issues, a method involving freeze???thawing and ionizing radiation technology is reported herein for synthesizing ???

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

Transparent electrodes (TEs) play critical roles in various applications [1???9], including displays, photovoltaic cells, touch panels, and energy-storage devices.Among them, electrochemical energy-storage devices (EESDs) with long cyclic stability and excellent power density have attracted intensive attention and are seen as one of the most potential power ???

on the recent progress on flexible energy???storage devices, including flexible batteries, SCs and sensors. In the first part, we review the latest fiber, planar and three??? dimensional (3D)???based flexible devices with different solid???state electrolytes, and novel structures, along with their technological innovations and challenges. In the

The primary task of a battery is to store energy and to power electronic devices. This has hardly changed over the years despite all the progress made in improving their electrochemical performance.

MULTIFUNCTIONAL FLEXIBLE ENERGY STORAGE DEVICE

Such functional, customized, and compatible membranes with synergies can boost the attributes of advanced K + storage devices, such as flexible K-ion capacitors and K-based dual-ion batteries. This work can afford new insights for designing flexible electrode in the energy storage field, as well as various types of conformations that can bring

With the advent of multifunctional devices with electrochromic (EC) behavior and electrochemical energy storage, complementary design of film structures using inorganic???organic materials has