

What are hydrogel-based photonic structures?

Hydrogel-based photonic structures may be categorized by the types of photonic structures in which hydrogels are used. To date, typical photonic structures, such as waveguides, optical fibers, PhCs, and plasmonic structures, have been developed based on hydrogels.

Can hydrogels be used for photonic devices?

Moreover, hydrogels possess unique properties that respond to external stimuli, causing them to be promising candidates for designing responsive optical devices for a variety of photonic applications.

Are multifunctional hydrogels suitable for energy storage and conversion?

This is largely due to their exceptional mechanical properties, inherent multifunctionality, and noteworthy biocompatibility. The goal of this review is to provide an in-depth analysis of the recent advancements made in the field of multifunctional hydrogels as applied to energy storage and conversion.

What is hydrogel photonics?

Hydrogel photonics has emerged as a promising solution in the field of active photonics by providing primarily deformable geometric parameters in response to external stimuli. Over the past few years, various studies have been undertaken to attain stimuli-responsive photonic devices with tunable optical properties.

Do hydrogels have tunable optical properties?

Over the past few years, various studies have been undertaken to attain stimuli-responsive photonic devices with tunable optical properties. Herein, we focus on the recent advancements in hydrogel-based photonics and micro/nanofabrication techniques for hydrogels.

Why do we need hydrogel thermoelectric materials?

Given the limited energy utilization efficiency, the enormous amount of waste heat generated from industrial manufacturing not only leads to energy loss but also exacerbates climate change problems. Hydrogel thermoelectric materials show great potential for converting low-grade thermal energy into electrical energy.

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Photonic crystal has become a powerful technique for regulating electromagnetic waves due to its excellent features, such as structure designability and dynamic adjustability; in addition, it has great application ...

A hybrid hydrogel system composed of CdTe quantum dots and photonic crystals. The composite materials combining quantum dots (QDs) and photonic crystals (PCs) could produce complex and high-dimensional anti-counterfeiting patterns, which solves the problems of simple coding information and a low

anti-counterfeiting level of monochromatic materials.

The advantages of photonic hydrogel sensors over conventional assay formats include label-free, quantitative, reusable, and continuous measurement capability that can be integrated with equipment-free text or image display. ... These handheld devices are simple, rapid, robust in storage and usage, and low cost. Thus, they are universally ...

Energy bands in photonic crystals. ... Photonic crystals can be used as chemical sensors for sensing the pH and ionic strength of solutions [73]. The authors of [73] made a colloidal crystal array (CCA) or an opal photonic crystal, which strongly diffracts light, using highly charged mono-disperse polystyrene spheres. ... Hydrogels are ...

Hydrogels hold great promise for a variety of applications, from soft robotics to electrolytes in energy storage devices. However, their mechanical strength, stiffness and ...

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Solar energy, as a renewable and sustainable resource, presents a cost-effective alternative to conventional energy sources. However, its intermittent nature necessitates ...

Flexible energy storage devices such as electrochemical capacitors are the best candidates for energy storage devices that can be operated in bio-environments because it is easier to find ...

We demonstrate azobenzene photochemically driven diffraction switching of a photonic crystal consisting of a crystalline colloidal array (CCA) polymerized within a hydrogel matrix. A novel azobenzene derivative that has a large ground-state activation barrier between the cis and trans forms in water is used. The system is actuated by excitation with UV light ...

Photonic crystals, which are materials with periodic dielectric constants on the submicroscale, have been the focus of research for an extended period. Photonic soft materials have been extensively developed for use as ...

Mechanochromic colloidal photonic crystals (PCs), which typically integrate a self-assembled PC array with a highly elastic medium, exhibit the ability to reversibly respond to external mechanical stimuli by altering the periodicity of PC structures. Nowadays, leveraging visible indications and optical signals for mechanical forces, mechanochromic colloidal PCs ...

Colloidal photonic crystals (CPCs) are close-packed ordered arrays self-assembled from monodispersed colloid spheres. The self-assembled CPCs have great advantages of low cost, flexibility, and easy processability which show great potential for create captivating and diverse photonic structures for new photonic materials and devices.

In this paper, we review the latest advances in multifunctional hydrogels for energy storage and conversion. The discussion commences with an exploration of the mechanisms, ...

Nevertheless, this strategy enables the development of mechanically safe and deformable Li-ion batteries and could potentially be suitable for other energy storage devices ...

Recently, tunable photonic crystals (PhCs) have received great research interest, thanks to the wide range of applications in which they can be employed, such as light emission and sensing, among others. In addition, the ...

Bletilla striata is an herb with a good medicinal value whose main active ingredient is Bletilla striata polysaccharide (BSP) in the tuber of Bletilla striata. In this study, a polysaccharide-based semi-interpenetrating network ...

The color of most animals is relatively fixed, but some animals are capable of undergoing rapid, physiological color change which allows them to display different colors and patterns in response ...

Multifunctional polyacrylamide/hydrated salt/MXene phase change hydrogels with high thermal energy storage, photothermal conversion capability and strain sensitivity for personal healthcare. ... In situ formed thermogelable ...

We introduce recent studies of hydrogel-based photonic structures, including waveguides, optical fibers, photonic crystals, and plasmonic structures. Optically active photonic devices have been reported by doping luminescent ...

Microfluidics-Assisted Assembly of Injectable Photonic Hydrogels toward Reflective Cooling, Small, 2020, 16, 1903939. ... Photonic Crystals towards Robust Energy-Saving Performance, Angewandte Chemie International Edition, 2019, 58, 13556-13564. Hu XH * ...

This review initiates by exploring the pivotal role of hydrogels as energy storage devices, particularly in batteries and supercapacitors. It delves into the design principles and fabrication techniques utilized to augment the electrochemical ...

Conventional photonic devices exhibit static optical properties that are design-dependent, including the material's refractive index and geometrical parameters. However, they still possess ...

In this study, a phase change hydrogel was developed by incorporating a hydrated salt, polymers, and carbon nanotubes (CNTs). The energy storage material used was ...

A photonic hydrogel for health self-monitoring of solid-state electrolytes in zinc-air batteries Energy Storage Materials (IF 18.9) Pub Date : 2022-09-07, DOI: 10.1016/j.ensm.2022.08.047

Glucose monitoring in polyacrylamide-polyethylene glycol hydrogel designs was achieved through a blue shift in the photonic stopband arising from increased hydrogel crosslinking related to the formation of a supramolecular complex ...

Photonic crystals (PCs) with crack-free morphology, high-saturated structural color and sensitivity to circumstances are expanding their applications in painting, sensor, optical coding and information technology. ... J. Energy Storage, 27 (2020), Article 101078. View PDF View article View in Scopus Google Scholar [41] ... Highly stretchable ...

Three-dimensional photonic crystals made of close-packed polymethylmethacrylate (PMMA) spheres or air spheres in silica, titania and ceria matrices have been fabricated and characterized using SEM, XRD, Raman spectroscopy and UV-Vis transmittance measurements. ... [25], although the energy difference is small. Valuable ...

The fundamental characteristic of a PC is the photonic band-gap (PBG), which is a frequency range that forbids the existence of energy states similar to what the periodic potential does to the electrons in atomic crystals (5). In 1912, Bragg studied the relationship between X-ray diffraction and crystal structure, which can be used to predict ...

Artificial opal photonic crystals and inverse opal . Photonic crystals (PhCs) influence the propagation of light by their periodic variation in dielectric contrast or refractive index. This ...

Colloidal crystallization serves as one of the most economic and scalable production methods for photonic crystals. However, insufficient optical performance, nonuniformity and low reproducibility ...

Biopolymers used in photonics are mainly limited to linear optical color responses. Here, photon upconversion crystals incorporated into bacterial cellulose films demonstrate non-linear optical ...

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