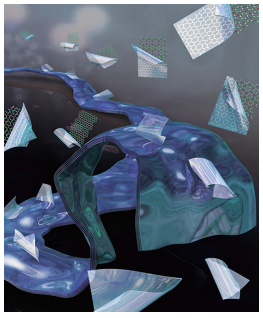
ADVANCED FUNCTIONAL MATERIALS

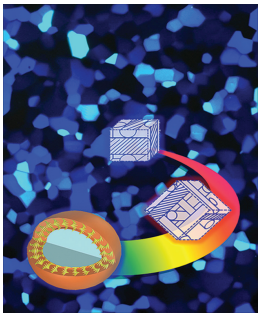
www.afm-journal.de



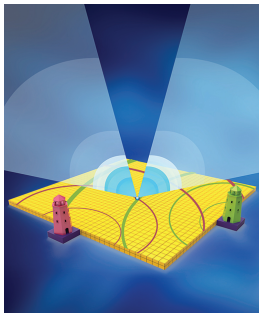
Sustainable Synthesis

On page 111, Z. Wang, J. Qiu, and co-workers report a scalable and economic approach for sustainable production of B/N co-doped carbon nanosheets by templating the biomass materials against two-dimensional crystals. The doped carbon nanosheets feature very thin thickness, ultrahigh aspect ratio, and excellent flexibility, enabling the assembly of flexible thin films for superior charge storage in supercapacitors.

Liquid-Crystal Nanostructures



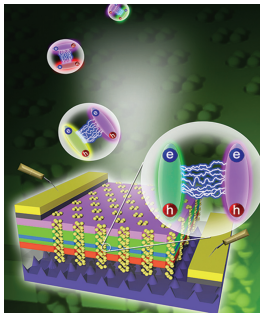
Nature is a fabulous gallery of 3D photonic nanostructures, formed through evolution and natural selection over billions of years. Soft nanotechnology—i.e., exploiting self-organized soft materials in nanotechnology—is emerging as a vibrant field of research in the bottom-up nanofabrication of intelligent, stimuli-driven 3D photonic materials and devices. On page 10, L. Wang and Q. Li provide a glimpse of the advancements in design, fabrication, and applications of self-organized 3D liquid crystalline photonic nanostructures.



Holographic Metasurfaces

T. J. Cui and co-workers propose, on page 29, a new method to design planar dual-functional devices using isotropic holographic metasurface, in which two different functions are written on the same hologram with no mutual coupling. Via specific design, double-beam or double-polarization radiating devices are realized independently by orthogonal excitations. Scanning radiating beams controlled only by frequency are demonstrated with different performances under orthogonal polarizations.

Light-Emitting Diodes



On page 36, Z. Zhuang, B. Liu, R. Zhang, and co-workers demonstrate a white light-emitting diode with a novel hybrid nanohole nitride/nanocrystals structure, exhibiting high color-conversion efficiency and effective quantum yield by utilizing an efficient nonradiative energy transfer. These devices can achieve a very high color rendering index with warm white, natural white, or cold white emission, providing great prospects for mass production in future.

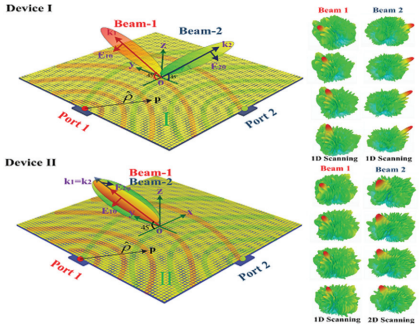
EDITORIAL

FEATURE ARTICLE

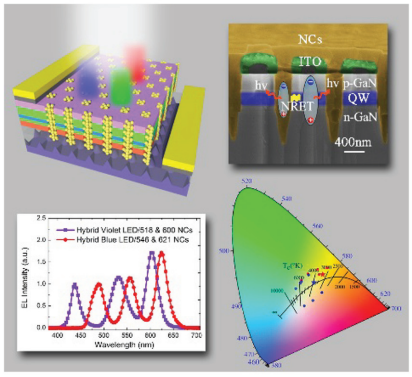
Soft nanotechnology—i.e., exploiting self-organized soft materials in nanotechnology—is emerging as an attractive paradigm in the bottom-up nanofabrication of intelligent stimuli-driven 3D photonic materials and devices. Liquid-crystalline materials undoubtedly represent such an elegant dynamic system that combines the liquid-like fluidity and crystal-like ordering from molecular to macroscopic levels. This review provides a glimpse of the advancements in design, fabrication and applications of stimuli-directing self-organized 3D liquid-crystalline photonic nanostructures.

FULL PAPERS

A new method is proposed to design planar dual-functional devices using isotropic holographic metasurface, in which two different functions are written on the same hologram with no mutual coupling. In this specific design, double-beam or double-polarization radiate devices are realized independently by orthogonal excitations. Scanning radiate beams that are only controlled by frequency with different performances under orthogonal polarizations are demonstrated.



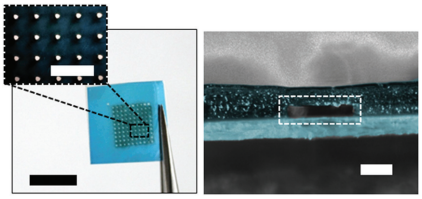
White light-emitting diodes, with a novel nanohole nitride quantum well/II–VI nanocrystal hybrid structure, are demonstrated. High color-conversion efficiency and high effective quantum yield are achieved in these devices by utilizing an efficient nonradiative energy transfer. Moreover, they can realize a high color rendering index, covering different correlated color temperatures corresponding to warm white, natural white, and cold white.



CONTENTS

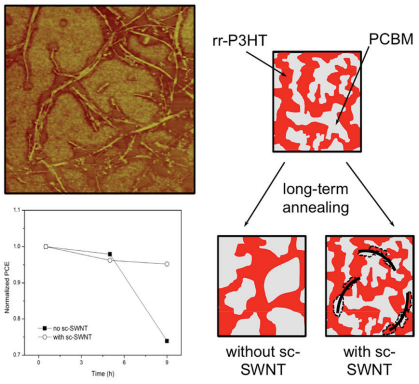
FULL PAPERS

Silk Fibroin



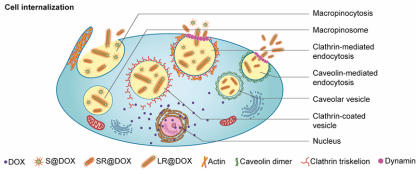
A thermal processing method for producing patterned multilayer laminates in silk fibroin is presented, based on thermal reflow of amorphous protein films. The method is able to produce laminates with strength on the order of the bulk material, and features as small as 100 μm. Applications of geometries produced by this method in bioelectronics and drug delivery are also presented.

Photovoltaic Devices

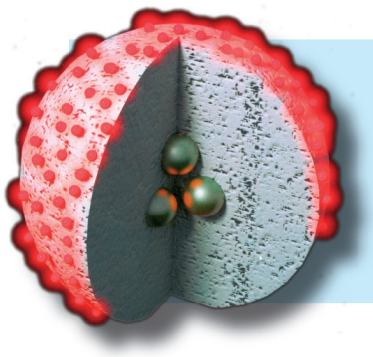


Semiconducting single-walled nanotubes (sc-SWNTs) with high purity improve both device performance and thermal stability of organic solar cells based on a blend of a conjugated polymer and a fullerene derivative. The presence of sc-SWNTs induces the organization of the polymer phase, while suppressing the excessive phase separation of the blend materials.

Drug Delivery



A novel bio-inspired rod-shaped micellar system is developed as a nanoplatform for highly effectively delivering anticancer drugs. The nanoplatform has a great capacity of escaping the rapid clearance of reticuloendothelial system in blood, a high internalization rate of tumor cells, and a significant enhancement of therapeutic agent potency against artificial solid tumors.



How to contact us:

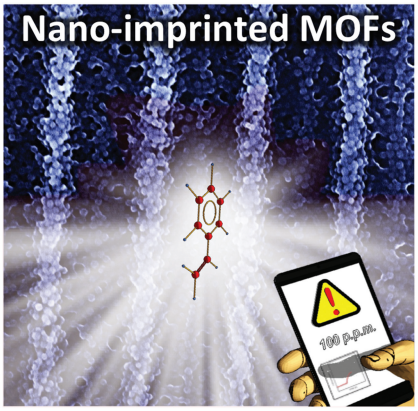
Editorial Office:
Phone: (+49) 6201-606-286/531
Fax: (+49) 6201-606-500
Email: afm@wiley-vch.de

Reprints:
cherth@wiley-vch.de

Copyright Permission:
Fax: (+49) 6201-606-332
Email: rights@wiley-vch.de

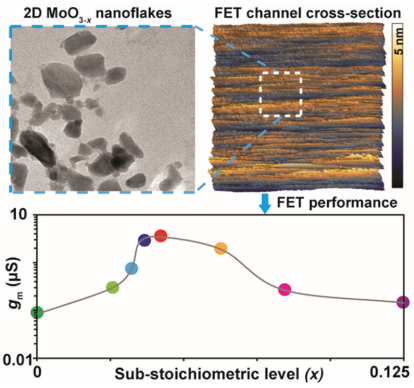
FULL PAPERS

2D Photonic metal–organic framework (MOF)-based homo- and heterostructures are fabricated by soft-lithographic approaches. This versatile approach allows preparation of large-scale patterned surfaces on several substrates including flexible plastics. The materials are used as selective optical sensing platform. Detection of toxic vapors such as styrene is performed by using an easy transduction method, compatible with smartphone camera technology.



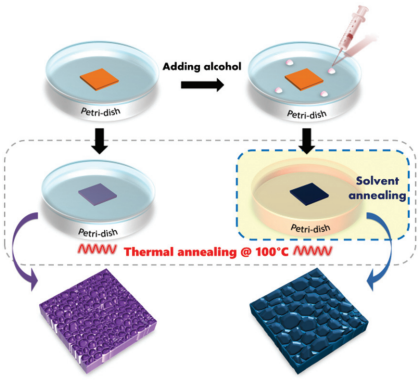
Vapor Sensing

Electronic inks of 2D MoO_{3-x} flakes based on a solar light irradiation in liquid-phase exfoliated method are used for developing channels FETs for future high-performance printed nanoelectronic devices. It is shown that the carrier concentration, energy band, and carrier charge mobility in 2D MoO_{3-x}-based FETs can be tuned and the optimal substoichiometric value with the maximum transconductance is obtained.



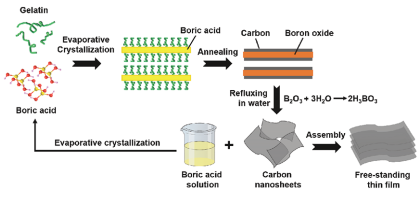
Field-Effect Transistors

High performance of perovskite photovoltaics (perovskite solar cells and perovskite photodetectors) is realized by alcohol-vapor solvent annealing treatment on $CH_3NH_3PbI_3$ thin films to enhance the crystal growth and the grain size of the $CH_3NH_3PbI_3$ crystals.



Perovskite Photovoltaics

B/N co-doped carbon nanosheets with ultrahigh aspect ratio are synthesized by assembling the biomass molecule in long-range order on recyclable 2D hard template followed by annealing. The unique structural features allow them to be assembled to flexible thin films and ultralight aerogels for superior charge storage in supercapacitors.

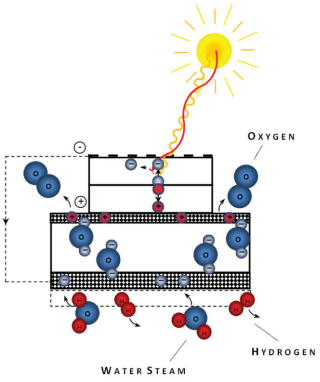


Sustainable Synthesis

CONTENTS

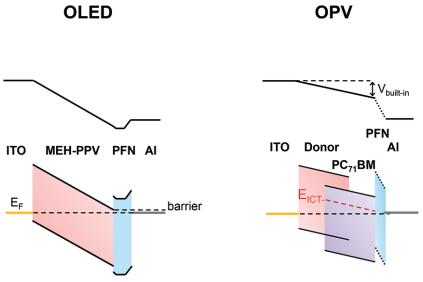
FULL PAPERS

High Temperature Photoelectrochemistry



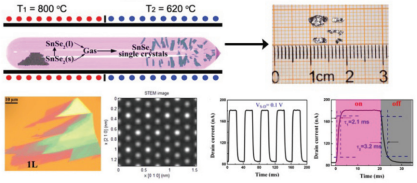
Photon-driven electrochemical energy storage is realized by stacking a high-temperature oxide-based solar cell and a zirconia-based oxygen pump. The solar cell part exhibits more than 900 mV cell voltage at 400 °C and this driving force is transferred to the electrochemical process by a shared electrode in the single stack device.

Organic Electronics



There is no agreement on the dipole direction of the cathode interfacial layer in organic electronic devices in the literature. By splitting the device at different interfaces to study the energy-level alignment, the energetic diagrams of the organic light-emitting diode (OLED) and the organic photovoltaic (OPV) device are clarified. The vacuum level is aligned across the organic/metal interface in OLED, while energy pinning occurs in OPV.

Photodetectors



A high performance atomically layered $SnSe_2$ photodetector has been first successfully fabricated for the first time. The photodetector displays a good responsivity of 0.5 A W^{-1} and a fast photoresponse down to ≈2 ms at room temperature, one of the fastest response times among all types of 2D photodetectors.

Organic Memory Devices

A donor–acceptor structured small molecule is rationally designed to contain three distinct electron acceptors. Organic quaternary memory behavior is demonstrated for the first time induced by a stepwise charge-transfer process. The threshold voltages of the memory device are distinct, and the current ratio of the four states is identified, which indicate a low possibility of read and write errors.