ADVANCED FUNCTIONAL MATERIALS

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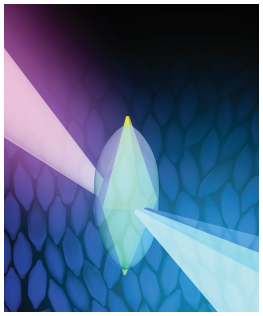
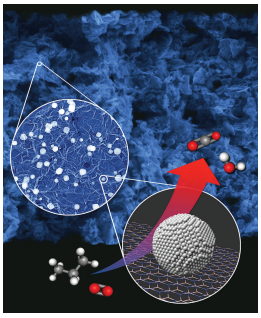


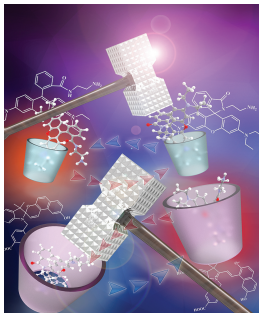
Bimetallic Nanostructures

On page 341, Z. Yang, J. F. Wang, and co-workers report a facile method for the preparation of Ag nanostructures with narrow plasmon linewidths and improved chemical stability, through Ag overgrowth on high-purity Au nanobipyramids. The Ag nanostructures exhibit superior sensing characteristics, offering great potential in the development of ultrasensitive sensors as well as in various other plasmonic applications.

Gas Sensors

R. Maboudian and co-workers demonstrate, on page 433, an ultra-high surface area boron nitride aerogel acting as a scaffold for catalytic platinum nanoparticles. Use of this material integrated onto a microheater platform leads to a fast, sensitive, and stable low-power catalytic gas sensor, opening up possibilities for wireless monitoring of combustible gases.



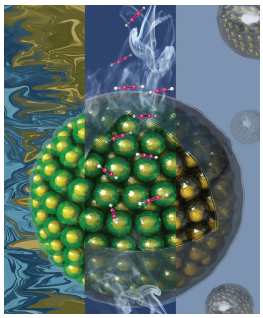


Mechanochromic Switches

Covalent bond-activated mechanoresponse in a supramolecule-triggered mechanochromic switch is reported by M. Yin and co-workers on page 353, through complexing rhodamine or spiropyran with cyclodextrin (CD). The strong hydrogen bonds provided by CD play a crucial role in triggering the mechanochromic switch. Unique characteristics such as noncovalent chemical modification and convenient preparation make this approach promising for practical applications.

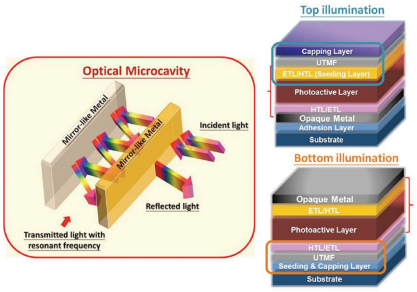
Lithium-Ion Batteries

On page 440, S. Dou, H. Liu, and co-workers present yolk-shell-structured carbon@void@silicon (CVS) anode material as a promising candidate for Li-ion cells. The anode material is composed of an interior carbon network supporting the CVS yolk–shell silicon nanobeads. Fabrication of the anode material is achieved via a simple and green templating method.



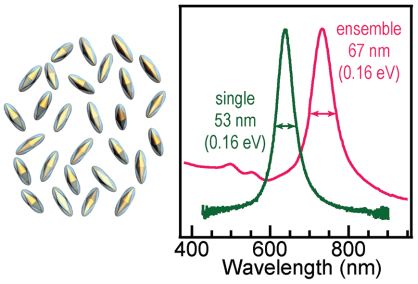
FEATURE ARTICLE

Recent developments and achievements in polymer solar cell electrode engineering are reviewed. Planar ultra-thin metal electrodes are highlighted because they can induce optically coherent interference to confine incident light with resonant frequencies within the photovoltaic cell. Such optical microcavities can boost the light absorption of thin-film PSCs while maintaining efficient charge dissociation and extraction.

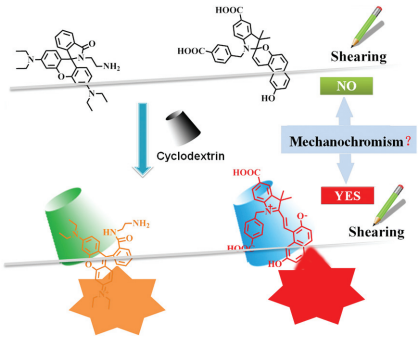


FULL PAPERS

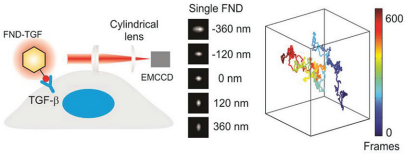
Silver nanostructures of controllable plasmon wavelengths are synthesized by the use of highly pure, highly uniform gold nanobipyramids as supports. They are nearly monodispersed in size and shape, possess narrow plasmon linewidths, high refractive index sensitivities, and figure of merit values. They are expected to be useful in developing ultrasensitive plasmonic sensors.



An innovative approach for covalent-bond-activated mechanoresponse by complexing rhodamine or spiropyran with cyclodextrin is reported. This is the first report of supramolecule-triggered mechanochromic switches. This approach endows diverse fluorophores with perfect mechanochromism by introducing a supramolecular system. This study opens an avenue to correlate mechanochemical reaction with a supramolecular system.



Fluorescent nanodiamonds conjugated with tumor growth factor (FND-TGF) are developed for TGF-β receptors labeling and 3D single molecule imaging in live cells. The real-time dynamics of TGF-β receptors after binding conjugated FNDs and treated with therapeutic inhibitors are revealed. The developed technique can be a powerful tool to investigate how the drug influences the target protein dynamic behaviors in live cells.



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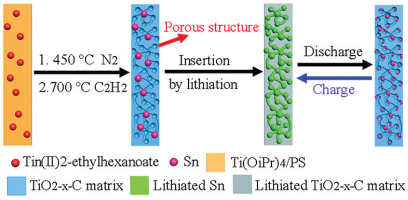
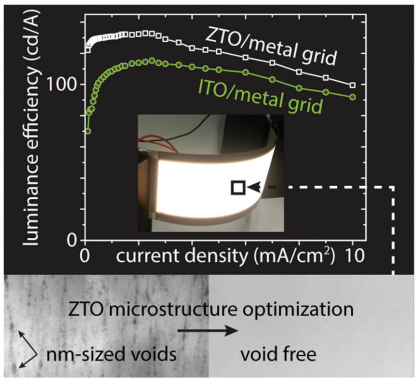


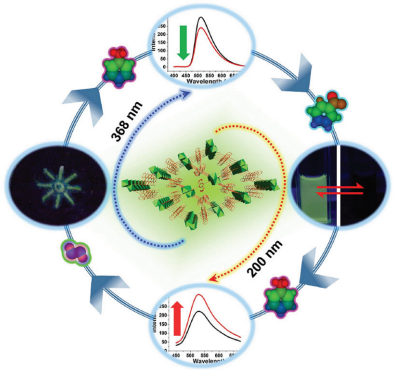
A novel approach induced by lithiation is exploited to insert Sn nanoparticles into the pores of highly stable TiO_{2-x}–C nanofiber substrates, which can effectively localize the postformed smaller Sn nanoparticles and thereby address the problem of structural degradation of Sn anodes. The anodes show a high capacity of 957 mAh g^{-1} after 200 cycles at 0.1 A g^{-1} and the longest cycle life of over 10 000 times at 3 A g^{-1} while retaining 82.3% of their capacity.

Indium-Free Anodes

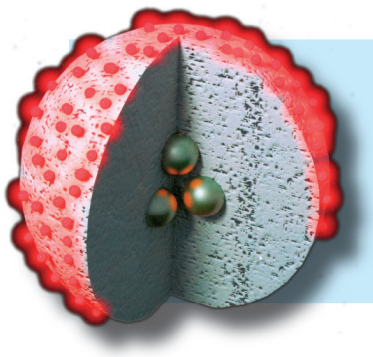


An indium-free anode is developed by a ZnO–SnO_2 combinatorial study. The optimized Zn–Sn–O (ZTO) compound presents a void-free amorphous microstructure, low roughness, high electron mobility, and <5% visible range absorptance. Large-area (41 cm^2) flexible organic light-emitting diodes (OLEDs) fabricated with a ZTO/grid anode outperform those with a Sn-doped In_2O_3 (ITO)/grid anode, confirming the industrial application potential of ZTO.

Sensors



A 3D metal-organic framework (MOF) consisting of an anthracene moiety is reported, which is the first example of a MOF exhibiting both direct chemiluminescence and dual tunable photoluminescence. The material is explored as a selective visual sensor for probing hydrogen peroxide, a dual sensor for aromatics, and a quantitative sensor for nitroaromatics.



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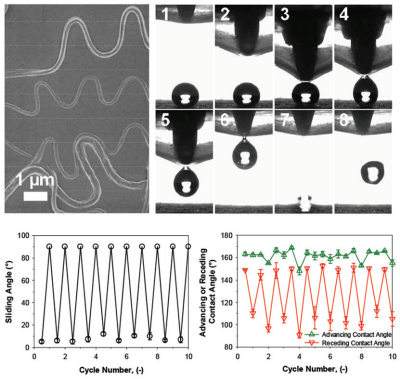
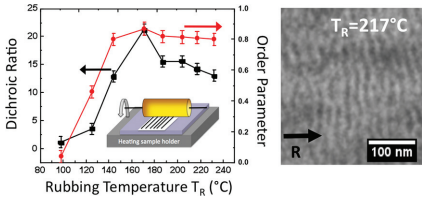
FULL PAPERS

A disordered surface texture that enables robust dynamic and reversible tuning of its wetting state from adhesive rose petal to highly repulsive lotus leaf superhydrophobicity is presented. This optimal wave-like nanofiber morphology demonstrates multicycle hand-like manipulation of microdroplets with mechanically actuated lift-off and release. The tunable structure offers a low-cost and scalable solution for fabrication of switchable water adhesive/repulsive surfaces.



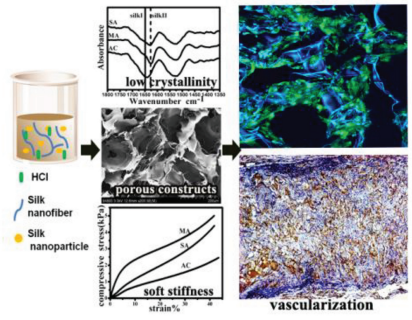
Switchable Surfaces

Precise control of orientation and crystallinity is achieved in regioregular poly(3-hexylthiophene) (P3HT) thin films by using high-temperature rubbing, a fast and effective alignment method. Uniquely, the exciton coupling in P3HT is correlated to the length of the planarized chain segments in the crystals. The evolution of charge transport versus rubbing temperature is correlated to the crystal orientation and film nanomorphology.



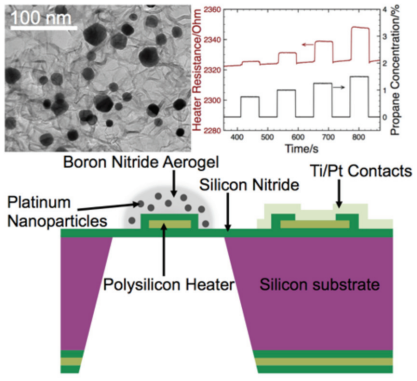
Semiconducting Polymers

Engineering complex organs requires functional vasculatures that can provide oxygen and nutrients to sustain cell viability. Here, silk materials with softer mechanical properties are developed and show the cell differentiation into endothelial cells and neovascularization capacity in vitro and in vivo, without the addition of the growth factors. The study suggests a promising way to fabricate a silk matrix used in complex soft tissues.



Vascularization

A high specific surface area boron nitride aerogel loaded with platinum nanoparticles is integrated with a low-power microheater platform for catalytic gas sensing. Characteristics of the nanoparticle-loaded aerogel lead to superior propane sensing performance with response and recovery time <2 s and 1.5 mW pulsed power consumption, opening up possibilities for ubiquitous wireless monitoring of combustible gases.



Gas Sensors

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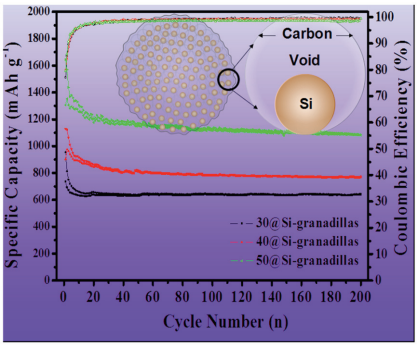
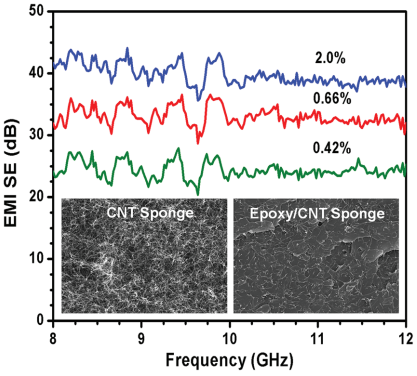


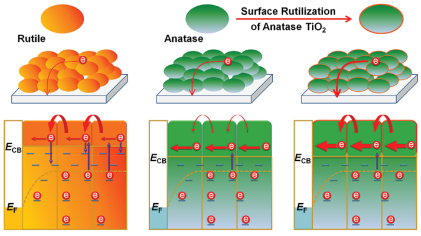
A green and facile way to synthesize an integrated outer carbon-layer-coated granadilla-like silicon/carbon composite is presented. The material is composed of inside carbon network supported yolk-shell silicon nanobeads. The simple fabrication makes it promising to serve as improved anode material for lithium-ion batteries.

Carbon Nanotube Sponges



High-performance electromagnetic interference shielding epoxy nanocomposites are prepared using a preformed highly porous and electrically conductive CNT sponge. The CNT sponge acts as the three-dimensional conducting framework and as effective reinforcement. Only 0.66 wt% of CNT sponge leads to an outstanding EMI shielding effectiveness of around 33 dB in the X-band, and vast increments in the flexural strength and tensile toughness are achieved.

Photoelectrochemical Cells



Transport of charges in TiO_2 electrodes can be improved by bridging and fencing the electronic highways, which can be realized by surface rutilization of the anatase building blocks prior to fabrication of the electrodes. The ultrathin rutilized phase can promote the intergrain electronic connectivity and facilitate charge transfer between adjacent building blocks while suppressing the charge recombination on semiconductor–electrolyte interfaces.