ADVANCED FUNCTIONAL MATERIALS

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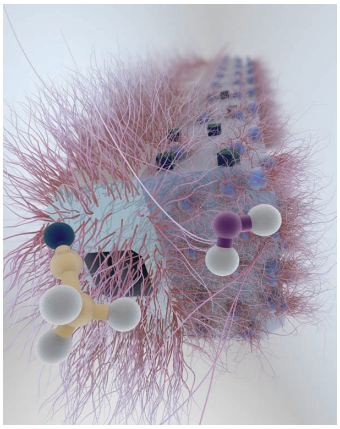
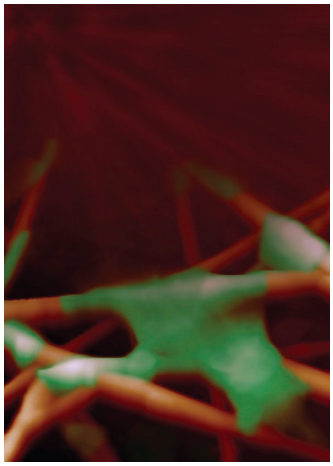


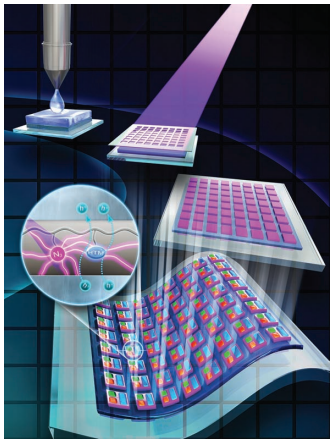
Semiconductors

On page 7570, A. P. O'Mullane, V. Bansal, and colleagues show how the spontaneous reaction of Ag^+ ions with a pre-fabricated CuTCNQ metal-organic charge transfer complex results in different CuTCNQ/AgTCNQ hybrids in different solvents. The reaction in acetonitrile forms a pure CuTCNQ/AgTCNQ hybrid through a process of corrosion-recrystallization. Conversely, in water, CuTCNQ undergoes a galvanic replacement reaction with Ag^+ ions that results in additional decoration of newly-formed CuTCNQ/AgTCNQ hybrids with Ag nanoparticles and $Cu(OH)_2$ crystals.

Transparent Conductors

The inside cover shows an atomic force microscopy false color image of a silver nanowire network wrapped with pristine graphene platelets. On page 7580, A. B. Dalton and team demonstrate that graphene present at inter-wire junctions as well as graphene connecting adjacent wires contribute to a marked enhancement in electrical properties. The hybrid material shows promise as a potential replacement for indium tin oxide, commonly used in transparent electrodes for touch-screen sensors.





Organic Electronics

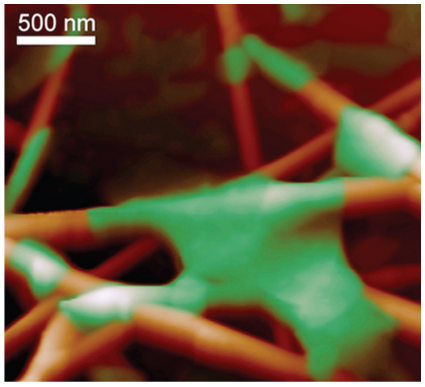
B. Ma, B. J. Kim, and co-workers report a novel platform of photo-crosslinkable azide (N_3) functional hole conducting polymers (X-PTPA) for use in highly efficient, solution-processed, multilayer OLEDs. On page 7588 the X-PTPA with 5 mol% of N_3 group can be crosslinked via mild UV irradiation at short exposure time. A twofold enhancement of device performance is achieved with X-PTPA layer over the control device without X-PTPA.

FULL PAPERS

Semiconductors

A new metal organic semiconductor hybrid of CuTCNQ and AgTCNQ is reported. The synthesis of these hybrids in water and acetonitrile reveal two completely unexpected and different mechanisms in these solvents. A facile generalized approach to prepare hybrid materials comprising two metal-TCNQs in a single system will expand the applicability of TCNQ-based charge transfer complexes to new applications.

Transparent Conductors



A simple, scalable, and relatively inexpensive method is described for preparing highly conducting AgNW/graphene hybrid transparent electrodes that use low-cost solution-processed pristine graphene. A combination of spray deposition and Langmuir-based techniques is used to produce ultrathin films with controlled nanowire and graphene densities. The results indicate that these graphene/nanowire hybrid films may serve as a cheap replacement for existing technologies in electronic devices.

Organic Electronics

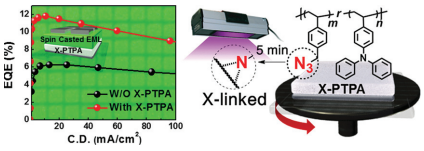
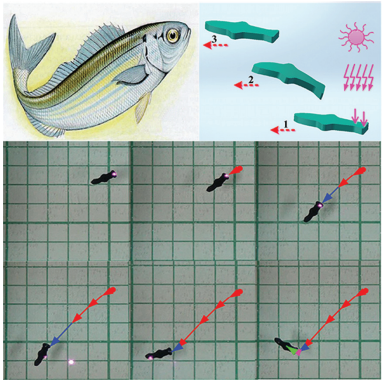


Photo-crosslinkable azide (N_3) containing X-PTPA is used as a HTL/EBL layer for highly efficient, solution-processed multilayer OLEDs. The X-PTPA with 5 mol% of N_3 group can be fully crosslinked via mild UV irradiation at short exposure time. A twofold enhancement of device performance is realized with X-PTPA layer over the control device. This photo-crosslinkable HTL/EBL layer also allows the fabrication of micro-pixelated multilayer OLEDs by photolithography.

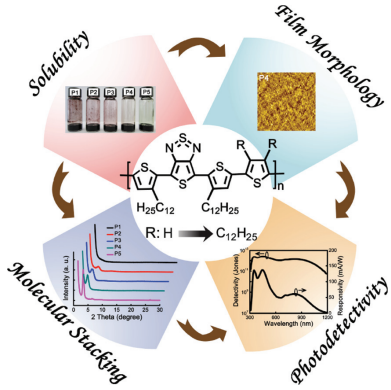
Robotics



Soft and fast-response robotic platform constituted by PDMS/graphene-nanoplatelets composited layer (PDMS/GNPs) and pristine PDMS layer are proposed. The robotic platform can be driven by near infrared irradiation (nIR) due to the photothermal effect of graphene to mimic the fish swimming, which is hopeful in developing light-driven drug-delivery platform, but also the bio-robotic microgrippers applying in vivo and in vitro.

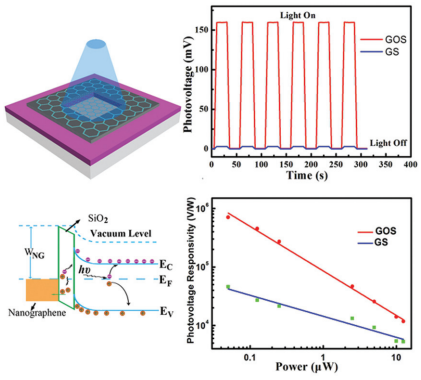
FULL PAPERS

A series of thieno[3,4-*b*]thiadiazole based low-bandgap polymers with different amounts of side chains are designed for probing the effect of side chains on solubility, molecular packing, film morphology, and key performance of polymer photodetectors. Among them, the **P4**-based photodetector demonstrates the best performance and shows fairly constant specific detectivity of about 10^{12} Jones in the spectral range of 330–950 nm.



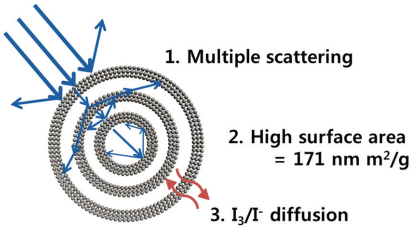
Low-Bandgap Polymers

A simple and low cost approach of directly producing high-performance metal-free nanographene-oxide-silicon diodes is developed. The nanographene is from photoresist without any transfer and the approach is based on the conventional photolithography and silicon technique. Due to the source material is photoresist, the fabrication approach is easy for device fabrication, integration and miniaturization, and thus for commercial use.



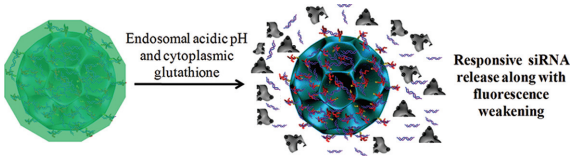
Graphene

Multi-shell porous TiO_2 hollow nanoparticles (MS-TiO_2-HNPs) are prepared by a sol–gel method and calcination and etching processes. Due to the porous multi-shell structure, the MS-TiO_2-HNPs exhibit strong light scattering and facile electrolyte diffusion and circulation. Additionally, the high surface area increases the adsorption of the dye molecules to the surface of the MS-TiO_2-HNPs, resulting in an enhanced power conversion efficiency of 9.4%.



Solar Cells

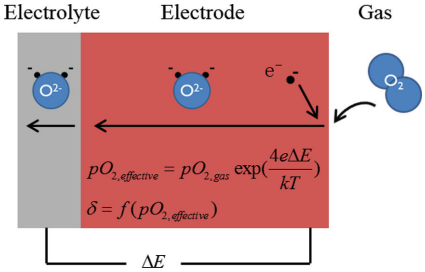
Novel intracellular microenvironment-sensitive fluorescence label-free nanostructured dendrimer-like silica hybrid nanocarriers are successfully developed to achieve traceable, effective, and safe gene delivery. The pH- and GSH-responsive autofluorescent and biodegradable properties of the coated polymer not only endow a responsive gene release property, but also allow real-time monitoring of the gene delivery process.



Gene Delivery

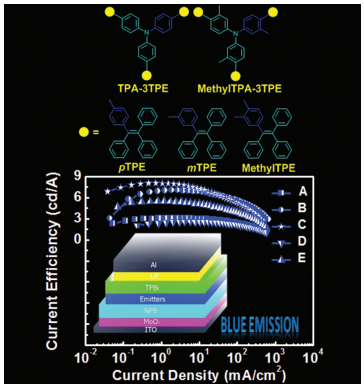
FULL PAPERS

Nonstoichiometry



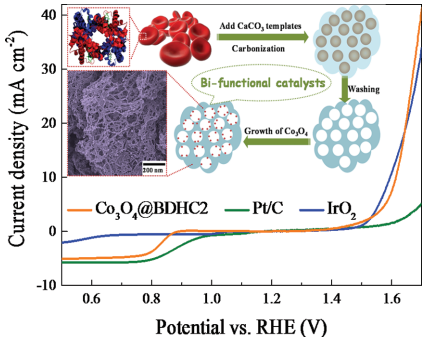
The non-stoichiometry of oxide thin films is systematically controlled by use of DC bias. The suitability of using bias across an electrochemical cell to conveniently and precisely control non-stoichiometry of oxide thin films, in an in situ fashion, and simultaneously monitor these changes by measurement of the chemical capacitance, is confirmed.

Fluorescent Materials

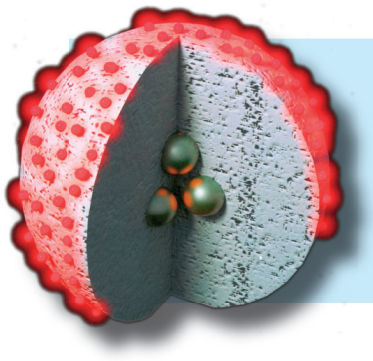


Five hole-dominated blue AIE molecules, constructed from TPA core and TPE derivatives peripheries, are successfully synthesized and serve as hole-transport layers and emitters for non-doped blue OLEDs with current efficiencies up to 8.03 cd A^{-1}. By adopting construction approaches of changing linkage modes and increasing intramolecular torsion together, the conjugation lengths are effectively shortened for ensuring blue emission.

Porous Carbon



A simple, versatile and cheap synthetic route is developed for the preparation of Co_3O_4 decorated blood powder derived foam-like heteroatom doped porous carbon (BDHC). The hybrid performs well as an advanced bifunctional non-precious metal electrocatalyst for oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) in the alkaline medium.



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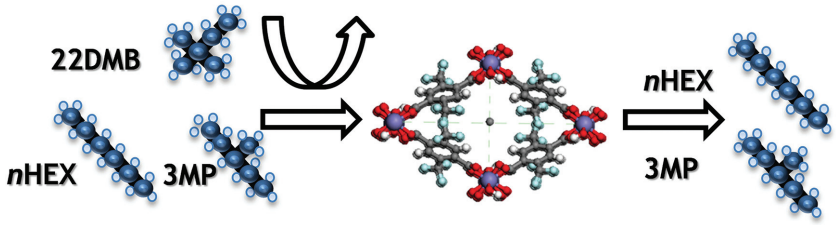
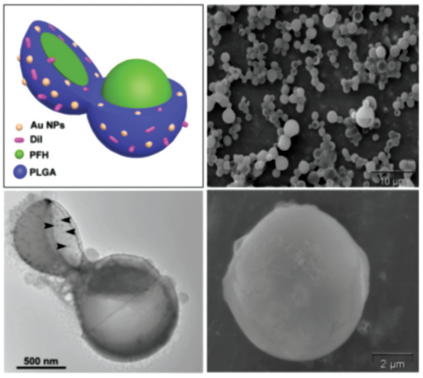
FULL PAPERS

A kinetically controlled molecular sieve separation between the 2,2-Dimethyl-Butane (22DMB) branched alkane isomer from a mixture of paraffins is achieved for the first time using the flexible and functionalized MIL-53(Fe)-$(CF_3)_2$ metal-organic-framework.



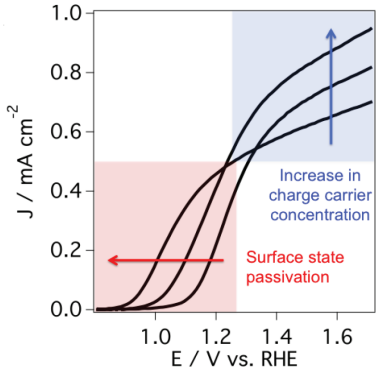
Isomers

PLGA particles containing gold nanoparticles/DiI dye in the shell and perfluorohexane in the core are investigated as intravenous theranostic agents. Upon laser irradiation, the liquid core violently vaporizes into a microbubble, damaging nearby tissue. A tumor region can be selectively targeted in vivo, and the vaporization process verified through an increase in contrast during ultrasound imaging.



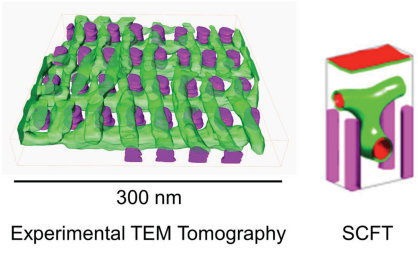
Cancer Theranostics

Impedance spectroscopy reveals new details for efficiency-enhancing modifications of hematite water splitting photoanodes. Suitable underlayers such as Nb_2O_5 and SiO_x dramatically increase the conductivity in hematite ultrathin films, thereby improving the plateau photocurrent, and the photocurrent onset potential is determined by the energetic position and density of surface states, which can be modified by annealing and surface treatments.



Hematite

Understanding the 3D structure of self-assembled block copolymer films is essential to their applications in nanolithography. The 3D microdomain structure of a block copolymer consisting of polydimethylsiloxane cylindrical domains in a polystyrene matrix, templated by posts, is determined by TEM tomography. The cylinders form a cross-point array (left), which is compared with the predictions of self-consistent field theory (right).



Self-Assembly

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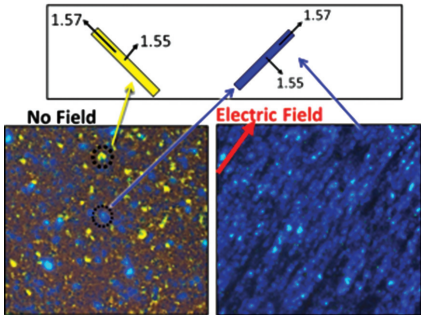
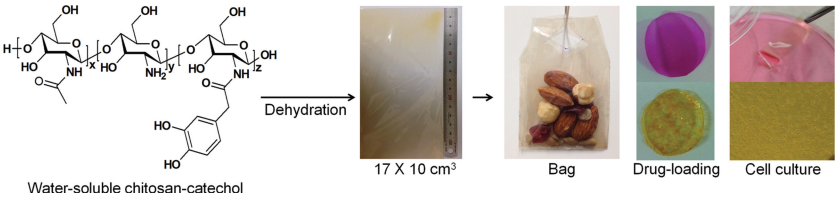
Electric Birefringence



Kinetics of electric field induced alignment of anisotropic particles through the thickness of polymer film is studied using birefringence. Kinetics of alignment is used to determine the processing conditions to create continuous oriented films using roll-to-roll manufacturing process. The directional percolation of these particles enhances thickness properties creating functional films for membranes and flexible electronics.

Polymer Films

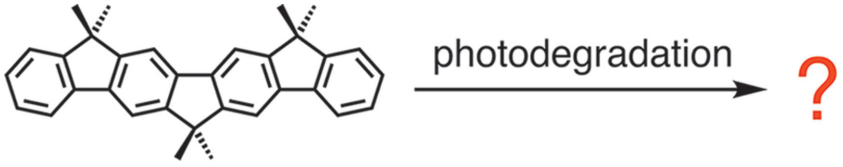
The water-basis, environment-friendly strategy evolutionarily optimized in nature can solve problems shown in the widely implemented petroleum-based olefin materials. Here, the spontaneous formation of water-insoluble, biocompatible microfilms from a water-soluble polymer is demonstrated without using any chemical additives similar to the biological process shown in the insect cuticle formation.



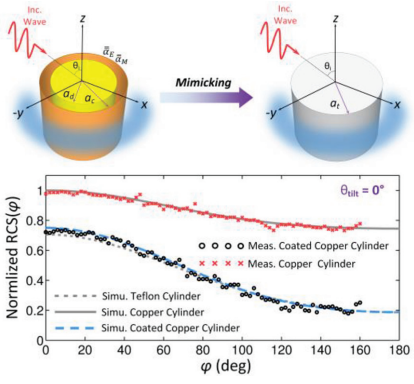
Water-soluble chitosan-catechol

Organic Optoelectronics

Photodegradation in polyfluorenes has traditionally been explained by fluorenone-type defects. Thorough analysis of the photodegradation products of ladder-type quarterphenyl and comparison with separately synthesized, potential ketone products now shows that the observed green emission indeed originates from the introduction of carbonyl groups yet only if associated with an additional disruption of the backbone rigidity and hence planarity of the π-system.



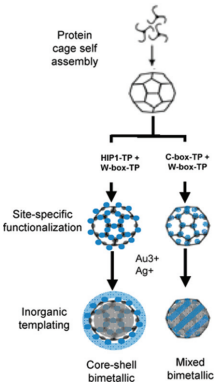
Conformal Coatings



Quasi-three-dimensional and angle-tolerant electromagnetic illusion coatings are proposed, designed, and demonstrated using ultrathin single-layer functional metasurfaces with nonvanishing radial response. The quasi-two-dimensional metasurface coatings transform the electromagnetic perception of one object to mimic that of another which has been pre-selected by the designer. The illusion coating is realized using hundreds of composite electric and magnetic subwavelength unit cells.

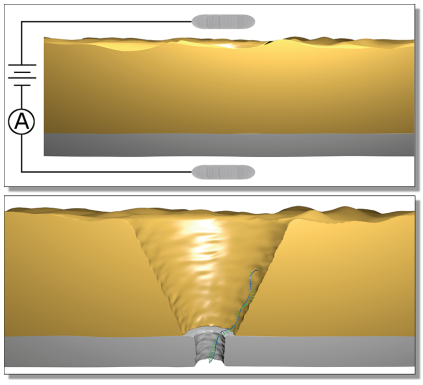
FULL PAPERS

A unique noncovalent biotemplating method is used to localize multiple inorganic species at specific nucleation sites on a single clathrin protein template. The data illustrate that this templating strategy facilitates the synthesis of two types of composite nanostructures based on the location of the nucleation sites: silver–gold mixed bimetallic and silver–gold core–shell nanostructures.



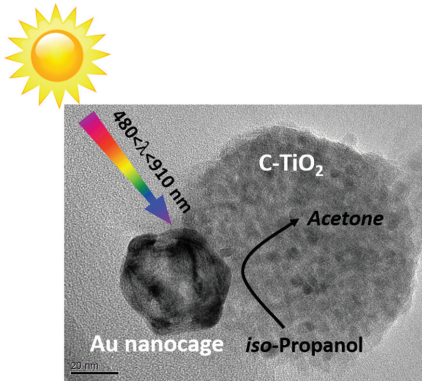
Biotemplates

Controlled breakdown (CBD) is used to fabricate a single nanometer-scale hole, or nanopore, in Au-coated silicon nitride membranes immersed in 1 M KCl and subjected to high electric fields. These metallized nanopores can extend the dwell times of 50-nt ssDNA fragments by as much as two orders of magnitude, by relying on nucleoside-Au interactions.



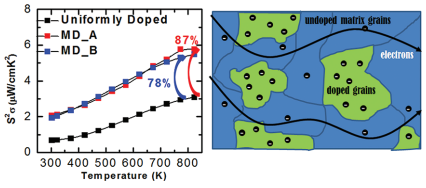
Nanofabrication

A novel and facile approach is developed for preparing asymmetric Janus nanostructures comprising a gold nanocage and carbon–titania hybrid nanoparticles. The microemulsion-based preparation, results in composites with increased plasmon–photon coupling at the interface of the AuNC and C–TiO_2 particle. The amplification of the plasmon–photon coupling leads to enhanced generation of energetic hot electrons for visible-light photocatalysis.



Photocatalysis

Charge carriers swimming in matrix grains free of ionized impurites in undoped region in the notion of modulation doping leads to a significant enhancement on power factor over the uniformly doped counterpart.



Thermoelectrics