ADVANCED FUNCTIONAL MATERIALS

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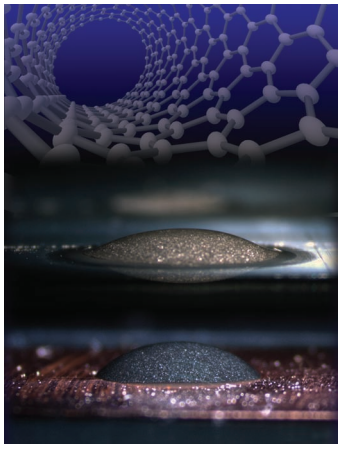
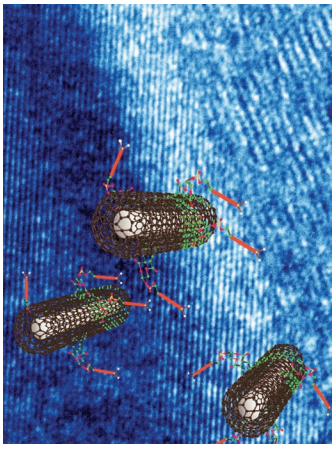


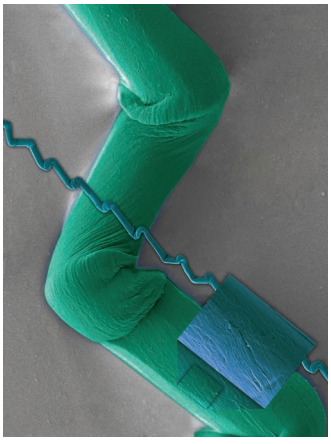
Lithium-Ion Batteries

On page 846, Jiaping Wang and co-workers report carbon nanotube (CNT) current collectors for lithium ion batteries (LIBs). The CNT current collectors with excellent flexibility, extremely low density, and tunable thickness are fabricated by cross-stacking continuous CNT films drawn from super-aligned CNT arrays. Electrodes with CNT current collectors show better wetting, stronger adhesion, lower contact resistance, greater mechanical durability, and higher energy density than those with metal current collectors, suggesting CNT films as a promising type of current collector for lightweight and flexible LIBs.

Iron Nanowires

Ferromagnetic nanowires (NWs) encapsulated by a fine graphitic coating form vectors for nanorobotic drug delivery, as reported on page 823 by Salvador Pané and co-workers. The coating protects the NWs from degradation, reduces the possibility of toxicity from the NWs, and provides a platform for functionalization with therapeutic molecules. Fe NWs can be wirelessly manipulated with magnetic fields and field gradients. The nanorobots are functionalized with the model drug rhodamine B and are manipulated in a controlled way.





Flexible Composites

Stretchable conductors based on buckled carbon nanotube (CNT) fibers are fabricated using a simple prestraining-then-buckling approach. The primary deformation mode of the CNT fibers is lateral kinking. This buckling shape is quite different from the sinusoidal shape observed previously in systems that are otherwise similar. As reported by Tsu-Wei Chou and co-workers on page 789, the prepared CNT fiber/poly(dimethylsiloxane) (PDMS) composite film shows excellent stability and repeatability in performance as a stretchable conductor.

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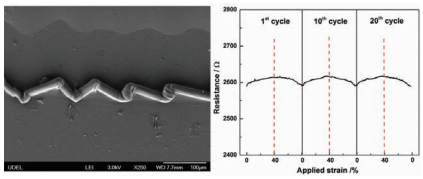
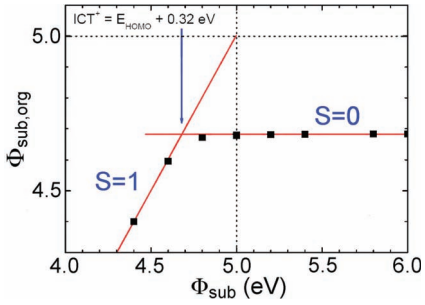
Carbon Nanotubes



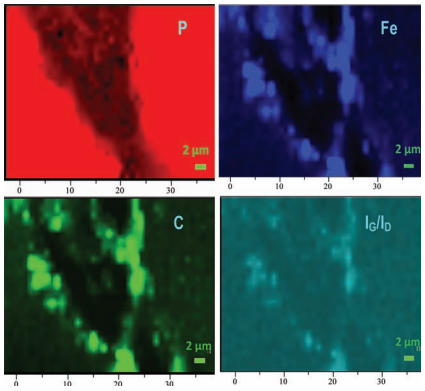
Stretchable conductors based on buckled carbon nanotube (CNT) fibers are fabricated by a simple prestraining-then-buckling approach. The primary deformation mode of the CNT fibers is lateral kinking. This buckling shape is quite different from the sinusoidal shape observed previously in otherwise similar systems. The prepared CNT fiber/polydimethylsiloxane composite film shows excellent stability and repeatability in performance as a stretchable conductor.

Organic Electronics



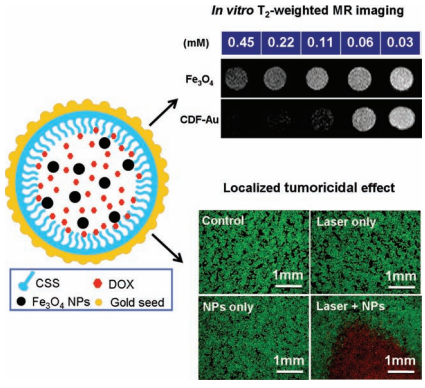
A model that describes the universal energy alignment of organic molecules on metal oxides is developed. The approach explains why the level alignment is rather independent of the experimental details, such as the electronic structure of the oxide, defects in the oxide, and the thickness of the oxide and the overlayer.

Lithium-Ion Batteries



A local visualization study of the influence of impurity phases on carbon coating for $LiFePO_4$ is presented. It is demonstrated that a phosphorus-rich phase has an inhibiting effect (or no positive catalytic effect) on carbon formation, while iron-rich phases (mainly iron phosphides) promote carbon growth by contributing to more carbon deposition and a higher graphitic-carbon content.

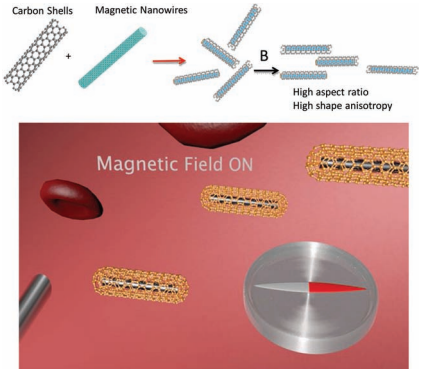
Bionanotechnology



A novel multifunctional drug-delivery platform based on gold-shell nanomicelles loaded with doxorubicin and Fe_3O_4 nanoparticles is fabricated to combine magnetic resonance (MR) imaging, magnetic-targeted drug delivery, light-triggered drug release, and thermotherapy into one system simultaneously. Such nanomicelles can be developed as a smart and promising nanosystem that integrates multiple capabilities for effective cancer diagnosis and therapy.

FULL PAPERS

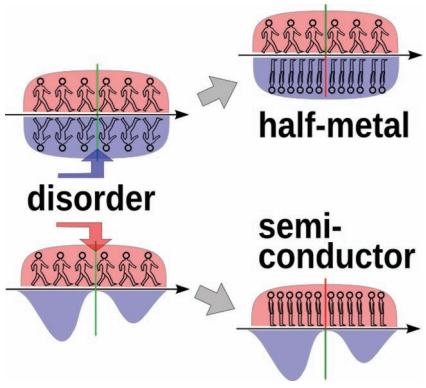
Graphite-coated nanomagnets are successfully manipulated in a simulated body fluid environment using a 5-DOF electromagnetic system. The nanomagnets are fabricated in batch by template-assisted deposition. Iron nanowires are electrodeposited in an alumina template and subsequently coated with high quality graphitic shells using chemical vapor deposition. This approach enables having both arrays of graphite-coated ferromagnetic nanowires as well as potential drug-delivery nanovectors.



Nanomagnets

Graphite Coating of Iron Nanowires for Nanorobotic Applications: Synthesis, Characterization and Magnetic Wireless Manipulation

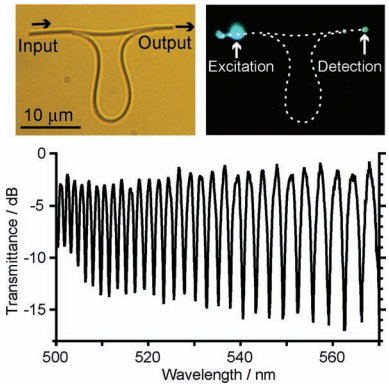
A new scheme dedicated to improving spin-transport characteristics by applying random disorder as a constructive agent is reported. This leads to novel systems with a surprising combination of properties: half-metals with no net magnetization and magnetic semiconductors.



Magnetic Materials

Improving Spin-Transport by Disorder

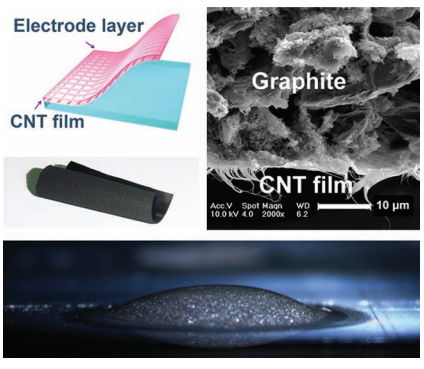
Ultracompact asymmetric Mach–Zehnder interferometers are fabricated using self-assembled nanofibers of thiacyanine dye that propagate exciton polaritons. The devices with a footprint of only ≈20 μm × 20 μm exhibit a visibility of nearly unity and function as high-performance channel drop filters for the visible wavelength region. The results demonstrate the remarkable potential of polariton-based miniaturized photonic circuits.



Photonics

Ultracompact Asymmetric Mach–Zehnder Interferometers with High Visibility Constructed from Exciton Polariton Waveguides of Organic Dye Nanofibers

Carbon nanotube (CNT) current collectors with excellent flexibility and extremely low density are fabricated by cross-stacking continuous CNT films drawn from super-aligned CNT arrays. The graphite-CNT electrodes show greater mechanical durability, lower contact resistance, and more than 180% improvement in gravimetric energy density than the graphite-Cu electrodes, suggesting CNT films as a promising type of current collector in flexible lithium ion batteries.



Carbon Nanotubes

Super-Aligned Carbon Nanotube Films as Current Collectors for Lightweight and Flexible Lithium Ion Batteries

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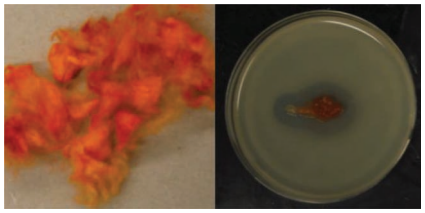
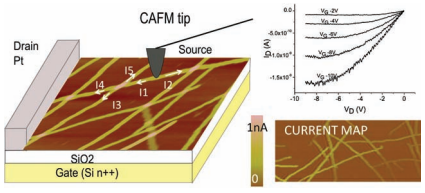
FULL PAPERS

Drug Delivery



Silk biomaterials represent a novel, customizable platform for focal antibiotic delivery with advantageous properties including biocompatibility, tunable biodegradation rate, stabilizing effects, water-based processing, and diverse material formats. Injectable and implantable antibiotic-releasing silk biomaterials (including hydrogels, microspheres, films, nanofilm coatings, and antibiotic-loaded fibers) repress local bacteria growth in vitro and in vivo.

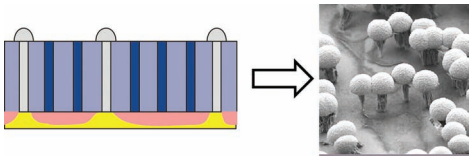
Nanofibers

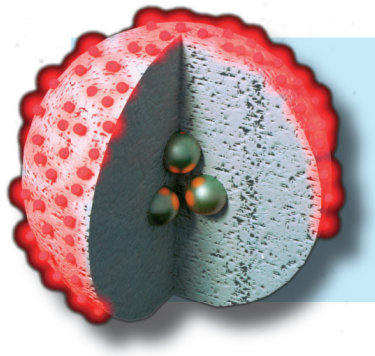


A transistor is developed in which one of the electrodes is the mobile conductive AFM tip. This device allows for the measurement of the hole mobility in one single conjugated polymer nanofiber and the detailed observation of the current distribution in a web of nanofibers, leading to the conclusion that the interfiber transport is not reducing the charge transport. The structure of nanofibers bridging points is discussed.

Lithography

An efficient strategy to produce forests of aligned nanowires and nail-like microstructures, whose density can be tuned in a broad range, is reported. It combines electrodeposition in nanoporous sacrificial templates and partial masking of a surface with a self-assembled colloidal monolayer. The fabrication of omniphobic surfaces comprised of metal micronails whose density is varied to approach high contact angles is demonstrated.





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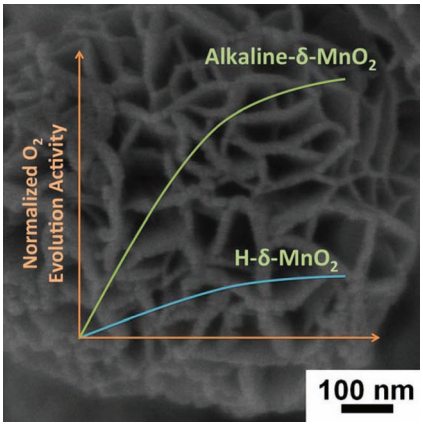
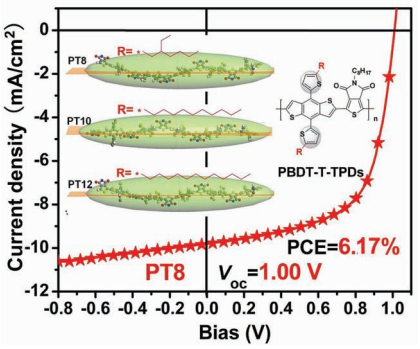
FULL PAPER

Alkaline-cation-containing δ-MnO_2 nanosheets and nanoparticles are fabricated, and both exhibit a high catalytic activity in visible-light-driven water oxidation. The alkaline-cation-containing δ-MnO_2 exhibit activities per surface site approximately one order magnitude higher than a H-δ-MnO_2 catalyst with a similar morphology and crystal structure. The alkaline cations are not directly involved in the catalytic water oxidation, but stabilize the MnO_2 layers.



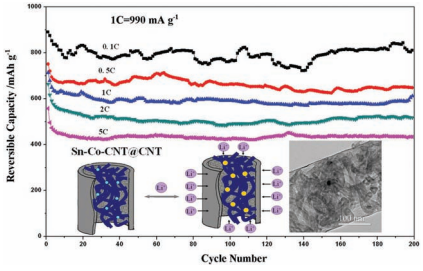
Photocatalysis

A large-bandgap material for polymer tandem solar cells is designed by modifying a series of polymers containing a BDT-TPD backbone by the incorporation of different alkylthienyl side chains. Experimental results and theoretical calculations prove that the size and topology of the alkyl chains can fine-tune the polymer solubility, highest occupied molecular orbital energy level, and intermolecular packing by affecting the molecular coplanarity.



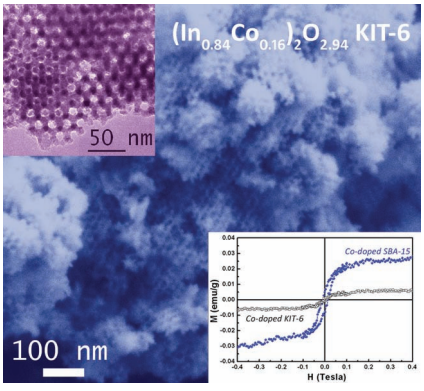
Photovoltaics

A new Sn-Co-CNT@CNT tube-in-tube electrode nanostructure is designed and fabricated in this work. A large amount of small carbon nanotubes (CNTs) (≈25 nm) with supported Sn-Co nanoparticles are filled inside a large CNT (≈200 nm). This composite exhibits highly stable large capacities at both small and high current rates, which is mainly ascribed to the unique tube-in-tube electrode structure.



Carbon Nanotubes

3D transition metal (TM = Co, Fe, Mn)-doped In_2O_3 oxide architectures are obtained by hard templating from mesoporous SBA-15 and KIT-6 silica hosts. The TM cations enter the lattice of the bixbyite In_2O_3, rendering mesoporous dilute-oxide magnetic semiconductors with compositions $(In_{1-x}TM_x)_2O_{3-y}$. The obtained materials exhibit a mixed ferromagnetic-paramagnetic behavior and have potential applications in spintronics.



Magnetic Materials