ADVANCED FUNCTIONAL MATERIALS

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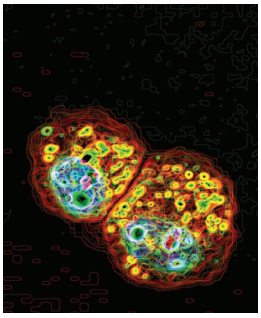
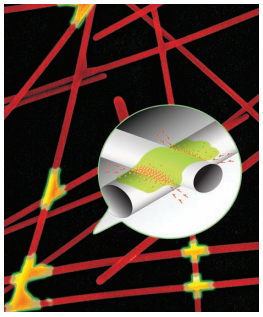


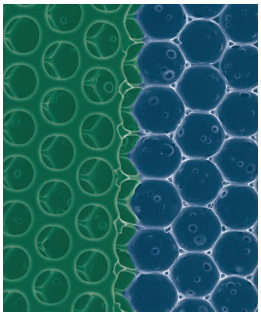
Tumor Targeting

Engineered siRNA-peptide nanoparticles are presented on page 4183 by J. Conde, F. Tian, and co-workers as armed soldiers to combat cancer, and with tools to inhibit the traitor soldiers (tumor-associated macrophages) that join the cancer forces to abolish the body's retaliation mechanism. Potent delivery of these weapons results in efficacious abrogation of an aggressive lung cancer in a mouse model with substantial increase in survival rate. (Credit: João Conde)

Optoelectronics

Welding the nanowire junctions is an effective strategy for reducing sheet resistance and improving operational stability of flexible nanowire electrode in practical applications. On page 4211, W. C. H. Choy and team develop a simple alcohol-based chemical post-treatment on silver nanowires for forming locally welded silver nanonetwork electrode, without any assistance of heat, light, electrical current, nor mechanical pressure.



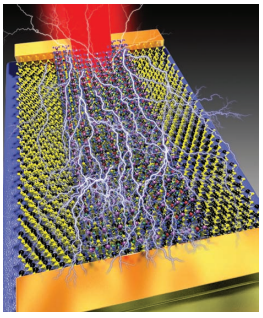


Liquid Manipulation

On page 4195 J. Kamei and H. Yabu create a superrepellent surface with programmable wetting property that enables the collection of liquid droplets, transport along a pre-programmed path, and manipulation on-demand. This new technology opens the path for a new generation of omniphobic surfaces with potential application as antifouling medical coatings, water harvest and transport technology, and on-demand 2D microfluidic for lab-on-a-chip.

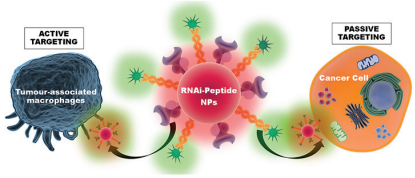
Photodetectors

High-performance transition metal dichalcogenide photodetectors are enhanced by self-assembled monolayer (SAM) doping. On page 4219, J.-H. Park and colleagues show how the photoresponsivity of WSe_2 and MoS_2 photodetectors is dramatically improved as a result of the enhancement of transition metal dichalcogenides optical properties by SAM doping. This is also investigated in detail through photoluminescence analysis.



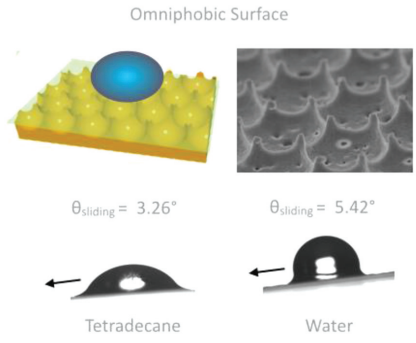
FULL PAPERS

Immunomodulation using RNA interference (RNAi) nanoparticles against tumor associated immune cells and cancer cells at the same time is presented. Using a multi and long-term dosing system, the administration of RNAi nanoparticles targeting tumor associated macrophages substantially reduces the recruitment of these inflammatory immune cells in lung tumor tissue, reduces tumor size (≈95%), and increases animal survival (≈75%) in mice.



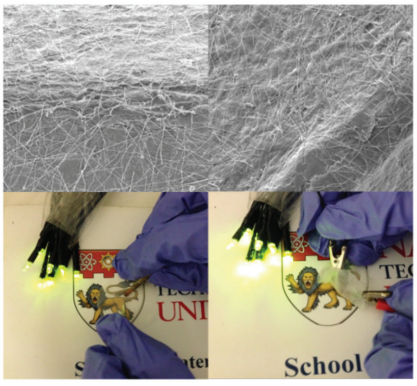
Tumor Targeting

On-demand control of liquids is realized by using elastic, patterned omniphobic surfaces composed of fluorinated polybutadiene porous films infused with a fluorinated lubricant.



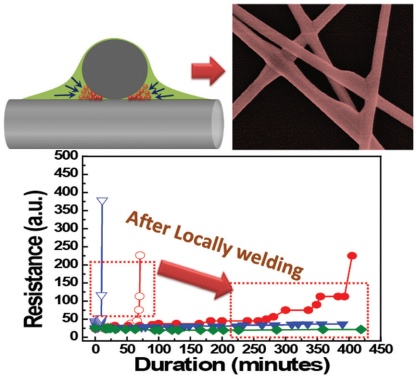
Liquid Manipulation

A facile nanopaper transfer strategy is developed for foldable transparent conductors of high quality. Electrochromic nanopaper that maintains a stable performance under repeated folding is demonstrated. The exceptional surface properties of nanocellulose endow a stable cycling and efficient coloration with the electrochromic device. The nanopaper transfer technique creates new opportunities for the next generation deformable electronics.



Foldable Electronics

A simple alcohol-based solution approach is proposed to weld crossed silver nanowires through a locally chemical welding pathway without any assistance of heat, light, electrical current, or mechanical pressure. In addition, silicon dioxide nanoparticles are used for filling the voids among the nano-networks to depress electrical shorting and enable their application in organic solar cells.



Optoelectronics

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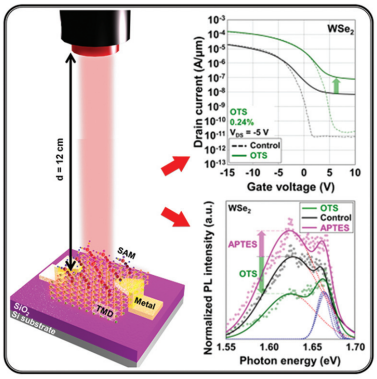
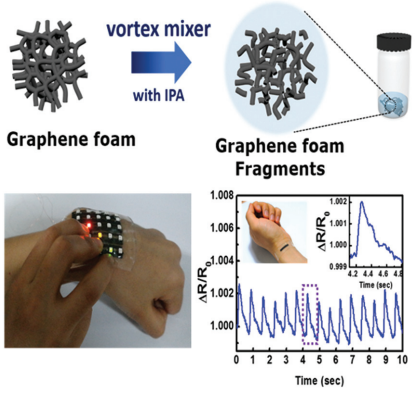
Optoelectronics



High-performance transition metal dichalcogenides (TMD) photodetectors are enhanced by self-assembled monolayer (SAM) doping. The photoresponsivity of WSe_2 and MoS_2 photodetectors is improved by a factor of ≈28.2 (with OTS p-doping) and ≈26.4 (with APTES n-doping), respectively. These improvements are attributed to the enhancement of TMD optical properties by SAM doping and this is also investigated in detail through photoluminescence analysis.

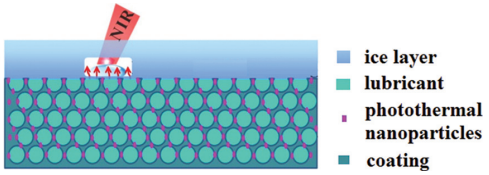
Wearable Electronics

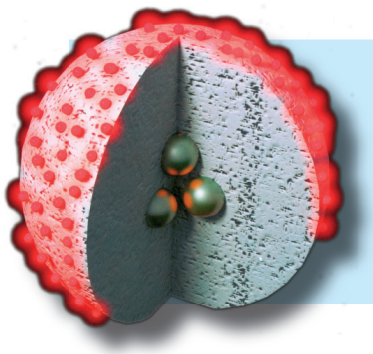


A highly stretchable and sensitive strain sensor based on a composite of fragmentized graphene foam (FGF) and polydimethylsiloxane (PDMS) is fabricated in a facile process. The FGF/PDMS sensor demonstrates high stretchability up to 70% and high durability over 10 000 stretching cycles with gauge factor in the range of 15–29 depending on the maximum strain applied and the FGF content.

Ice Removal

Self-lubrication and photothermogenesis are integrated into a coating for excellent anti-icing and remote deicing application. The frosting and icing process are significantly delayed. Highly efficient photothermogenesis allows rapid melting of ice accumulated on the surface.





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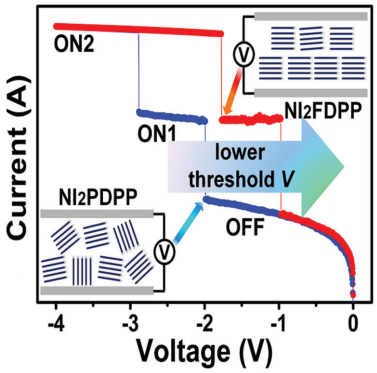
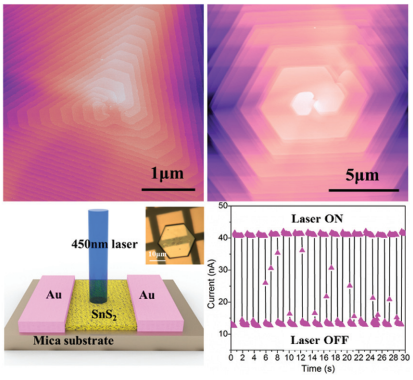
FULL PAPERS

Organic multilevel memory device has proven effective to achieve high-density data storage. Especially with this device comprising vertically arranged electrodes, a strategy of inducing highly oriented crystallite arrangement is desirable. This study reveals that through tuning molecular planarity, the crystallite packing can be efficiently controlled to obtain the favorable orientation that facilitates high-performing and reproducible multilevel memory effects.



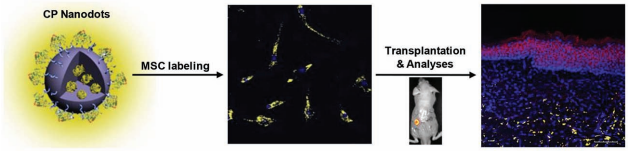
Data Storage

Large scale of 2D SnS_2 crystals are successfully synthesized on mica substrates. Detailed characterizations reveal that the as-synthesized 2D crystals follow a screw-dislocation-driven spiral growth fashion. Photoresponse study of these 2D SnS_2 crystals demonstrates their potential as a promising building block for high-performance optoelectronic devices.



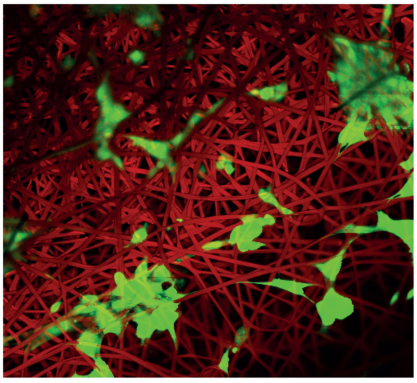
Semiconductors

Conjugated polymer (CP) nanodots act as noninvasive fluorescent trackers for long-term in vivo tracking of transplanted mesenchymal stem cells to understand the mechanism in skin regeneration. Considering the merits of good fluorescence stability and negligible interference with stem cell properties, CP nanodots hold promising potential as efficient exogenous trackers to answer crucial questions in stem cell therapies.



Regenerative Medicine

A biocompatible and angiogenic scaffold that emits in the near infrared region range is fabricated by electrospinning of the luminescent low bandgap polymer TQ1. The scaffold can be visualized in tissue using noninvasive fluorescence and lifetime imaging, which facilitates tracking of the material when implanted. The scaffold demonstrates excellent biocompatibility, tissue integration, and stimulates formation of blood vessels within the implant.



Tissue Regeneration

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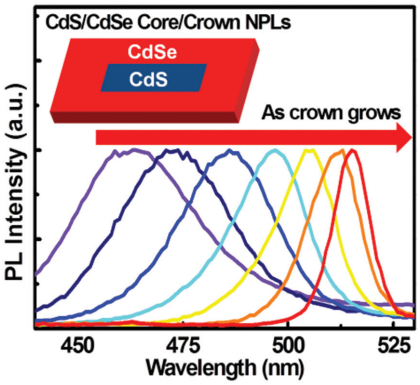
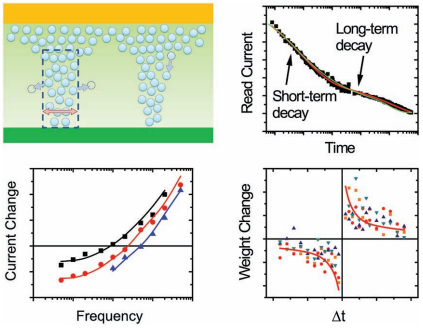
Semiconductors



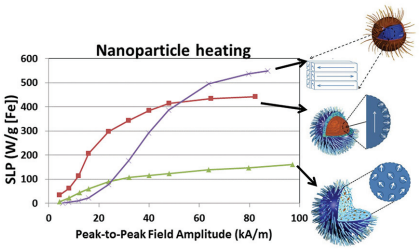
Continuously tunable photoluminescence in a model platform of inverted core/crown nanoplatelets is demonstrated with a tunability range of 90 nm. The unique continuous tunable emission is achieved by controlling the lateral width of the CdSe crown around the seed CdS nanoplatelet template because of the finely tuned lateral quantum confinement in the crown region additional to the pure vertical confinement.

Memristive Systems



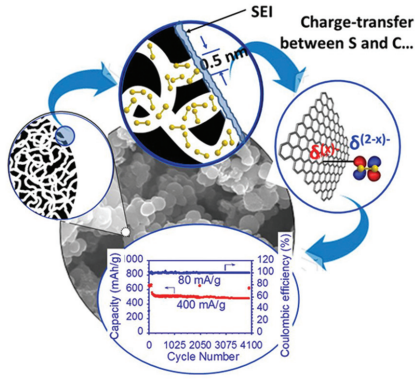
Internal dynamics of oxide memristors allow the device to implement different rate- and timing-dependent plasticity rules naturally in a biorealistic fashion with simple, nonoverlapping spikes.

Magnetic Nanoparticles



Internal magnetic properties of nanoparticles hold key for medicine. This study focuses on the dramatic differences observed among the specific loss power of three magnetic iron oxide nanoparticle constructs having comparable size and chemical composition. The results challenge the prevailing concepts in hyperthermia which limit consideration to size and shape of magnetic single domain nanoparticles.

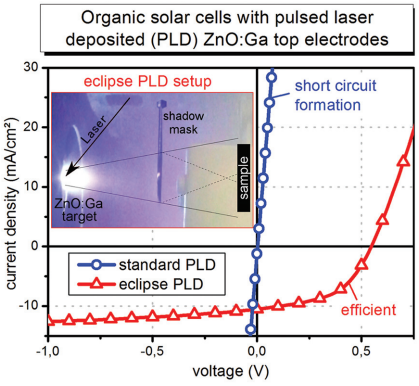
Batteries



A new sulfur chemistry is created with the sequestration of short-chain sulfur species into subnanometer cavities and the charge delocalization between them and the carbonaceous host. Highly reversible capacities achieved at almost 100% Coulombic efficiency over 4020 cycles are demonstrated. This new charge/discharge mechanism opens up new possibilities for designing nanostructured cathode materials for rechargeable Li/S battery chemistry.

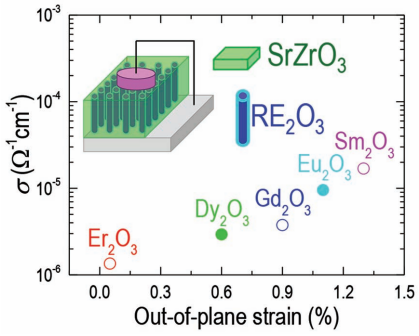
FULL PAPERS

ZnO transparent topelectrodes are successfully deposited onto evaporated small molecule organic solar cells by eclipse pulsed laser deposition (PLD). The damage-free deposition is achieved by variation of the target composition (Ga content), the chamber background gas (O_2, N_2, Ar) and pressure, and the PLD parameters, including distance and substrate shadowing (eclipse PLD). Thus, PLD enables the deposition of TCO materials onto sensitive organic devices.



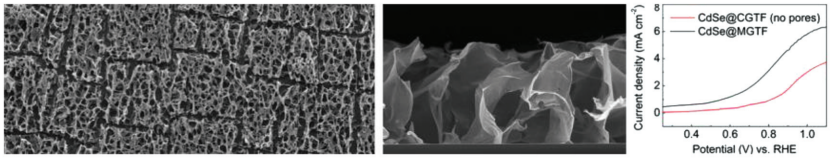
Organic Photovoltaics

It is shown that the ionic conductivity in vertical nanocompositeheteroepitaxial films of $SrZrO_3$–RE_2O_3 can be tuned and strongly enhanced using embedded, stiff, and vertical nanopillars of RE_2O_3 (RE = Sm, Eu, Gd, Dy, and Er). This is attributed to proportional increase of tensile strain in $SrZrO_3$ with increasing lattice constant of RE_2O_3 from Er_2O_3 to Sm_2O_3.



Ion Transport

Macroporous graphene thin films (MGTFs) that combine the features of 2D graphene films (being transparent) and 3D porous monoliths (being porous) are fabricated. The MGTFs can be used as porous electrode for electrochemical deposition of nanoparticles such as Pt and CdSe. The macroporous structures lead to enhanced performance in ORR and photoelectrochemical H_2 generation.



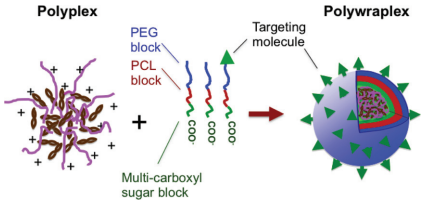
Graphene

A novel bactericidal silver/reduced graphene oxide (Ag/rGO) hydrogel with well-dispersed Ag nanoparticles and controlled porous rGO network is synthesized by an environment-friendly one-pot hydrothermal reaction. The highly porous Ag/rGO hydrogel exhibits excellent antibacterial performance when it is used to filter real impaired water driven only by gravity, inactivating more than 94% of *Escherichia coli* cells and around 99% of coliforms.

Water Treatment

FULL PAPER

Cell Targeting



This report demonstrates an easy-formulating core-shell structured carrier for nucleic acids, comprising a polyplex core of any content and triblock copolymer membrane to encapsulate, protect, and direct the nucleic acid materials such as siRNA to target cells without pre-phagocytic leaking, degradation, and disassembly.