ADVANCED FUNCTIONAL MATERIALS

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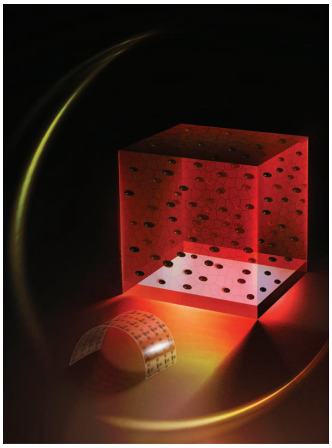
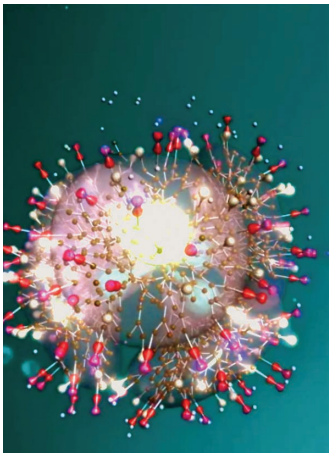


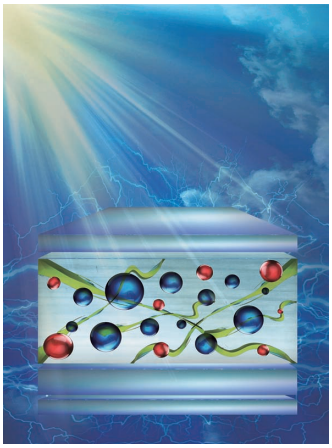
Memory

On page 1372, H. N. Alshareef and co-workers demonstrate high-performance polymer memory fabricated using blends of ferroelectric P(VDF-TrFE) and highly insulating poly(p-phenylene oxide). The films spontaneously phase separate into amorphous PPO nanospheres embedded in a semicrystalline P(VDF-TrFE) matrix. These blend devices display highly improved ferroelectric and dielectric performance with low dielectric losses, enhanced thermal stability (up to ≈353 K), excellent polarization fatigue (80% retention after 106 cycles), and high dielectric breakdown fields (≈360 MV/m).

Dendrimers

The nano brain created by S. Ghosh, A. Bandyopadhyay, and co-workers is a single cell gygote which can sense the environment around it. At just 7 nm, it has sensors (white balls on the surface), the ability to analyse and make decisions (sea green computing device) and to respond (red molecular machines). This cell, described on page 1364, can grow continuously into a series of complex structures to form a brain-jelly made to use in a Robot's brain.





Solar Cells

A solar cell device under sunlight irradiation is shown by Y.-J. Cheng and co-workers. The device contains a photoactive layer which can efficiently absorb the light. There are three components in the active layer: the green flying ribbons represent the p-type poly3-hexylthiopehene polymers, while the blue shining balls represent the n-type PC61BM, and the red balls are the other PCBM-based fullerene material, functionalized with pentafluorophenyl groups. The device is described in detail on page 1418.

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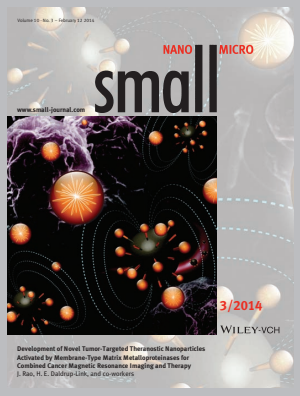

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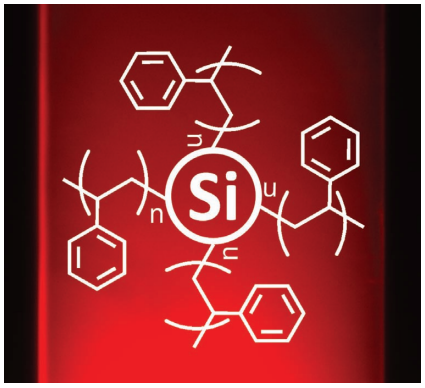
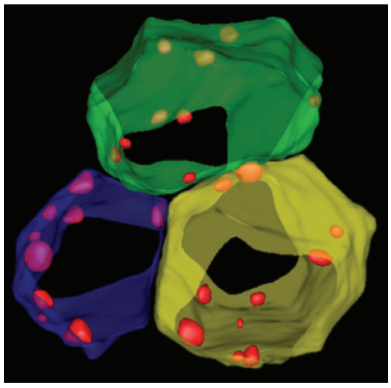
FULL PAPERS

Hybrid Materials



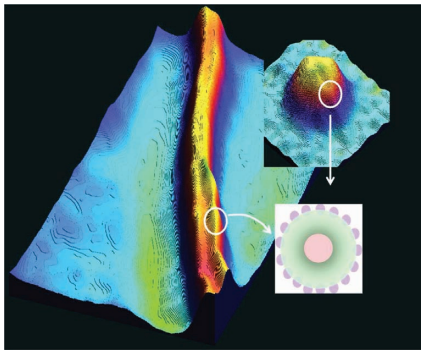
Highly luminescent, solution processable silicon nanocrystals/polystyrene hybrid materials are synthesized using size-independent radical-initiated hydrosilylation. Combining the properties of nanocrystals with polymer significantly increases solubility and processability, provides the opportunity to fabricate uniform nano- and microscale architectures, and renders silicon particles chemically resistant to prolonged exposure to strongly basic conditions.

Water Treatment



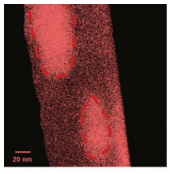
Delicate γ-Fe_2O_3 @ macroporous silica composites with well-dispersed small γ-Fe_2O_3 nanoparticles and open pore networks are fabricated as efficient arsenic adsorbents. Electron tomography technique confirms that iron oxide nanoparticles are spatially separated and anchored on the pore walls. Spatially well-dispersed small nanopartilces and open pore networks make composites promising for both As (III) and As (V) removal.

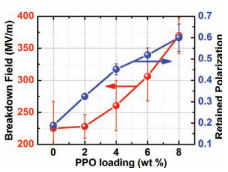
Dendrimers



The doped molecules inside a dendritic box control 32 molecular rotors on the surface of the dendrimer and trigger chain-reaction of supramolecular structures, nanometer to milli-meter scale by harnessing electrical or optical energy. The communication pathway between molecular rotor, dendritic core molecule, and the dendrimer is identified as a non-chemical route for programming giant supramolecular architectures via molecular programming.

Memory





High-performance polymer ferroelectric memory is fabricated using blend films of ferroelectric P(VDF-TrFE) and highly insulating polyphenylene oxide (PPO). The morphology consists of phase-separated nanospheres of amorphous PPO, surrounded by a ferroelectric P(VDF-TrFE) matrix. The devices are relatively smooth and display improved ferroelectric and dielectric performance with enhanced thermal stability, fatigue endurance, and dielectric breakdown fields.

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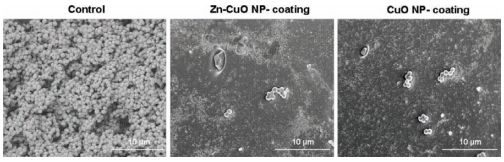
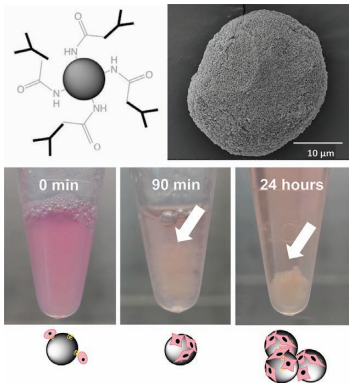
FULL PAPERS

Antibiofilm properties of Zn:CuO and CuO nanoparticle coatings. High-resolution scanning electron microscopy (HR-SEM) imaging of *S. mutans* biofilms on coated and uncoated teeth are shown. Biofilms are grown for 24 h at 37 °C. No *S. mutans* biofilm formation is observed on nanoparticle-coated teeth (with Zn:CuO and CuO nanoparticles) as compared to the control, uncoated teeth.



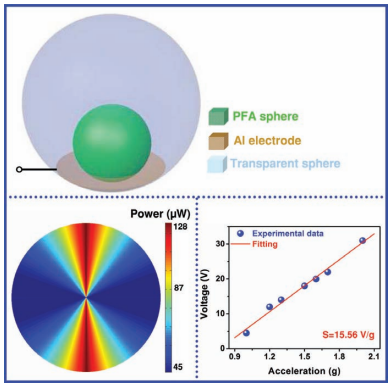
Antibacterials

The utility of functionalized microparticles as a strategy to form instructive cell microenvironments is demonstrated. Microparticles are modified with antibodies, to target specific growth factors. These particles promote the assembly into a stable 3D construct triggered by the presence of stem cells. The obtained construct simultaneously provides support for cell proliferation, as well as localized and sustained presentation of factors to modulate cell function.



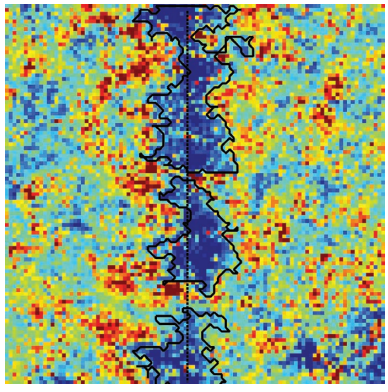
Regenerative Medicine

A spherical three-dimensional triboelectric nanogenerator (3D-TENG) with a single electrode is designed. The rationally developed 3D-TENG can effectively scavenge ambient vibration energy in full space. Moreover, the TENG is utilized to design the self-powered acceleration sensor.



Nanogenerators

A decrease in the nonlinear piezoelectric response is observed in the vicinity (720–820 nm) of the 24° tilt grain boundary. It is proposed that the elastic strain field at the grain boundary interacts with the ferro-electric/elastic domain structure, stabilizing (101)/($\bar{1}$01) rather than (011)/(0$\bar{1}\bar{1}$) type domain walls, which inhibits domain wall motion under applied field and decreases non-linearity.



Piezoelectrics

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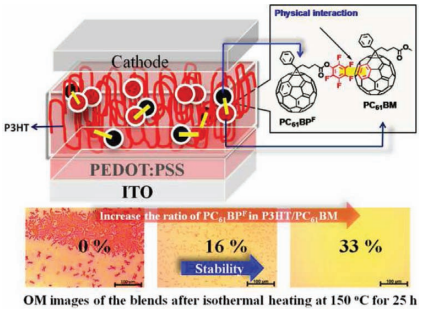
Solar Cells

Morphological Stabilization by Supramolecular Perfluorophenyl-C_{60} Interactions Leading to Efficient and Thermally Stable Organic Photovoltaics

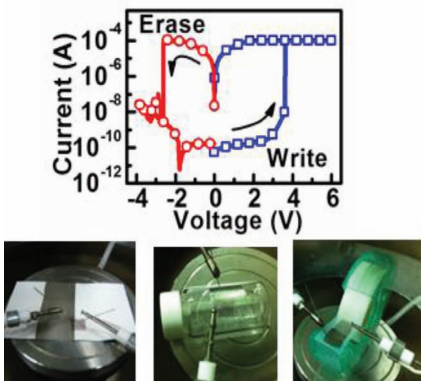


OM images of the blends after isothermal heating at 150 °C for 25 h

A new $PC_{61}BM$-based fullerene, [6,6]-phenyl-C_{61} butyric acid pentafluorophenyl ester ($PC_{61}BP^F$) is presented. Supramolecular attraction between the pentafluorophenyl group of $PC_{61}BP^F$ and the C_{60} cores of $PC_{61}BP^F/PC_{61}BM$ can effectively suppress the n-type $PC_{61}BP^F/PC_{61}BM$ materials from severe aggregation to mitigate the morphological evolution and preserve the device performance.

Organic Electronics

Rewritable, Moldable, and Flexible Sticker-Type Organic Memory on Arbitrary Substrates

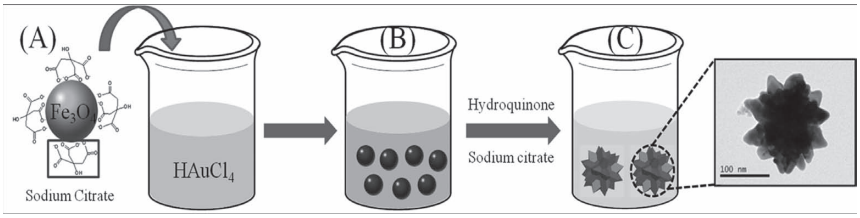


The first reprogrammable sticker-type organic memory is successfully demonstrated. The erasable sticker-type organic memory with a ready-to-conduct graphene electrode underlying can be easily molded onto arbitrary substrates and functions normally. It is believed that the newly designed sticker-type organic memory with reprogrammable feature may greatly broaden organic memory applications and advantage for the development of future soft electronic systems.

Nanoparticles

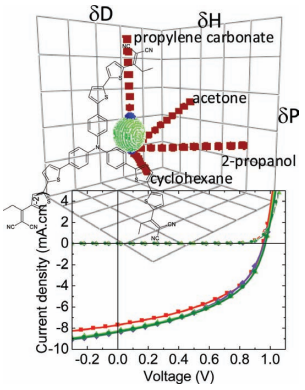
Self-Assembly Mechanism of Spiky Magnetoplasmonic Supraparticles

Synthesis of nanoparticles with uncommon non-Platonic shapes is only vaguely understood, however, such particles with concave shapes demonstrate a variety of unique chemical, optical, and biological properties. In this work, the spiky colloidal particles can be successfully made by self-assembly. This makes it possible to combine different materials and results in the first example of spiky magnetoplasmonic supraparticles.



Organic Photovoltaics

Solubility Based Identification of Green Solvents for Small Molecule Organic Solar Cells



The binary solvent gradient method is used to determine the Hansen solubility parameters (HSP) of a star-shaped D-π-A small molecule and a fullerene derivative. The HSPs are used to predict suitable green formulations to successfully replace halogenated solvents in solution-processed active layer in bulk heterojunction photovoltaic devices.

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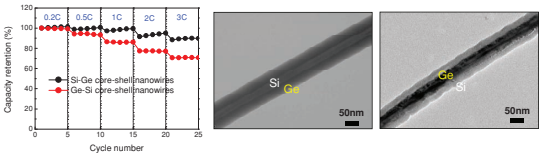
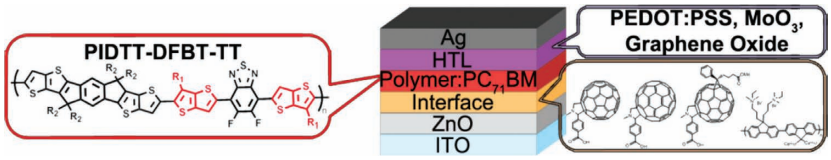
Si-Ge and Ge-Si core–shell nanowires are synthesized to systematically study the structural effect of Si-Ge heterogeneous nanostructures on both mechanics and kinetics through theoretical analysis and detailed experimental results. The Si-Ge core–shell nanowires show a much improved electrochemical performance, especially cycle performance and rate capability, compared to those of the Ge-Si core–shell nanowires electrode.



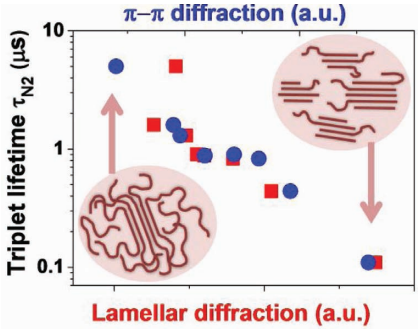
Charge Transport

Highly efficient inverted solar cells are produced through a combination of material and device engineering. Structural optimization of an indacenodiethieno[3,2-b] thiophene-based polymer is achieved through incorporation of a alkylthieno[3,2-b] thiophene π-bridge. The new polymer exhibits high efficiencies in inverted solar cells utilizing a ZnO layer modified with a fullerene-based self-assembled monolayer in conjunction with a graphene oxide-MoO_3 hole-transporting layer.



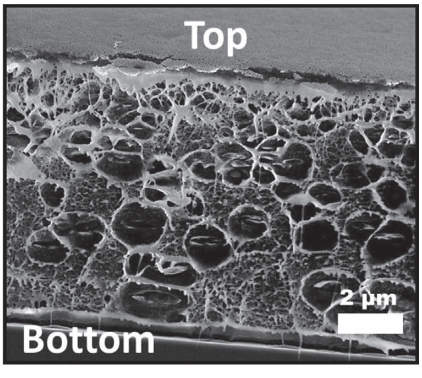
Conjugated Polymers

Triplet lifetime is found to strongly correlate with relative material crystallinity for a broad range of semiconducting polymers, with more amorphous/disordered polymer films exhibiting longer triplet lifetimes.



Organic Photovoltaics

Thin films with porosities spanning from the nanoscopic to the macroscopic are obtained by combining breath figures (BFs) with the nanoscopic morphology inherent to block copolymers. The hydrophilicity of the blocks is found to be critical in defining the structure of the film.



Polymeric Films

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