ADVANCED FUNCTIONAL MATERIALS

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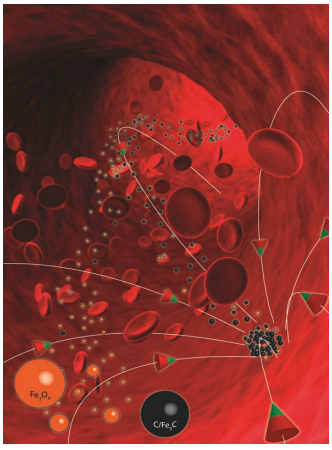
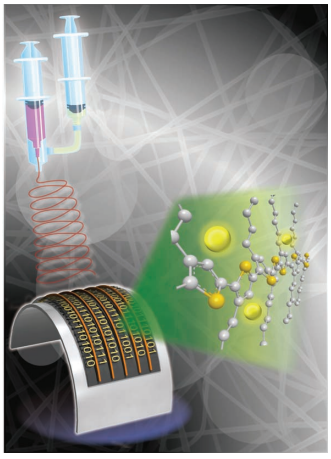


Magnetic Nanoparticles

High magnetic responsiveness is critical for nanomagnets in biomedicine, and fast and complete separation is essential for blood purification or targeted drug delivery, to diminish potential risks. However, studies on the collection efficiency of iron-based nanoparticles are rare. On page 4888, W. J. Stark and co-workers present a new quantification approach based on platinum doping of magnetite and carbon-coated cementite nanoparticles. Their findings show that a good separation efficiency from human whole blood calls for nanomaterials with high saturation magnetizations.

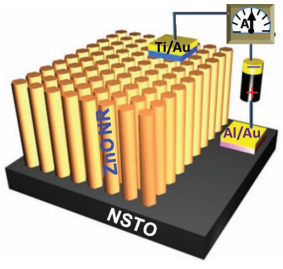


Flexible Transistors

Electrospun P3HT:Au hybrid nanofibers are employed by W.-C. Chen and co-workers to fabricate a nonvolatile transistor memory device. On page 4960, using hybrid semiconducting nanofiber as channels and functionalized Au nanoparitcles as potential wells, it is demonstrated how charges can be stored or erased. The controllable storage density of high-performance hybrid nanofiber devices could be used in future plastic information storage.

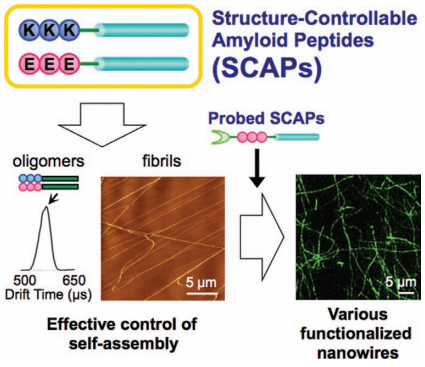
Nanomaterials

X. W. Sun, T. Wu, and co-workers create an optically reconfigurable resistive switching diode on page 4977. This Schottky diode is created by growing ZnO nanorods onto single crystals of Nb-doped $SrTiO_3$, in solution, at a low temperature. The resulting versatile heterojunction displays persistent photoconductivity and light-controlled resistive switching behavior, and its ON and OFF memory states are highly tunable.



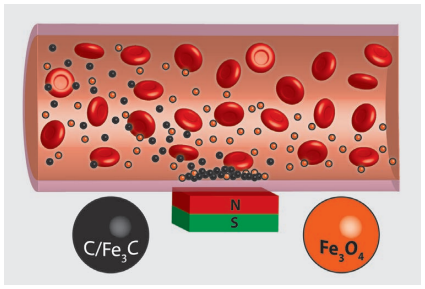
FULL PAPERS

Self-Assembly



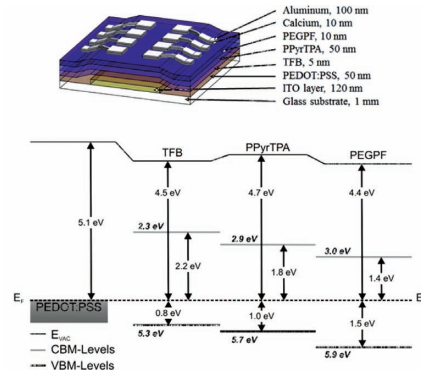
Straightforward preparation of various functionalized or inorganic nanowires can be achieved by a very simple method based on mixing structurally related modified amyloid peptides, which allows effective control of self-assembly. The peptides contain three-amino-acid-residue units that provide remarkable control during the entire self-assembly process, starting from a small oligomer up to the macroscopic fibril level.

Magnetic Nanoparticles



The responsiveness to external magnetic fields is a critical parameter for the successful application of nanomagnets in biomedicine, as fast and complete magnetic separations are essential. Here, the superior separation performance of strongly magnetizable carbon-coated cementite nanoparticles over magnetite nanomagnets from stagnant/flowing human blood is shown. Beyond, a robust quantification approach for iron-based nanomaterials in iron-rich matrices is presented.

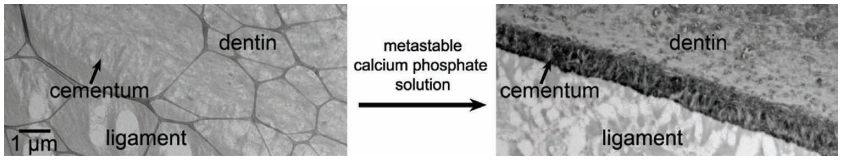
Organic LEDs



A conceptual study on triple-layer PLEDs fabricated by successive solution based deposition of multiple polymer layers without extensively redissolving of existing layers is shown. Ultraviolet photoemission spectroscopy (UPS) measurements of the triple-layer assembly reveal a favorable energy level alignment at the respective material interfaces resulting in a charge carrier confinement in the emitting layer, thus enhancing maximum luminance and luminous efficiency values.

Biomineralization

A novel model of collagen biomineralization is presented, based on deposition of mineral from metastable calcium and phosphate-containing solutions into demineralized sections of mouse periodontal tissues. Mineral deposits selectively into natively mineralized tissues of the tooth root with high fidelity, mimicking the pattern of mineralization in vivo, and demonstrating that the extracellular matrix of these tissues retains sufficient information to control collagen mineralization.



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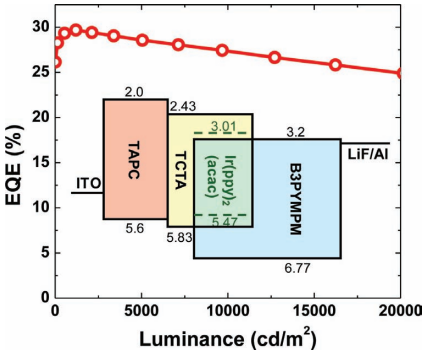
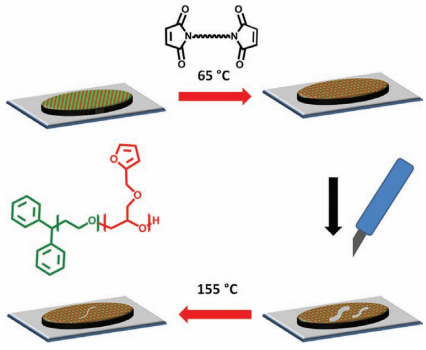
Using an exciplex-forming co-host, an organic light-emitting diode (OLED) with ultimate efficiency is produced. The OLED has a low turn-on voltage of 2.4 V, a very high external quantum efficiency (EQE) of 29.1%, a very high power efficiency of 124 lm W^{-1}, and an extremely low efficiency roll-off. The EQE of the optimized OLED is maintained at more than 27.8%, up to 10 000 cd m^{-2}.



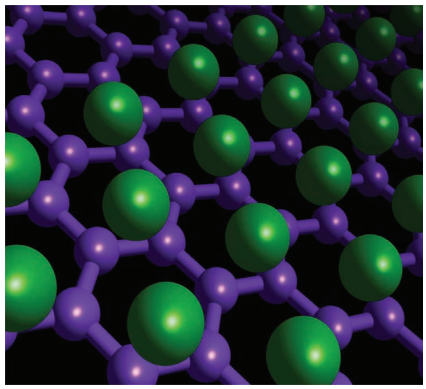
Organic LEDs

Films of poly(furfuryl glycidyl ether) (PFGE) and poly(ethylene oxide)-*b*-poly(furfuryl glycidyl ether) PEO-*b*-PFGE block copolymers are prepared and reversibly crosslinked by Diels-Alder chemistry. The self-healing of damaged surfaces is studied in detail with help of differential scanning calorimetry, depth-sensing indentation, small angle X-ray scattering, and profilometry.



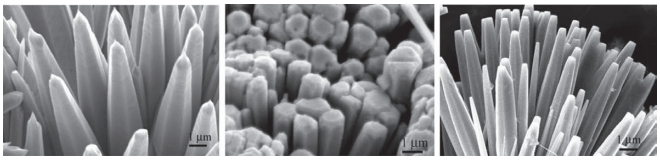
Copolymer Films

Solid phase epitaxy of the amorphous alloy CoFeB is used to fabricate crystalline ferromagnet/graphite interfaces, which are of great interest for carbon spintronics but hardly achievable with conventional thin film deposition techniques. The heterointerface features a strong body-centred-cubic (110) texture and is free from boron accumulation upon crystallization, favorable for obtaining a high spin polarization at the CoFe/graphite interface.



Spintronics

A seedless solution process is developed to control the morphologies and orientation of crystalline ZnO micro/nanowires on graphene sheets by face-down floating or face-up in the solution. The UV detectors based on vertically aligned ZnO micro/nanowires on graphene show high responsivity and fast response.



Hybrid Photodetectors

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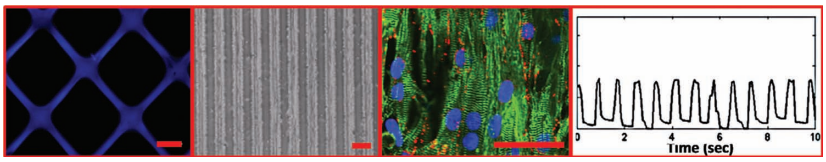
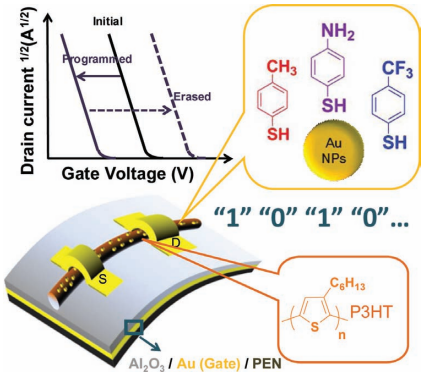
Functional Biomaterials

Highly elastic hydrogels containing well-defined micropatterns are engineered from recombinant human tropoelastin, the resilience-imparting protein found in all elastic human tissues. These elastic substrates are then used to engineer biomimetic cardiac tissue constructs. The micropatterned hydrogels support the alignment, intercellular communication, and synchronous beating of cardiomyocytes by providing an elastic mechanical support that mimics their dynamic mechanical properties in vivo (scale bar: 50 μm).

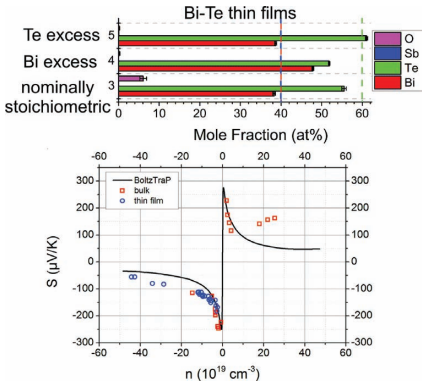


Flexible Transistors

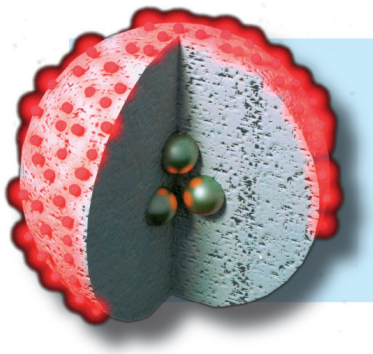


Novel flexible nonvolatile transistor memory devices based on the electrospun nanofiber of poly(3-hexylthiophene):surface-modified gold nanoparticles show a low voltage operation (±5 V), large threshold voltage shift (3.5–10.6 V), long retention times (>10^4 s), and good endurance properties (>100 cycles) regardless of mechanical bending stress.

Thin Films



Wavelength-dispersive X-ray spectrometry (WDX) is applied to Bi_2Te_3 thermoelectric thin films for accurate chemical analysis. The antisite densities can thus be measured and this can be used to control the charge-carrier densities. The transport properties are compared with solutions of the linearized Boltzmann transport equation. For sputtered films, the argon concentration, which is relevant for phonon scattering, is measured.



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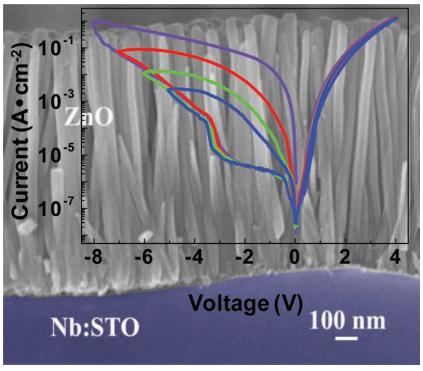
An optically reconfigurable resistive switching diode is realized by growing ZnO nanorods on Nb-doped $SrTiO_3$ single crystals in solution at low temperatures. The ZnO nanorods/Nb:$SrTiO_3$ heterojunction forms a high-quality Schottky diode that shows persistent photoconductivity and light-controlled resistive switching behaviors with highly tunable ON and OFF memory states.



Nanomaterials