ADVANCED FUNCTIONAL MATERIALS

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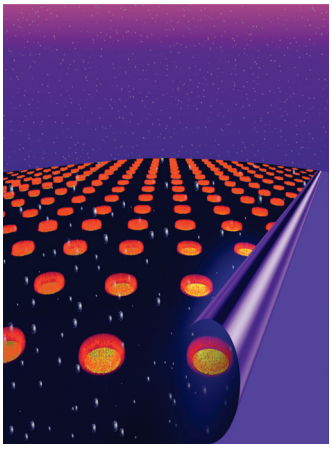
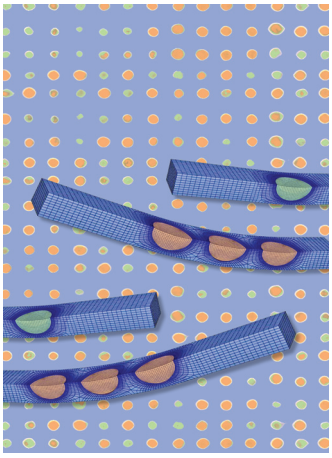


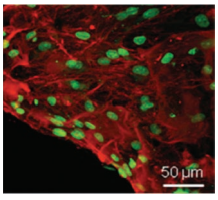
Plasmonics

On page 2812, Sang-Hyun Oh and co-workers report using template stripping to create embedded plasmonic nanodisks that can generate tunable plasmonic fields on ultraflat surfaces. The embedded nanodisks are topographically flat and capped with a silica layer to form a laterally homogeneous and biocompatible substrate. The nanoplasmonic architecture hidden underneath creates a tunable plasmonic landscape. Nanostructures can also be embedded in elastomeric materials, which can be peeled off the substrate to create flexible plasmonic membranes that conform to nonplanar surfaces.

Hydrogels

On page 2835 Richard A. Vaia and co-workers discuss a novel design-fabrication concept for autonomic materials, where the size and arrangement of active-nodes enables the natural hydrogel to feed off of ambient chemical energy and convert it to mechanical motion in a biomimetic fashion. The image shows oscillating chemo-mechanical nodes and a model of the coupled oscillations producing an actuator. Lauren Aprill is acknowledged for the design of the inside cover.





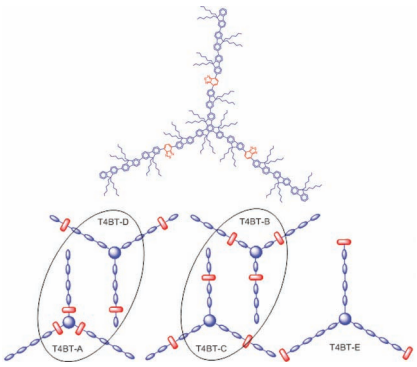
Biomaterials

Functional biomaterials with a 3D porous architecture are required for biomimetic scaffolds for skeletal tissue remodeling. On page 2850 Richard O. C. Oreffo, Mark Bradley, and co-workers report the fabrication and screening of microarrays of ternary polymer blends. This results in the generation of structural and functional 3D biomimetic scaffolds that are capable of directing skeletal tissue formation.

FULL PAPERS

Photonics

Location, Location, Location - Strategic Positioning of 2,1,3-Benzothiadiazole Units within Trigonal Quaterfluorene-Truxene Star-Shaped Structures

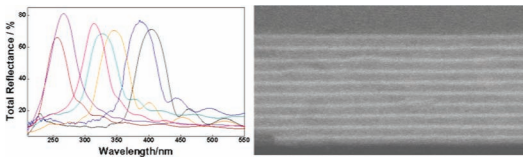


2,1,3-benzothiadiazole (BT) units are systematically incorporated into star-shaped trigonal molecules comprising a truxene core and three quaterfluorene arms. Five isomers are synthesized corresponding to the symmetric insertion of a single BT unit into each of the possible positions within the arms. Three BT locations are identified by comparison of absorption and photoluminescence (PL) spectra, supported by theoretical calculations. Additional experimental and theoretical characterizations reveal the influence of BT position on Raman, photoluminescence, and stimulated emission properties.

Nanoparticles

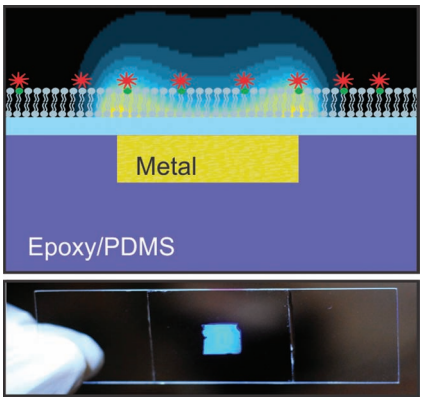
Selective UV Reflecting Mirrors Based on Nanoparticle Multilayers

A new type of nanostructured selective ultraviolet reflecting mirrors based on the alternated deposition of layers of SiO_2 and ZrO_2 nanoparticles is presented. The UV blocking effect arises exclusively from optical interference phenomena and depends only on the number of stacked layers and the refractive index contrast between them.



Plasmonics

Topographically Flat Substrates with Embedded Nanoplasmonic Devices for Biosensing

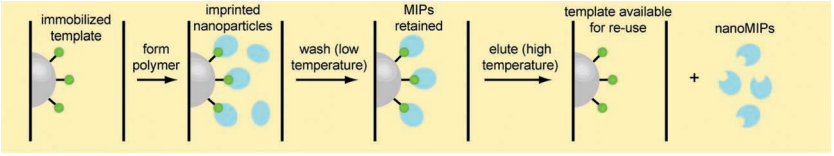


A topographically flat and laterally homogeneous silica surface with embedded metallic nanostructures is fabricated using a template-stripping technique to interface biomembranes with tunable plasmonic fields for label-free optical biosensing and imaging.

Nanoparticles

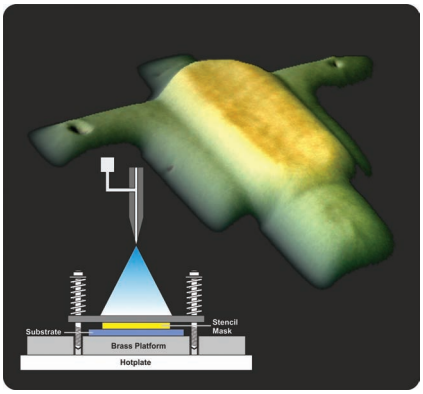
Solid-Phase Synthesis of Molecularly Imprinted Polymer Nanoparticles with a Reusable Template–"Plastic Antibodies"

The first example of the solid-phase synthesis of molecularly imprinted polymer (MIP) nanoparticles is reported using an immobilized template in an automated reactor. Formation of nanoMIP by photopolymerization in a column packed with the template phase is followed by washing to remove low affinity particles. High temperature elution releases the high affinity nanoMIPs and the template phase, which can be re-used.



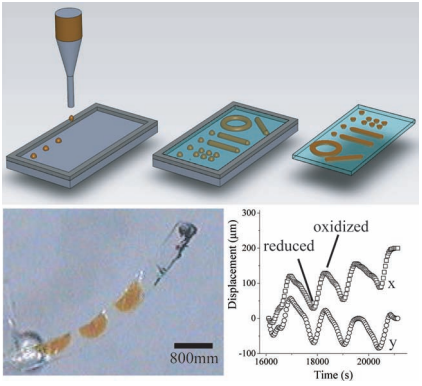
FULL PAPERS

All-inorganic, transparent n-type transistors are deposited by means of the solution processing technique of chemical spray pyrolysis. The use of different precursors leads to semiconducting, conducting, and insulating materials, which are patterned with a simple stencil mask technique during the spray process, thus realizing fully functional devices. Optical, electrical, and microstructural properties are investigated.



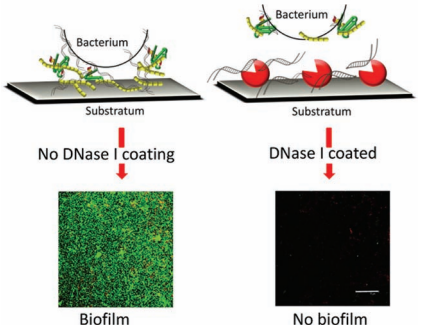
Thin Films

A straightforward technique for fabricating autonomic, heterostructured hydrogels is presented. These gels represent a novel composite concept involving internally responsive and autonomous constituent materials. Critical design parameters are established and a basic modeling approach and material functionality are demonstrated through a coupled patch actuator.



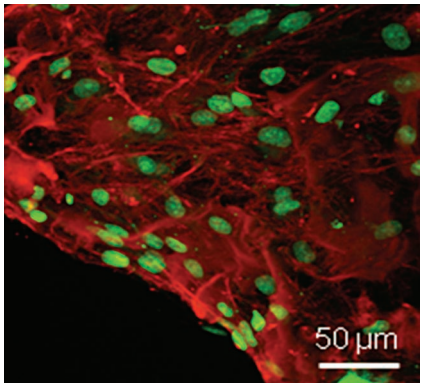
Composites

A DNase I coating using dopamine as an intermediate layer strongly reduces bacterial adhesion and prevents biofilm formation by degradation of extracellular DNA (eDNA) in the biofilm matrix causing disruption of the matrix that holds the biofilm together, without affecting mammalian cell adhesion and proliferation.



Biofilms

Functional biomaterials with a 3D porous architecture are a requirement for biomimetic scaffolds for skeletal tissue remodeling. Microarrays of ternary polymer blends are fabricated and screened, resulting in the generation of structural and functional 3D biomimetic scaffolds capable of directing skeletal tissue formation.



Biomaterials

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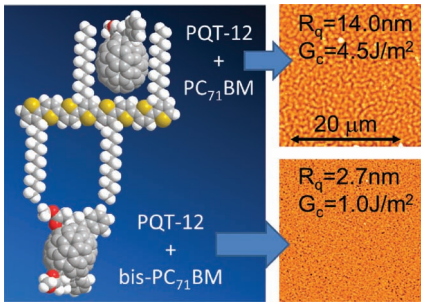
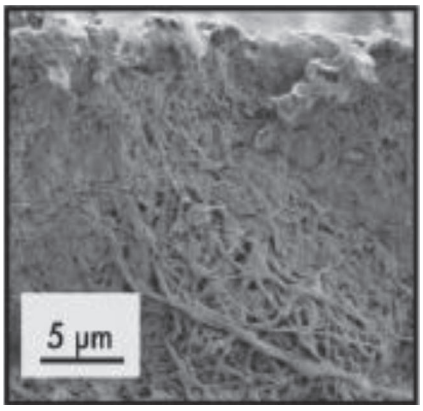
Solar Cells



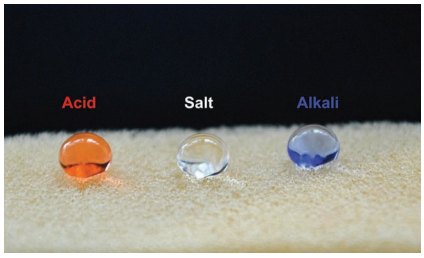
The effects of molecular intercalation and thermal annealing are described on active layer cohesion in organic photovoltaics with the donor polymer poly(3,3‴-didocecyl quaterthiophene) (PQT-12). Increased cohesion is related to the extent of intercalation and the presence of fracture resistant domains. Correlation with annealing and device efficiency is presented.

Hybrid Materials

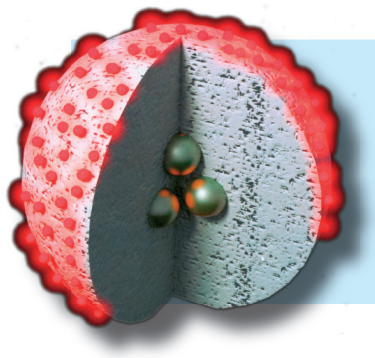


The design of hybrid organic–inorganic membranes using an electrospinning approach is discussed. The sulfonated silica-based membranes exhibit proton conductivity comparable to Nafion at high temperature and low humidity and have better mechanical properties. This behavior is related to the specific microstructure of the membrane, which is reached via the electrospinning. The membrane contains polymer fibers surrounded by functionalized large silica domains.

Bioinspired Materials



Inspired by superhydrophobic self-cleaning lotus leaves and porous biomaterials, polyurethane foam with simultaneous superhydrophobicity and superoleophilicity is fabricated. The resulting foam exhibits super-repellency towards corrosive liquids, self-cleaning, and oil/water separation properties, thus possessing multifunction integration.



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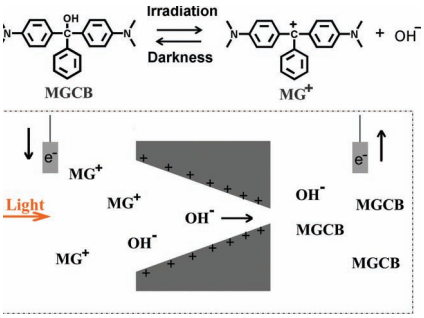
FULL PAPERS

Biomimetics

Learning from nature has inspired the invention of intelligent materials and devices. Inspiration from the retina, which can serve as a light-driven cross-membrane proton pump, a photoelectric conversion system based on smart gating hydroxide ion-driven nanochannels and photoinduced reversible pH changes is demonstrated. This photoelectric conversion system closely mimics the mechanism of the retina and shows potential applications for future energy demands.



Liquid Crystals

The electrocaloric effect (ECE) is investigated in a dielectric liquid. By exploiting the large dielectric anisotropy in a liquid crystal, 5CB, that facilitates the electric-field-induced large polarization change, a large ECE is observed near 39 °C, the nematic-isotropic transition temperature region. Fluidic ECE materials could lead to easier and better design of ECE-based cooling devices.