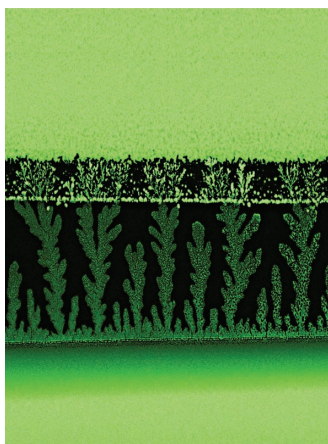


ADVANCED FUNCTIONAL MATERIALS

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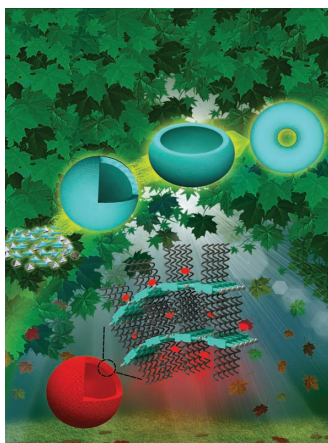


Bioelectronics

On page 5591, hydrated thin films of the biomolecule eumelanin are contacted with Au electrodes. Prolonged biasing of these films by C. Santato and co-workers leads to the growth of Au-eumelanin dendrites, as shown. These structures form upon application of electrical biases as low as 0.6 V and result in a sudden resistive change of the sample upon bridging the interelectrode region. This phenomenon, possibly related to the metal chelation properties of eumelanin, has to be considered in the design of eumelanin-based bioelectronic devices and can potentially be exploited for biocompatible memory devices.

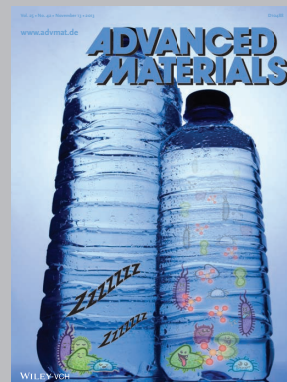
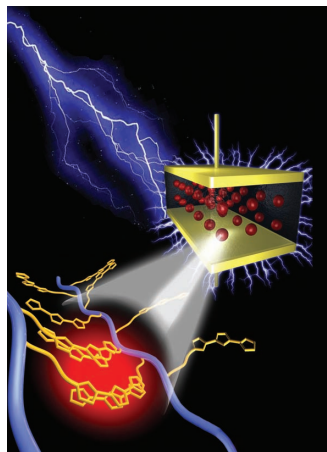
Nanomaterials

High-performance nanodielectric materials are built by C. Tang and co-workers on page 5638 based on nano-dipolar π -conjugated oligomer thiophene-containing polymers that exhibit high permittivity and low dielectric loss over a wide range of frequencies (100 Hz to about 10 MHz). Highly polarizable and fast-responsive nano-dipoles from nanoscale crystalline domains from π - π stacked oligomer thiophenes are believed to dictate the performance. These materials could be used to construct high energy-density capacitors. The cover image is courtesy of Xiaodong Yin and Mitra Ganewatta.



Porous Hybrids

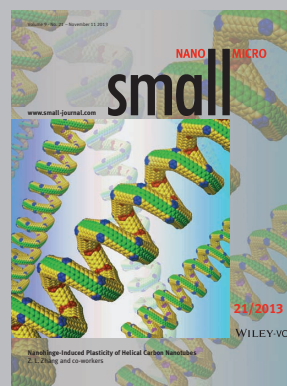
Nature employs light-harvesting complexes for efficient migration of photons to the reaction centre for the conversion of solar energy to chemical energy. Mimicking this natural process of energy transfer in a synthetic light-harvesting system is demonstrated by V. M. Suresh, S. J. George, and T. K. Maji in a functional nanoscale soft-porous luminescent metal-organic framework. On page 5585, coordination-directed self-assembly of a chromophoric organic linker results in ordered metal-organic vesicular and toroid nanostructures that act as a light-harvesting scaffold for noncovalently entrapped dye molecules.



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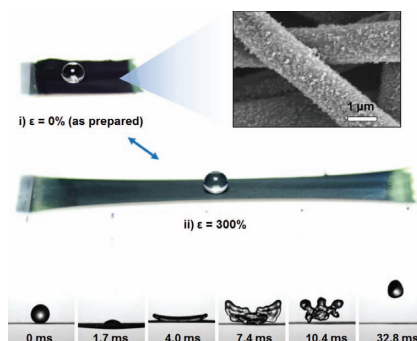
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FULL PAPERS

Hierarchical Nanostructures

S. J. Cho, H. Nam, H. Ryu,
G. Lim*5577–5584

A Rubberlike Stretchable Fibrous Membrane with Anti-Wettability and Gas Breathability

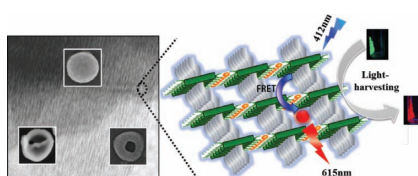


A mechanically stable superhydrophobic membrane with high stretchability and gas breathability is presented. The membrane has excellent superhydrophobic properties under $\geq 300\%$ strain and maintains its anti-wettability (water contact angle $\approx 160^\circ$; hysteresis $\approx 10^\circ$) for 1000 stretching cycles. It is also determined that the stretchable and superhydrophobic surface suppressed the fragmentation and rebound of impact droplets, compared with rigid superhydrophobic surfaces. Finally, underwater gas sensing is demonstrated as a novel application.

Porous Hybrids

V. M. Suresh, S. J. George,*
T. K. Maji* 5585–5590

MOF Nano-Vesicles and Toroids: Self-Assembled Porous Soft-Hybrids for Light Harvesting

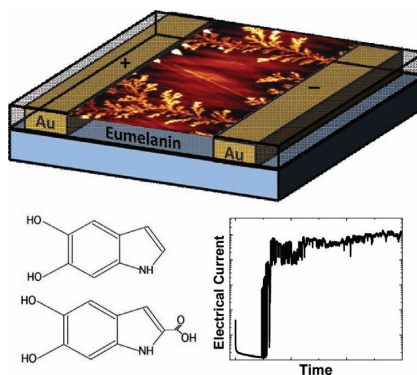


Novel, metal-organic vesicular and toroid nanostructures with efficient light-harvesting properties are achieved by coordination-directed self-assembly of chromophoric organic linker and by controlling the reaction parameters. The amphiphilic nature of the coordination-polymer chains with long alkyl chains renders softness and crystallinity to the 3D framework structure.

Bioelectronics

J. Wünsche, L. Cardenas, F. Rosei,
F. Cicoira, R. Gauvin, C. F. O. Graeff,
S. Poulin, A. Pezzella,
C. Santato*5591–5598

In Situ Formation of Dendrites in Eumelanin Thin Films between Gold Electrodes

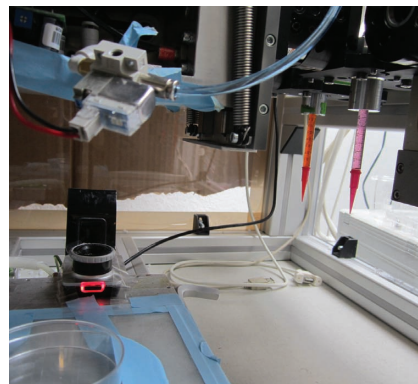


Thin films of the biomolecule eumelanin interfaced with Au electrodes lead to the growth of Au-eumelanin dendrites and show a resistive change under prolonged electrical bias. This phenomenon, partially attributable to the metal chelation properties of eumelanin, has to be considered in the design of eumelanin-based bioelectronic devices.

Hydrogels

M. Ø. Andersen,* D. Q. S. Le,
M. Chen, J. V. Nygaard, M. Kassem,
C. Bünger, J. Kjems*5599–5607

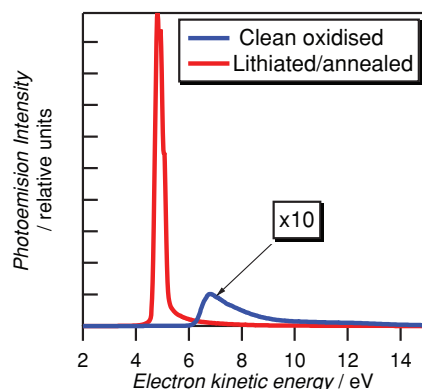
Spatially Controlled Delivery of siRNAs to Stem Cells in Implants Generated by Multi-Component Additive Manufacturing



A multi component additive manufacturing technique is developed for 3D printing hydrogel implants containing multiple spatially restricted RNA drugs. When human stem cells are seeded, these drugs are internalized and induce localized gene silencing. The technique allows the use of patient scanning data to guide the printing of a human spinal structure.

FULL PAPERS

A robust, air-stable negative electron affinity diamond surface with giant secondary electron yield enhancement is introduced. Starting with oxidized diamond (100), lithium deposition and annealing induce a structural and electronic change to a negative electron affinity surface showing electron yield enhancement greater than 200.

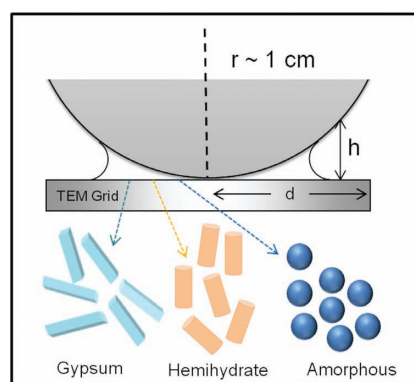


Surface Modification

K. M. O'Donnell,* M. T. Edmonds, J. Ristein, A. Tadich, L. Thomsen, Q.-H. Wu, C. I. Pakes, L. Ley 5608–5614

Diamond Surfaces with Air-Stable Negative Electron Affinity and Giant Electron Yield Enhancement

Precipitation of calcium sulfate between two surfaces in a crossed-cylinder apparatus shows that confinement can stabilize metastable phases of calcium sulfate at remarkably large surface separations. A new mechanism conferring stability in confinement is revealed that is attributed to restricted diffusion of precursor particles at small surface separations, hindering aggregation, and subsequent conversion to hemihydrate and gypsum.

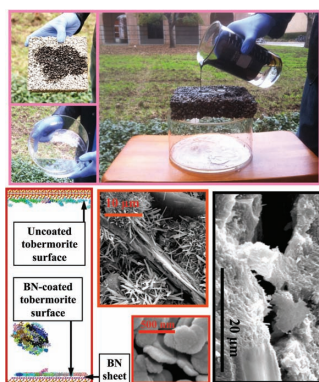


Biomineralization

Y.-W. Wang, H. K. Christenson, F. C. Meldrum* 5615–5623

Confinement Leads to Control over Calcium Sulfate Polymorph

Multifunctional cement-based composites, reinforced with bulk quantities of hexagonal boron nitride (h-BN) and graphite oxide fillers are developed for application in high strength porous concrete structures with excellent oil adsorption capacity. Mechanically strengthened porous h-BN composite concrete illustrates excellent ability for water filtration and crude oil adsorption. Such engineered forms of cement-based composites would enable the development of novel forms of multifunctional structural materials with a range of environmental applications.

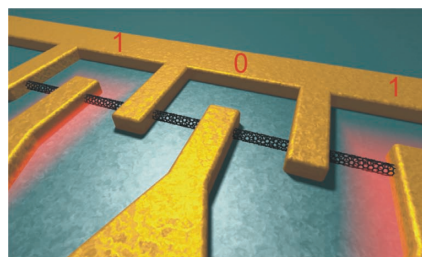


Composite Materials

M. A. Rafiee, T. N. Narayanan, D. P. Hashim, N. Sakhavand, R. Shahsavari, R. Vajtai, P. M. Ajayan* 5624–5630

Hexagonal Boron Nitride and Graphite Oxide Reinforced Multifunctional Porous Cement Composites

Multiple non-volatile resistive memory elements are integrated along individual single-wall carbon nanotubes and individually programmed without the use of multiple gate electrodes. The local charge storage mechanism also allows programming the direction of the current flow, demonstrating that single nanotube sections combine all-in-one the properties of an analog resistive memory and of a rectifying diode with tunable polarity.



Carbon Nanotubes

D. Brunel, C. Anghel, D.-Y. Kim, S. Tahir, S. Lenfant, A. Filoramo, T. Kontos, D. Vuillaume, V. Jourdain, V. Derycke* 5631–5637

Integrating Multiple Resistive Memory Devices on a Single Carbon Nanotube

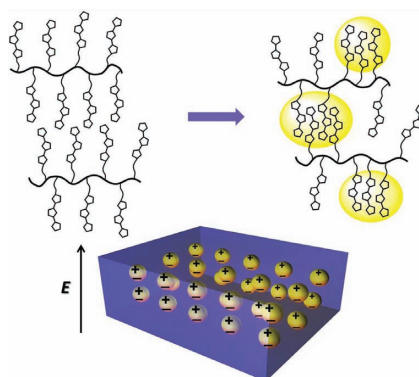


FULL PAPERS

Nanomaterials

Y. Qiao, M. S. Islam, K. Han,
E. Leonhardt, J. Zhang, Q. Wang,
H. J. Ploehn, C. Tang*5638–5646

Polymers Containing Highly Polarizable Conjugated Side Chains as High-Performance All-Organic Nanodielectric Materials

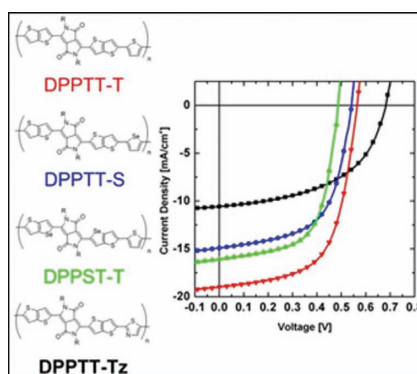


A new series of polymers containing π -conjugated oligomer as side chains show great promise as candidates for high performance nanodielectric materials. The oligomer-based highly polarizable side chains can self-organize to form nanoscale, conjugated, electrically conductive domains, which uniquely meet the requirement for nanodipole architecture, resulting in high permittivity and low dielectric loss across a wide range of frequency (100 Hz–4 MHz).

Solar Cells

H. Bronstein,* E. Collado-Fregoso,
A. Hadipour, Y. W. Soon, Z. Huang,
S. D. Dimitrov, R. S. Ashraf, B. P. Rand,
S. E. Watkins, P. S. Tuladhar, I. Meager,
J. R. Durrant, I. McCulloch... 5647–5654

Thieno[3,2-*b*]thiophene-diketopyrrolopyrrole Containing Polymers for Inverted Solar Cells Devices with High Short Circuit Currents

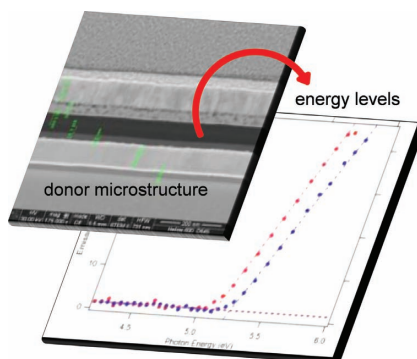


Four diketopyrrolopyrrole containing polymers are synthesized and evaluated for use in organic solar cells. Heteroatomic substitution allows precise control over the polymer energy levels with minimal disruption to the solid state properties. Variations in the short circuit current are linked to the energetic offset between polymer and fullerene.

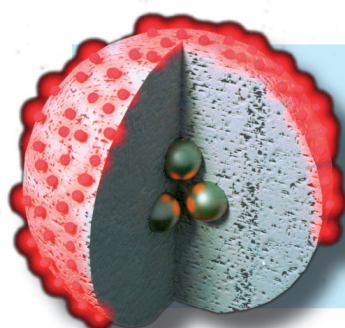
Solar Cells

F. H. Scholes,* T. Ehlig, M. James,
K. H. Lee, N. Duffy, A. D. Scully,
T. B. Singh, K. N. Winzenberg,
P. Kemppinen,
S. E. Watkins*5655–5662

Intraphase Microstructure—Understanding the Impact on Organic Solar Cell Performance



The influence of intraphase microstructure on the performance of organic photovoltaics (OPVs) is studied utilizing a bilayer (planar heterojunction) device architecture. Devices in which the donor layer exhibits subtle differences in microstructure are compared, and these differences are shown to affect critical parameters (energy levels, charge transport properties) having a significant impact on performance.



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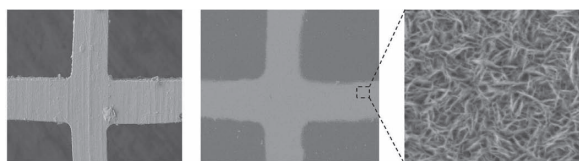
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FULL PAPERS

A new generic bottom-up scheme for creating patterned nanostructured gold films through spontaneous, direct reduction of gold-thiocyanate is presented. Incubation of $\text{Au}(\text{SCN})_4^-$ complex with amine-displayed surfaces in an aqueous solution results in the assembly of patterned films that exhibit remarkable transparency and electrical conductivity.

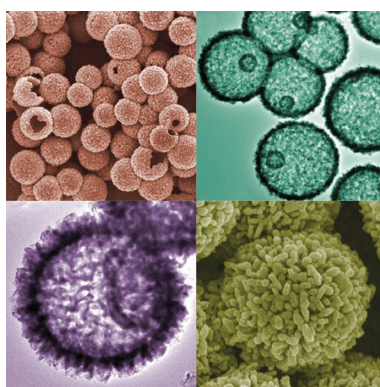


Electrodes

A. Morag, N. Froumin, D. Mogiliansky, V. Ezersky, E. Beilis, S. Richter, R. Jelinek*5663–5668

Patterned Transparent Conductive Au Films through Direct Reduction of Gold Thiocyanate

Rattle-type V_2O_5 ball-in-ball hollow microspheres are controllably synthesized using carbon spheres as hard templates. Carbon spheres@vanadium-precursor (CS@V) core-shell composite microspheres with controllable morphology and structure are first prepared through a one-step solvothermal method. Rattle-type V_2O_5 hollow microspheres with various structures can be obtained after removing the carbon microspheres by calcination in air. When evaluated as a cathode material for lithium-ion batteries, the rattle-type V_2O_5 hollow microspheres manifest high specific capacity, good cycling stability and rate capability.

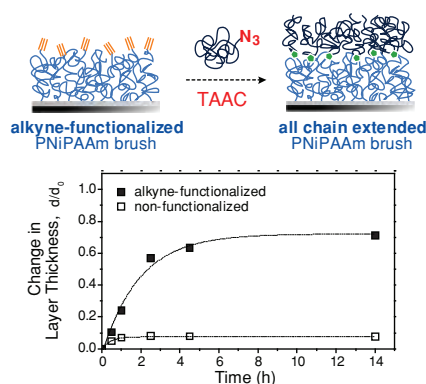


Lithium-Ion Batteries

H. B. Wu, A. Q. Pan,* H. H. Hng, X. W. Lou* 5669–5674

Template-Assisted Formation of Rattle-type V_2O_5 Hollow Microspheres with Enhanced Lithium Storage Properties

A general strategy to overcome the limits of the grafting-to approach concerning the intrinsic limitation of the grafting density, connected with a simultaneous improvement of the switching behavior of a temperature-responsive polymer brush, is reported. The thermal azide–alkyne cycloaddition reaction is used to perform a chain extension of alkyne-functionalized poly(*N*-isopropylacrylamide) (PNiPAAm) brushes with azide-functionalized PNiPAAm molecules to increase the molecular weight of the attached chains without changing the grafting density.



Stimuli-Responsive Materials

S. Rauch,* K.-J. Eichhorn, D. Kuckling, M. Stamm, P. Uhlmann*5675–5681

Chain Extension of Stimuli-Responsive Polymer Brushes: A General Strategy to Overcome the Drawbacks of the “Grafting-To” Approach