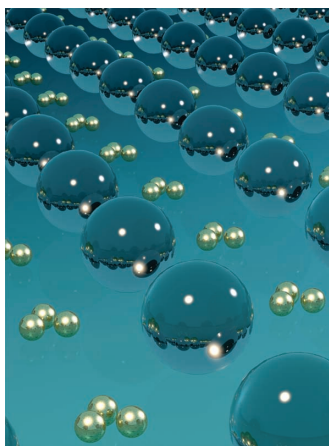


ADVANCED FUNCTIONAL MATERIALS

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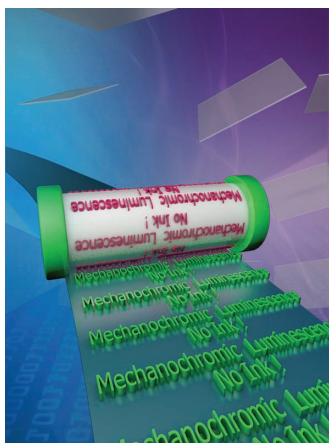
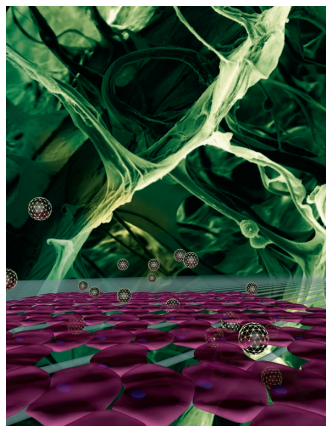


Plasmonics

Template-guided self-assembly facilitates the fabrication of optoplasmonic hetero-nanoparticle arrays that contain metallic and dielectric nanoparticles or nanoparticle clusters at pre-defined lattice sites. On page 739, the integration of nanoparticles with different compositions at programmable positions into an array by B. M. Reinhard and co-workers generates hybrid electromagnetic materials with new degrees of freedom for tailoring near- and far-field optical responses as well as enhancing light-matter interactions through synergistic electromagnetic interactions between the building blocks.

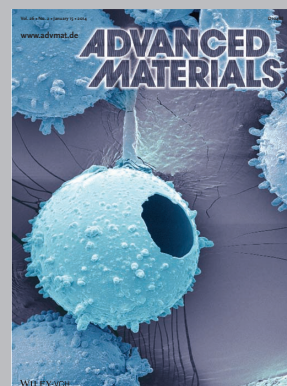
Collagen Scaffolds

The physical or chemical integration of ultrasamll superparamagnetic iron oxide nanoparticles into the 3D collagen-based scaffold matrix of tissue-engineered implants by T. Lammers and co-workers on page 754 allows highly sensitive visualization and monitoring using MRI, and enables the longitudinal assessment of implant localization, function, remodeling, and resorption. Labeled scaffolds are shown to be highly biocompatible and suitable for tissue engineering applications.



Luminescent Materials

A series of common *N*-heteroaromatic onium fluorophores with striking reversible mechanochromic luminescence are designed and synthesized on page 747 based on a cation-anion interaction-directed molecular design strategy, which has great potential for a wide variety of applications such as sensors, memory devices, motion systems, security systems, rewritable optical media, etc. The image by J. You and co-workers illustrates how color printing could be realized without ink through the adoption of their mechanochromic materials.



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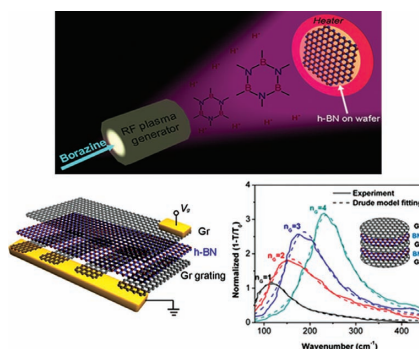
www.small-journal.com

FULL PAPERS

Hierarchical Structures

K. Zhang, F. L. Yap, K. Li, C. T. Ng,
L. J. Li, K. P. Loh* 731–738

Large Scale Graphene/Hexagonal Boron Nitride Heterostructure for Tunable Plasmonics

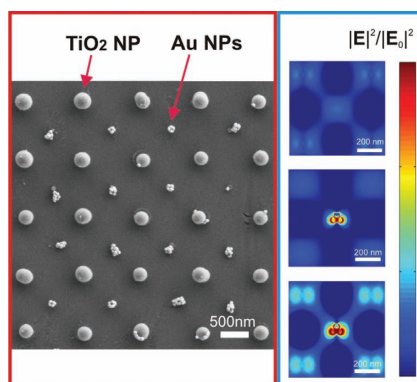


An array of graphene/h-BN vertically stacked micrometer-sized disks is fabricated by lithography and transfer techniques, and infrared spectroscopy is used to observe the modes of tunable graphene plasmonic absorption as a function of the repeating $(G/h\text{-BN})_n$ units in the vertical stack.

Plasmonics

Y. Hong, Y. Qiu, T. Chen,
B. M. Reinhard* 739–746

Rational Assembly of Optoplasmonic Hetero-nanoparticle Arrays with Tunable Photonic–Plasmonic Resonances



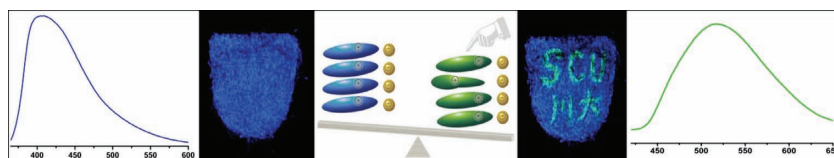
Photonic–plasmonic mode coupling in self-assembled optoplasmonic arrays. A template-guided self-assembly strategy for integrating metallic and dielectric nanoparticles into morphologically defined hybrid arrays is introduced. Control over the nanoparticle composition at pre-defined lattice sites provides electromagnetic materials with new functionalities and allows for a rational tuning of near- and far-field responses.

Luminescent Materials

G. Li, F. Song, D. Wu, J. Lan, X. Liu,
J. Wu, S. Yang, D. Xiao,
J. You* 747–753

Cation–Anion Interaction-Directed Molecular Design Strategy for Mechanochromic Luminescence

Molecular Design: A cation–anion interaction-directed molecular design strategy for mechanochromic luminescence is proposed. On the basis of this strategy, a series of common *N*-heteroaromatic onium fluorophores such as imidazolium, 1,2,4-triazolium, triazolopyridinium, benzoimidazolium, γ -carbolinium, and pyridinium salts are designed and prove to have striking reversible mechanofluorochromic behaviors.

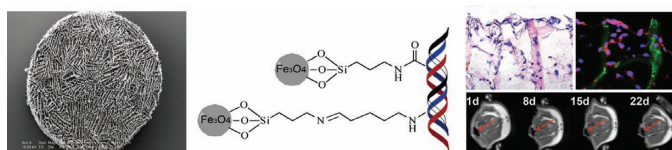


Collagen Scaffolds

M. E. Mertens, A. Hermann, A. Bühren,
L. Olde-Damink, D. Möckel, F. Gremse,
J. Ehling, F. Kiessling,
T. Lammers* 754–762

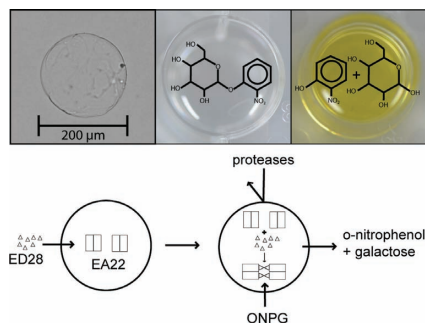
Iron Oxide-Labeled Collagen Scaffolds for Non-Invasive MR Imaging in Tissue Engineering

Three-dimensional collagen-based scaffold materials are labeled with ultras-small super-paramagnetic iron oxide (USPIO) nanoparticles, enabling their visualization and monitoring using magnetic resonance imaging. USPIO nanoparticles possessing different surface functionalities are incorporated either physically or chemically into the scaffolds. Labeled scaffolds are shown to be highly biocompatible and suitable for tissue engineering applications.



FULL PAPERS

Capsules made of recombinant spider silk proteins are suitable as reaction containers for various encapsulates including enzymes. Since low molecular weight substances can freely diffuse through the silk membrane while high molecular weight substances are retained, a specific triggering of reactions is possible. The capsules further protect encapsulates from proteolysis.

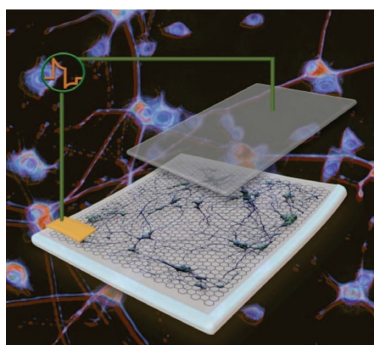


Capsules

C. Blüm, A. Nichtl,
T. R. Scheibel*763–768

Spider Silk Capsules as Protective Reaction Containers for Enzymes

Bilayer graphene, transferred as a layer onto biopolymers, is used as a flexible biological interface material for electrical cell stimulation. Bilayer graphene provides a conductive layer without changing the cytocompatibility of the underlying layer, allowing electrical stimulation of cells on substrates of chosen composition. The production of flexible, biocompatible electrodes is described and the differentiation of neural cells is demonstrated for the first time from a graphene-based electrode.

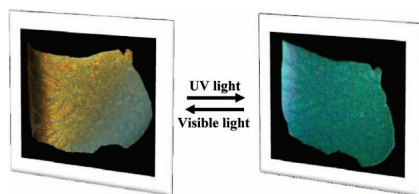


Graphenes

P. C. Sherrell, B. C. Thompson,
J. K. Wassei, A. A. Gelmi, M. J. Higgins,
R. B. Kaner, G. G. Wallace*769–776

Maintaining Cytocompatibility of Biopolymers Through a Graphene Layer for Electrical Stimulation of Nerve Cells

Liquid crystal-templated self-assembly of water-soluble, stabilized CdS quantum dots into a lyotropic alkoxyisilane/cellulose nanocrystal dispersion produce chiral nematic CdS/silica/cellulose composites. Subsequent removal of the cellulose template and other additives by controlled calcination generate freestanding iridescent, luminescent chiral nematic mesoporous silica-encapsulated CdS films. This one-pot alternative route to fabricate these new semiconducting photonic materials may prove useful in the design of sensors and optical devices.



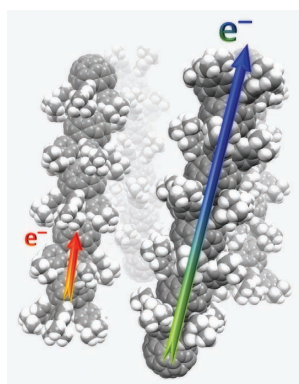
Nanocrystals

T.-D. Nguyen, W. Y. Hamad,
M. J. MacLachlan*777–783

CdS Quantum Dots Encapsulated in Chiral Nematic Mesoporous Silica: New Iridescent and Luminescent Materials



The roles of local and macroscopic electron mobility in conjugated polymer/fullerene BHJ photovoltaics are examined via a combination of density functional theory, flash-photolysis time-resolved microwave conductivity, and space-charge-limit current (SCLC) mobility estimates. The local mobility of different fullerene derivatives ('shuttlecock' molecules) is similar, so differences in solar cell efficiency and SCLC mobilities result directly from the different propensities of these molecules to self-assemble on macroscopic length scales.



Electron Mobility

J. C. Aguirre, C. Arntsen, S. Hernandez,
R. Huber, A. M. Nardes, M. Halim,
D. Kilbride, Y. Rubin, S. H. Tolbert,
N. Kopidakis, B. J. Schwartz*,
D. Neuhauser784–792

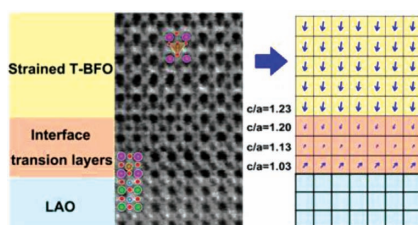
Understanding Local and Macroscopic Electron Mobilities in the Fullerene Network of Conjugated Polymer-based Solar Cells: Time-Resolved Microwave Conductivity and Theory

FULL PAPERS

Heterointerfaces

R. Huang, H.-C. Ding, W.-I. Liang,
Y.-C. Gao, X.-D. Tang, Q. He,
C.-G. Duan,* Z. Zhu, J. Chu,
C. A. J. Fisher, T. Hirayama, Y. Ikuhara,
Y.-H. Chu* 793–799

Atomic-Scale Visualization of Polarization Pinning and Relaxation at Coherent BiFeO₃/LaAlO₃ Interfaces



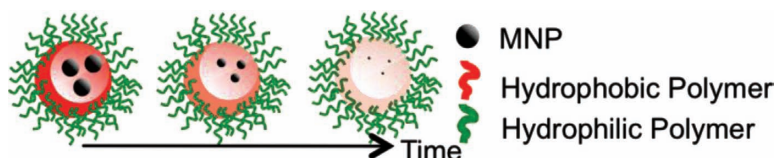
Changes in lattice strain and symmetry in BiFeO₃ (BFO) crystals at coherent T-BFO/LaAlO₃ (LAO) and rhombohedral-BFO/LAO interfaces are imaged with atomic resolution using annular bright-field scanning transmission electron microscopy and first-principles calculations. A common pinned BFO layer and polarization relaxation at the interfaces are identified, providing insight into the ferroelectric behavior of thin films and the complex oxide heterointerfaces between them.

Magnetic Nanoparticles

B. Mattix, T. R. Olsen, T. Moore,
M. Casco, D. Simionescu, R. P. Visconti,
F. Alexis* 800–807

Accelerated Iron Oxide Nanoparticle Degradation Mediated by Polyester Encapsulation within Cellular Spheroids

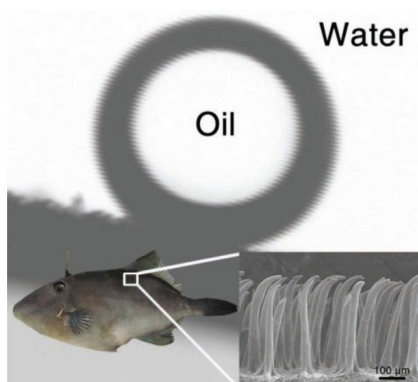
Methods to accelerate the degradation of nanomaterials within biological systems reduce their interaction and therefore limit potential adverse effects. It is shown that the degradation of iron oxide nanoparticles is accelerated by polymeric byproducts. Polymeric magnetic nanoparticles (PolyMNPs) can be safely incorporated within cellular spheroids to assemble fused tissues using magnetic force assembly.



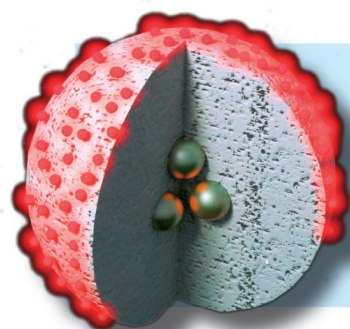
Oleophobicity

Y. Cai, L. Lin, Z. Xue, M. Liu,
S. T. Wang,* L. Jiang* 809–816

Filefish-Inspired Surface Design for Anisotropic Underwater Oleophobicity



Unique anisotropic underwater oleophobicity of the skin of filefish *Navodon septentrionalis* is revealed, which results from its oriented hook-like spines. Inspired by this, an anisotropic underwater oleophobic surface is fabricated on an oxygen plasma-treated PDMS layer. Anisotropic microfeatures on the surfaces and hydrophilicity are proposed as two main factors in achieving anisotropic underwater oleophobicity.



How to contact us:

Editorial Office:

Phone: (+49) 6201-606-286/531
Fax: (+49) 6201-606-500
Email: afm@wiley-vch.de

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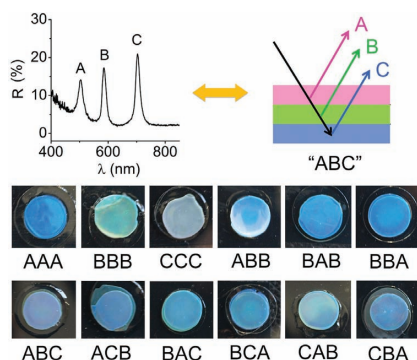
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FULL PAPERS

Polymerization-induced colloidal assembly is developed to prepare photonic crystal films with an ultra-narrow bandgap and tunable thickness and size. As the liquid monomer becomes solid polymer, the highly concentrated particles are driven to precipitate into colloidal microcrystals. Based on this synthesis, a coding–decoding system is developed in which the film's composition and stacking sequence can be identified by its distinctive reflection spectrum.

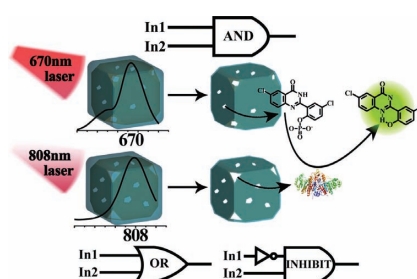


Photonic Crystals

D. P. Yang, Y. H. Qin, S. Y. Ye,
J. P. Ge*817–825

Polymerization-Induced Colloidal Assembly and Photonic Crystal Multilayer for Coding and Decoding

An NIR light-encoded orthogonally triggered logic gate for intracellular release is presented based on a gold nanocage (AuNC)@smart polymer shell. By using defined logic operations and the tunable LSPR properties of AuNCs, a sophisticated release system can be realized. This system could provide new insights into developing NIR light-encoded, logically controlled, intracellular release systems.

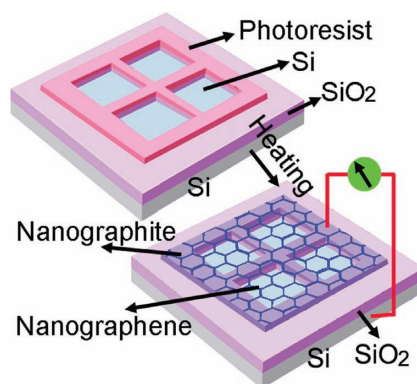


Gold Nanocages

P. Shi, E. Ju, J. Ren, X. Qu*826–834

Near-Infrared Light-Encoded Orthogonally Triggered and Logical Intracellular Release Using Gold Nanocage@Smart Polymer Shell

A simple low-cost approach to directly produce nanographene/graphite transparent electrodes on Si/SiO₂ for Schottky junction photoelectronics is developed. The approach is based on conventional photolithography and silicon techniques with high-temperature heating to transform photoresist into nanographene/graphite hybrids. The obtained devices exhibit excellent photodetection properties.

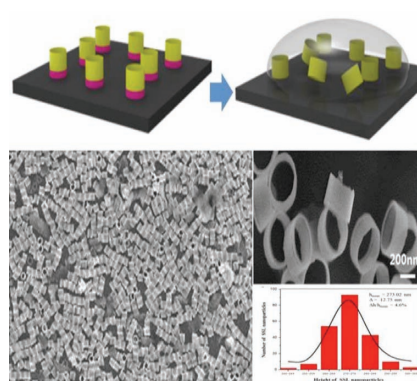


Graphene

Z. X. Zhang,* Y. X. Guo, X. J. Wang,
D. Li, F. L. Wang, S. S. Xie*835–840

Direct Growth of Nanocrystalline Graphene/Graphite Transparent Electrodes on Si/SiO₂ for Metal-Free Schottky Junction Photodetectors

A method for fabricating highly monodisperse 3D hybrid nanoparticles uses a unique top-down method based on secondary sputtering lithography. Nanostructures formed on a PEDOT sacrificial layer are transferred to an aqueous solution in a process that could successfully disperse a variety of nanoparticle shapes and hybrid nanoparticles. By this method, a fluorescent dye could be encapsulated within the fabricated hybrid nanoparticles for use in bio-sensing and drug delivery.



Hybrid Composites

J.-S. Kim, H.-J. Jeon, H.-W. Yoo,
Y.-K. Baek, K. H. Kim, D. W. Kim,
H.-T. Jung*841–847

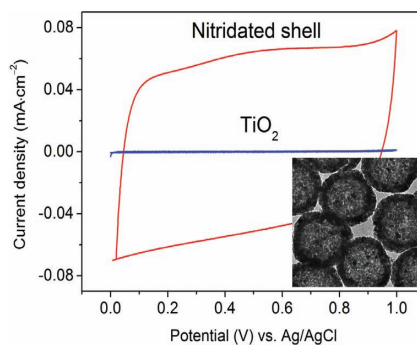
Generation of Monodisperse, Shape-Controlled Single and Hybrid Core–Shell Nanoparticles via a Simple One-Step Process

FULL PAPERS

Energy Storage

G. D. Moon, J. B. Joo, M. Dahl, H. Jung,
Y. Yin* 848–856

Nitridation and Layered Assembly of Hollow TiO_2 Shells for Electrochemical Energy Storage

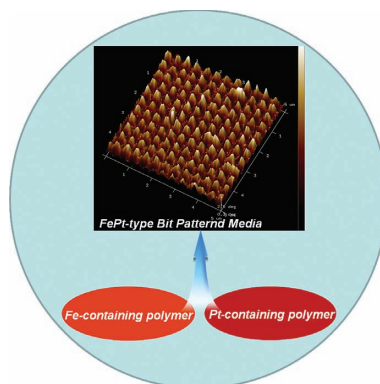


Hollow shells of TiO_2 are nitridated by annealing in NH_3 , assembled into a monolayer film on water surface, and stacked layer-by-layer into electrodes for electrochemical energy storage. This approach facilitates supercapacitor cell design by simplifying the electrode structure and avoiding the use of any organic binder or carbon-based conducting materials. The increased electrical conductivity due to the formation of TiN greatly enhances the electrochemical performance.

Nanoimprint Lithography

Q. C. Dong, G. J. Li, C.-L. Ho,
C.-W. Leung,* P. W.-T. Pong,*
I. Manners,* W.-Y. Wong* 857–862

Facile Generation of L_{10} -FePt Nanodot Arrays from a Nanopatterned Metallopolymer Blend of Iron and Platinum Homopolymers

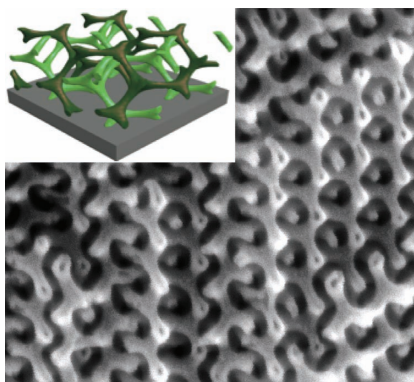


Rapid single-step fabrication of large-area nanodot arrays of L_{10} -FePt nanoparticles (NPs) are achieved by employing a metallopolymer blend of individual Fe- and Pt-containing homopolymers as the precursor through nanoimprint lithography. Imaging of the nanodot pattern indicates that the patterned NPs exhibit a decent magnetic response, which suggests potential to be utilized directly in the fabrication of bit-patterned media for the next generation of magnetic recording technology.

Nanostructures

E. Kim, Y. Vaynzof, A. Sepe, S. Guldin,
M. Scherer, P. Cunha, S. V. Roth,
U. Steiner* 863–872

Gyroid-Structured 3D ZnO Networks Made by Atomic Layer Deposition



3D continuous ZnO morphologies with characteristic feature sizes on the 10 nm length scale are replicated into crystalline ZnO by atomic layer deposition (ALD). Gyroid-structured and random worm-like polymer morphologies are voided and filled by ALD to generate continuous networks of polycrystalline ZnO. A photovoltaic device based on this material shows promising performance.