ADVANCED FUNCTIONAL MATERIALS

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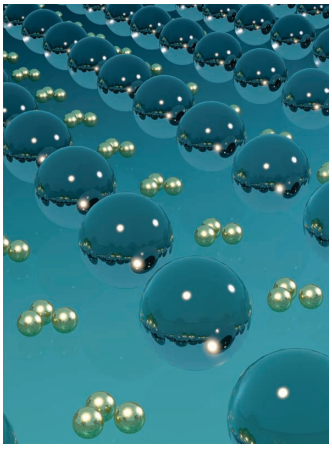
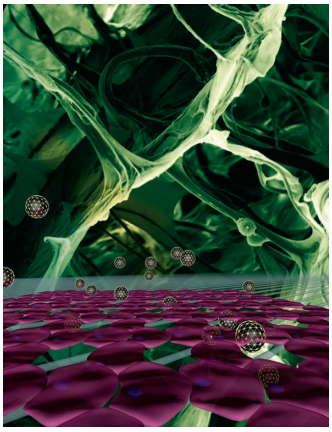


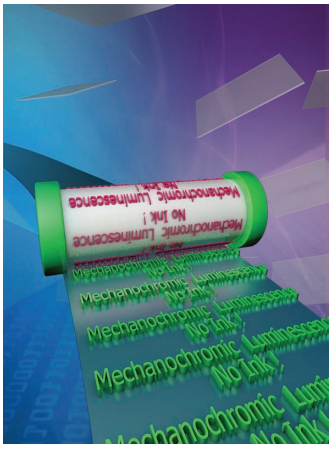
Plasmonics

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.



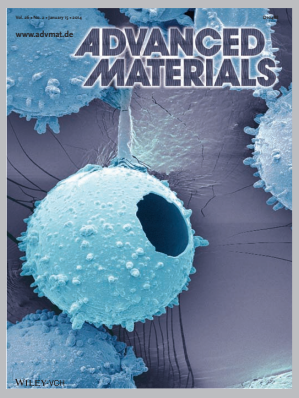
Collagen Scaffolds

The physical or chemical integration of ultrasmall 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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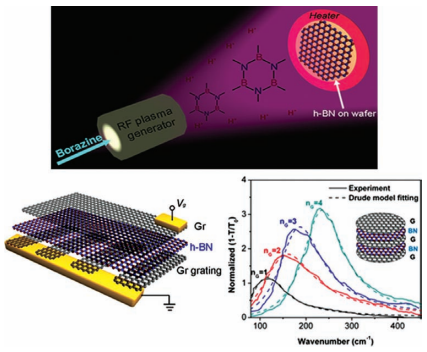
CONTENTS

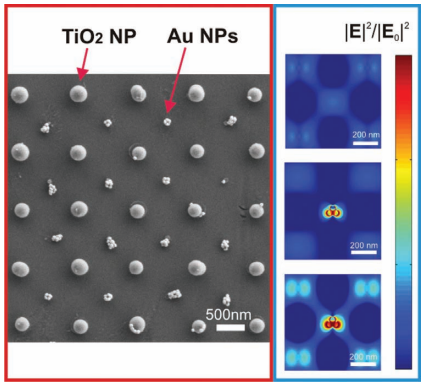
FULL PAPERS

Hierarchical Structures



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.

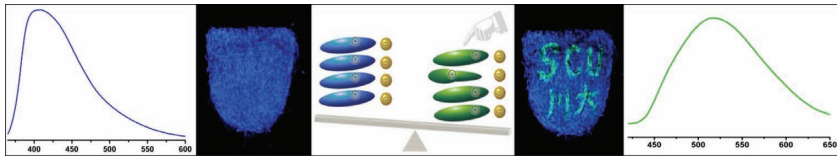
Plasmonics



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.

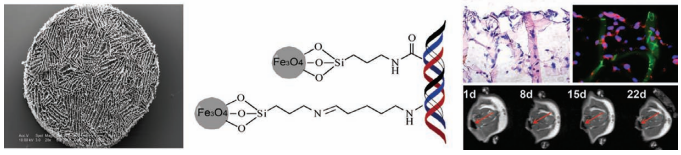
Luminescent Materials

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

Three-dimensional collagen-based scaffold materials are labeled with ultrasmall superparamagentic 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.



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CONTENTS

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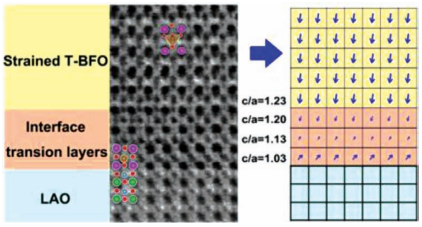
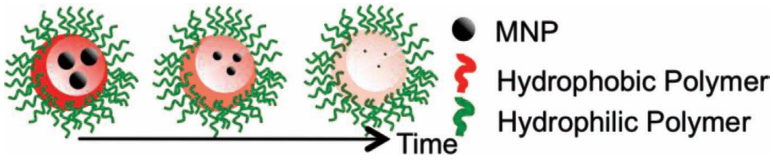
Heterointerfaces



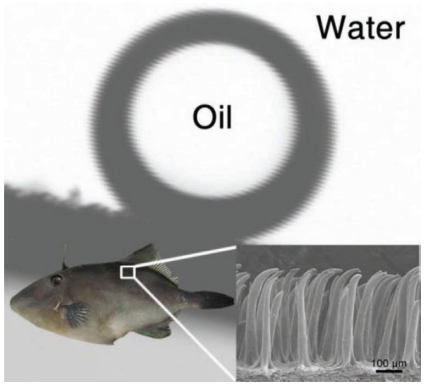
Changes in lattice strain and symmetry in $BiFeO_3$ (BFO) crystals at coherent T-BFO/$LaAlO_3$ (LAO) and rhombohedral-BFO/LAO interfaces are imaged with atomic resolution using annular bright-field scanning transmission electron microscopy and first-principles calculations. A common pinned BFO layer 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

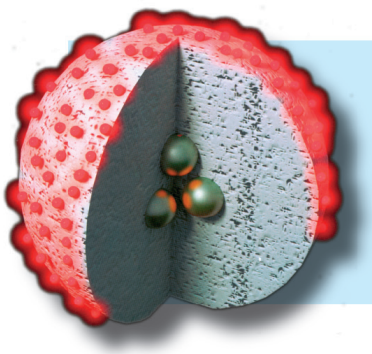
Methods to accelerate the degradation of nanomaterials within biological systems reduce their interaction and therefore limit potential adverse effects. It is shown that the degradation of iron oxide nanoparticles is accelerated by polymeric byproducts. Polymeric magnetic nanoparticles (PolyMNPs) can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



Oleophobicity



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.



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CONTENTS

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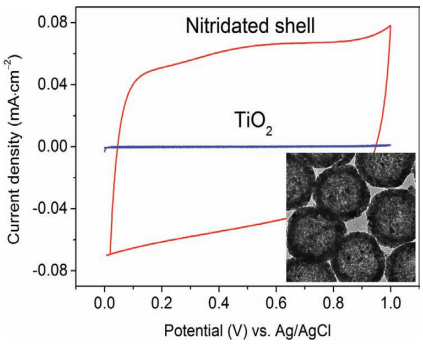
Energy Storage

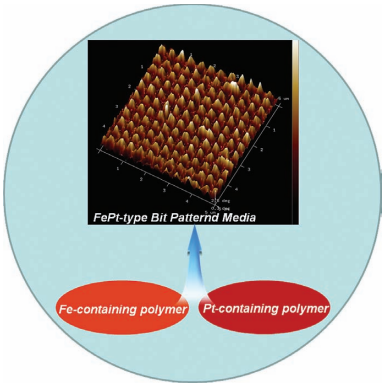
Nitridation and Layered Assembly of Hollow TiO_2 Shells for Electrochemical Energy Storage



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

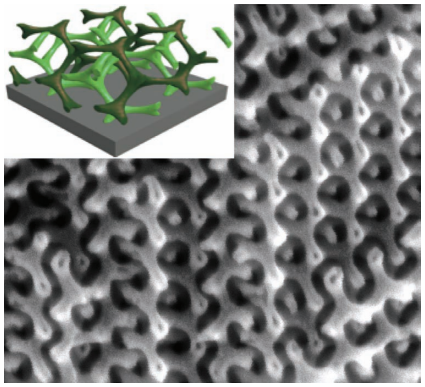
Facile Generation of $L1_0$-FePt Nanodot Arrays from a Nanopatterned Metallopolymer Blend of Iron and Platinum Homopolymers



Rapid single-step fabrication of large-area nanodot arrays of $L1_0$-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

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.

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