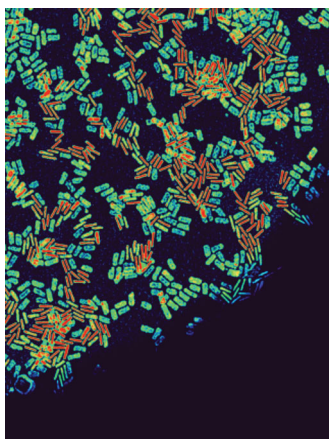


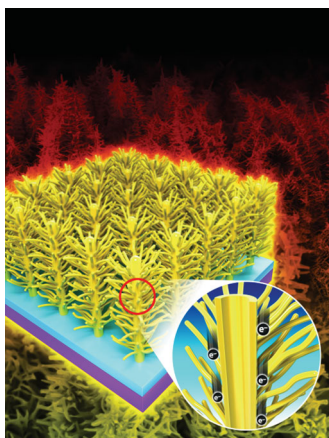
ADVANCED FUNCTIONAL MATERIALS

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LEDs

In the search for better-performing colloidal light-emitting diodes (LEDs), nanocrystals of anisotropic morphologies remain to be explored. On page 295, Z. Chen et al. present the first functional LEDs based on quasi-2D core/shell CdSe/CdZnS nanoplatelets, where quantum confinement takes place in the direction of thickness. These solution-processed hybrid LEDs exhibit extremely narrow electroluminescence under different driving voltages, which is highly promising to achieve superior color purity.

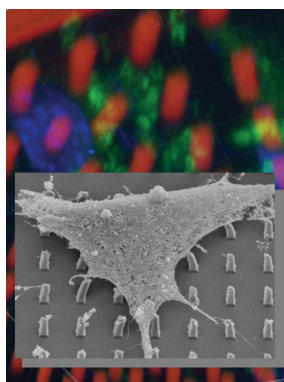


Dye-Sensitized Solar Cells

J. H. Kim and co-workers present a facile and effective method to prepare hierarchical pine tree-like TiO₂ nanotube arrays with an anatase phase directly grown onto a transparent conducting oxide substrate via a one-step hydrothermal reaction. On page 379, the length of the nanotube arrays is increased by up to 19 μm to significantly improve the specific surface area and charge transport in dye-sensitized solar cells.

Microstructures

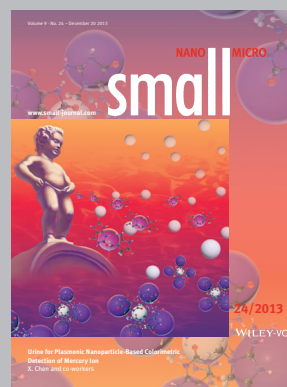
Fibroblasts are shown here pulling on a protein micropillar array. On page 277, B. P. Chan et al. show such complex protein microstructures and micropatterns can be fabricated using multiphoton-based free-writing, via the expression of specific adhesion molecules. This protein micropillar array presents a simple “write-and-seed” platform for cell niche studies.



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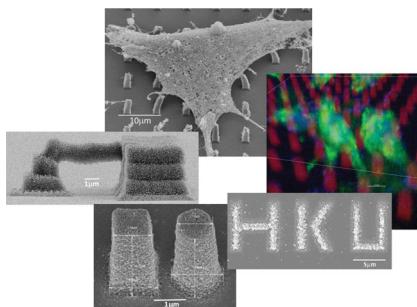
www.small-journal.com

FULL PAPERS

Microstructures

B. P. Chan,* J. N. Ma, J. Y. Xu,
C. W. Li, J. P. Cheng,
S. H. Cheng277–294

Femto-Second Laser-Based Free Writing of 3D Protein Microstructures and Micropatterns with Sub-Micrometer Features: A Study on Voxels, Porosity, and Cytocompatibility

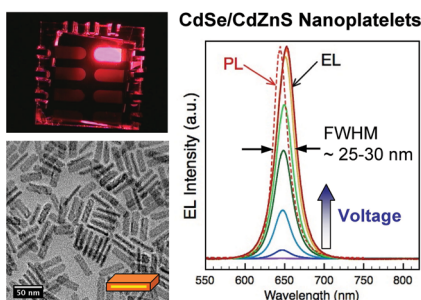


Multiphoton-based free-writing of 3D complex protein microstructures and micropatterns, with sub-micrometer features and controllability over voxel dimension, morphology, and porosity, is reported. Protein micropillar array presents a simple “write-and-seed” platform for cell niche studies. Fibroblasts attach to, grow on, express adhesion molecules and deposit extracellular matrices on these arrays without matrix coating.

LEDs

Z. Chen,* B. Nadal, B. Mahler,
H. Aubin, B. Dubertret..... 295–302

Quasi-2D Colloidal Semiconductor Nanoplatelets for Narrow Electroluminescence

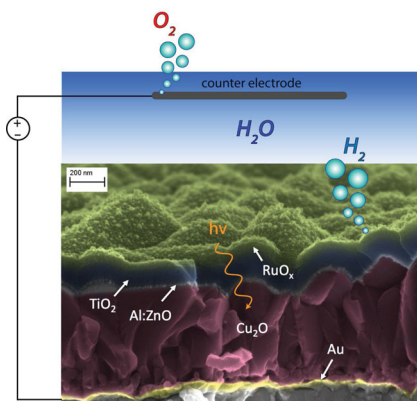


The first light-emitting diodes (LEDs) based on quasi-2D colloidal core/shell CdSe/CdZnS nanoplatelets (NPLs) under a solution-processed hybrid device structure are reported. Over different applied voltages, systematically narrow electroluminescence of FWHM in the range of 25–30 nm is observed, which is highly attractive in terms of color purity in the context of LED applications.

Water Splitting

S. D. Tilley,* M. Schreier, J. Azevedo,
M. Stefk, M. Graetzel303–311

Ruthenium Oxide Hydrogen Evolution Catalysis on Composite Cuprous Oxide Water-Splitting Photocathodes

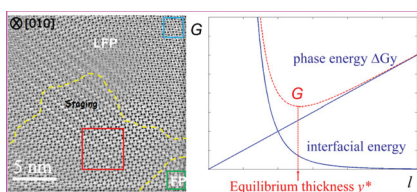


Ruthenium oxide on cuprous oxide photocathodes enhanced by a built-in p–n junction yields an active catalyst for hydrogen generation from water and unprecedented 94% stability over 8 h of light chopping chronoamperometry at 0 V vs. the reversible hydrogen electrode. The photocurrents obtained would correspond to greater than 6% solar-to-hydrogen efficiency in a tandem cell configuration.

Phase Transition

C. Zhu, L. Gu,* L. Suo,
J. Popovic, H. Li,* Y. Ikuhara,
J. Maier*312–318

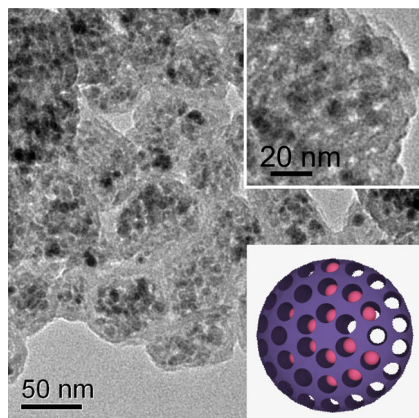
Size-Dependent Staging and Phase Transition in LiFePO₄/FePO₄



The phenomenon of Li-ordering in the system LiFePO₄/FePO₄ is investigated by STEM-ABF for different sizes. While in small crystals, the ordering affects the whole particle; for larger crystals, it was found to characterize the LiFePO₄/FePO₄ contact and the interfacial zones narrow with increasing size. These findings are discussed in the light of phase transition thermodynamics and kinetics.

FULL PAPERS

Robust composite structures consisting of Fe_3O_4 nanoparticles (~ 5 nm) embedded in uniform mesoporous carbon spheres with an average size of about 70 nm (IONP@mC) are synthesized with the purpose of application in high-rate batteries. Under high current densities ranging from 500 to 10 000 mA g^{-1} , such composites deliver stable and high reversible capacities, reaching 271 mAh g^{-1} at 10 000 mA g^{-1} .

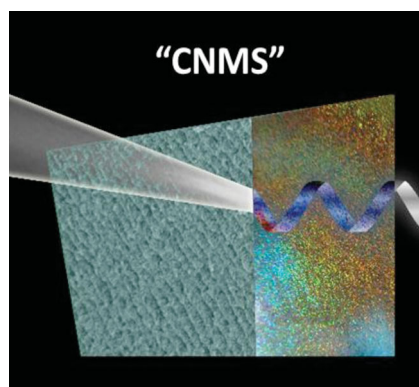


Batteries

Y. Chen, B. Song, M. Li, L. Lu,
J. Xue* 319–326

Fe_3O_4 Nanoparticles Embedded in Uniform Mesoporous Carbon Spheres for Superior High-Rate Battery Applications

A detailed investigation of the formation and properties of chiral nematic mesoporous silica (CNMS) templated by cellulose nanocrystals is presented. These materials are made by a simple self-assembly process and have tunable chirality, mesoporosity, and photonic properties. The chiral pore structure of these materials may provide unique opportunities for applications including refractometric sensing.

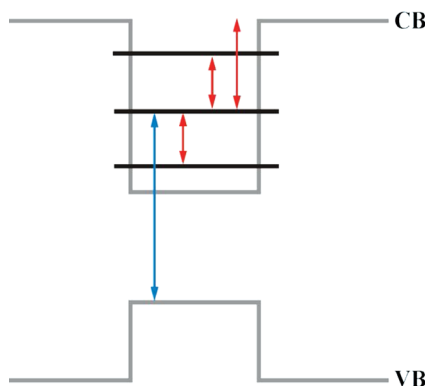


Self-Assembly

K. E. Shopsowitz, J. A. Kelly,
W. Y. Hamad,
M. J. MacLachlan* 327–338

Biopolymer Templated Glass with a Twist: Controlling the Chirality, Porosity, and Photonic Properties of Silica with Cellulose Nanocrystals

A model is developed to calculate the intersubband (blue arrow) and intrasubband (red arrows) photocurrents in an InAs/GaAs quantum dot solar cell. Temperature-dependent quantum efficiency measurements are reproduced with good agreement. The results reveal the radiative nature of the thermal escape from the quantum dots, and explain the difficulty in measuring intrasubband transitions.

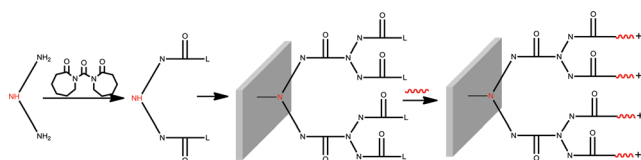


Solar Cells

A. Mellor,* A. Luque, I. Tobías,
A. Martí 339–345

Realistic Detailed Balance Study of the Quantum Efficiency of Quantum Dot Solar Cells

Shape-adaptive, hyperbranched polyurea with quaternary ammonium compounds. The preparation of AB2 monomers and the covalently attached hyperbranched polyurea coatings with polyethyleneimine covalently coupled to hyperbranched polyurea coatings. The coatings demonstrate high contact-killing efficacies toward adhering staphylococci, without any demonstrable leaching of antibacterial compounds.



Antibacterials

L. A. T. W. Asri, M. Crismaru,
S. Roest, Y. Chen, O. Ivashenko,
P. Rudolf, J. C. Tiller,
H. C. van der Mei,* T. J. A. Loontjens,
H. J. Busscher 346–355

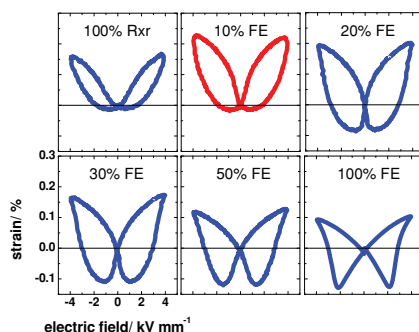
A Shape-Adaptive, Antibacterial-Coating of Immobilized Quaternary-Ammonium Compounds Tethered on Hyperbranched Polyurea and its Mechanism of Action

FULL PAPERS

Piezoceramics

C. Groh, D. J. Franzbach, W. Jo,*
K. G. Webber, J. Kling,
L. A. Schmitt, H.-J. Kleebe, S.-J. Jeong,
J.-S. Lee, J. Rödel356–362

**Relaxor/Ferroelectric Composites:
A Solution in the Quest for
Practically Viable Lead-Free Incipient
Piezoceramics**

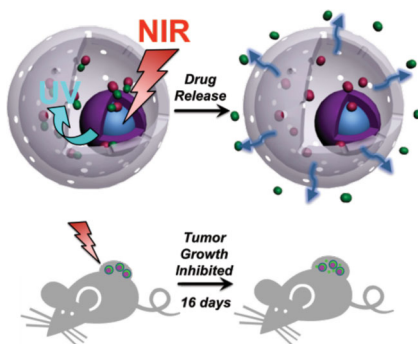


Incipient piezoceramics are featured by giant strain of $\approx 0.4\%$. However, this giant strain is only realized at relatively large electric field ($>4 \text{ kV mm}^{-1}$) with a significant strain hysteresis. Here, many of the challenges the incipient piezoceramics face can be overcome by relaxor/ferroelectric composite approach.

Tumor Therapies

L. Z. Zhao, J. J. Peng, Q. Huang,
C. Y. Li, M. Chen, Y. Sun, Q. N. Lin,
L. Y. Zhu,* F. Y. Li*363–371

**Near-Infrared Photoregulated Drug
Release in Living Tumor Tissue via
Yolk-Shell Upconversion Nanocages**

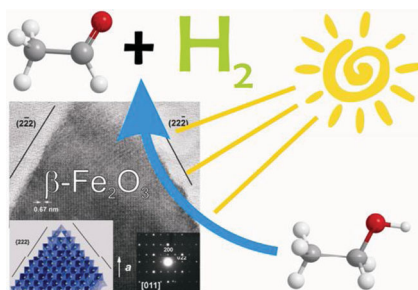


A near-infrared (NIR) phototrigger-controlled drug-release device (PDD) is designed using yolk-shell structured nanocages with upconversion nanophosphors as yolks and silica as shells (YSUCNP). The anticancer drug chlorambucil caged with a coumarin phototrigger is accommodated by YSUCNPs to a large loading capacity of 49 wt%. By employing NIR light with deep tissue penetration depth as stimuli, the PDD demonstrates efficacy in living tumor-bearing mice with zero premature release.

Hydrogen Production

G. Carraro, C. Maccato, A. Gasparotto,
T. Montini, S. Turner, O. I. Lebedev,
V. Gombac, G. Adami,
G. Van Tendeloo, D. Barreca,*
P. Fornasiero*372–378

**Enhanced Hydrogen Production
by Photoreforming of Renewable
Oxygenates Through Nanostructured
 Fe_2O_3 Polymorphs**

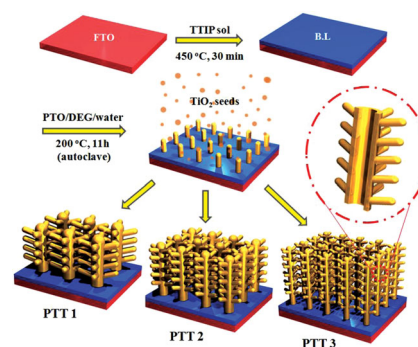


Sunlight-activated photoreforming of renewable oxygenates promoted by Fe_2O_3 nanosystems is a very attractive process for hydrogen production. In this context, scarcely investigated β - and ϵ - Fe_2O_3 polymorphs, fabricated by chemical vapor deposition, show very promising performances for photocatalytic solar hydrogen generation. The present approach holds a remarkable potential even for the synthesis of added-value by-products, paving the way to manifold technological applications.

Dye-Sensitized Solar Cells

D. K. Roh, W. S. Chi, H. Jeon, S. J. Kim,
J. H. Kim*379–386

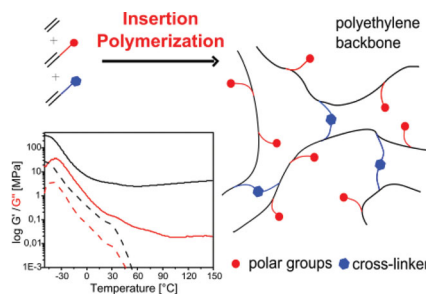
**High Efficiency Solid-State Dye-
Sensitized Solar Cells Assembled with
Hierarchical Anatase Pine Tree-like
 TiO_2 Nanotubes**



Hierarchical, 19 μm long, anatase, pine tree-like TiO_2 nanotube arrays directly grown on a transparent conducting oxide via a one-step hydrothermal reaction result in high-efficiency, solid-state dye-sensitized solar cells. The efficiency is 8.0% at 100 mW/cm^2 , one of the highest values observed for the N719 dye.

FULL PAPERS

Saturated polar-substituted elastomers are obtained via functional-group tolerant catalytic insertion polymerization. This novel direct approach to hydrocarbon- and oil-resistant elastomers is compatible with a wide range of cross-linking chemistries, which results in useful mechanical and thermal properties as well as solvent-resistance.

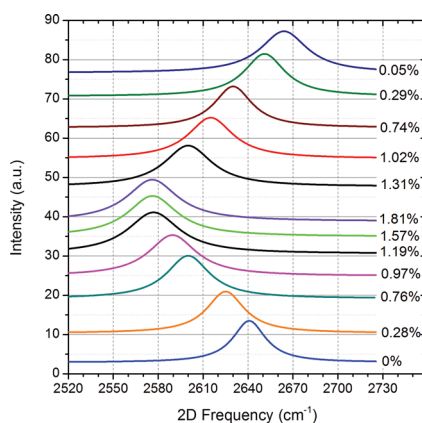


Elastomers

T. Rünzi, S. Mecking*387–395

Saturated Polar-Substituted Polyethylene Elastomers from Insertion Polymerization

The mechanical response of monolayer graphene on polyethylene terephthalate is characterized using in-situ Raman spectroscopy and atomic force microscopy. Two interfacial failure mechanisms, shear sliding under tension and buckling under compression, are identified. The interfacial shear strength is found to range between 0.46 and 0.69 MPa. Beyond a critical compressive strain of around -0.7% , buckling ridges are observed.



Graphene

T. Jiang, R. Huang,*
Y. Zhu*396–402

Interfacial Sliding and Buckling of Monolayer Graphene on a Stretchable Substrate

Optically transparent antibacterial films capable of healing scratches to restore transparency are fabricated by incorporating triclosan into branched polyethylenimine/poly(acrylic acid) multilayer films. Sustained release of triclosan endows the films with antibacterial properties. Film transparency can be healed multiple times by immersing the films in water or spraying water on them.

Self-Healing Materials

X. Wang, Y. Wang, S. Bi, Y. Wang,
X. Chen, L. Qiu, J. Sun*403–411

Optically Transparent Antibacterial Films Capable of Healing Multiple Scratches

