ADVANCED FUNCTIONAL MATERIALS

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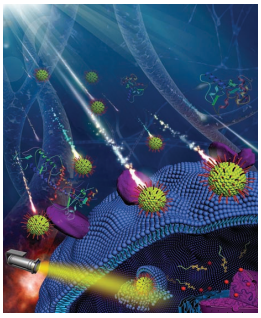
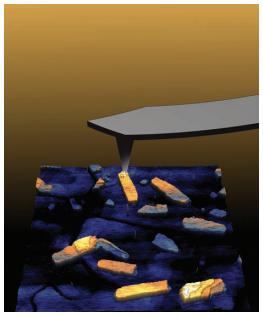


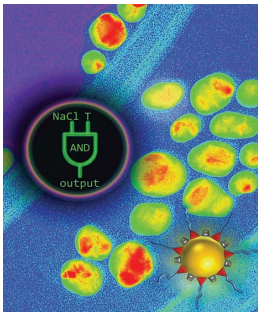
Micelles

On page 2489 H. Yu, Y. Li, and co-workers report a pH and near-infrared light responsive micelle for combating cancer multidrug resistance (MDR). The micelles induce moderate hyperthermia effect upon NIR laser illumination to facilitate their tumor penetration and lysosome escape, thus improving the therapeutic efficacy of doxorubicin. This study implies a novel strategy for treatment of MDR cancer.

Electrical Junctions

A multiscale structure versus electric properties correlation of a prototypical n-type organic semiconductor assembled in different ordered nanoarchitectures, from Langmuir–Blodgett monolayer films to few monolayers-thin structures, is performed by P. Samorì and team on page 2501. The highest charge carrier mobility yet reported for a n-type LB monolayer is obtained, being one order of magnitude higher than the out-of-plane mobility measured in the multilayered structures, evidencing charge-transport anisotropy.



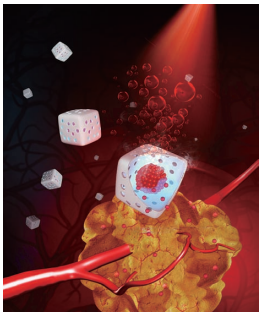


Gold Nanoparticles

Poly(2-alkyl-2-oxazoline) (PAOx) coated gold nanoparticles (PAOx@AuNPs) are synthesized in a straightforward manner leading to molecular AND logic gates that respond to environmental changes in ionic strength and temperature. As reported by R. Hoogenboom and colleagues on page 2511, the variation of the PAOx composition grants control over the temperature input value. This direct functionalization strategy can be extended to the development of PAOx@AuNPs, of high interest in biotechnology.

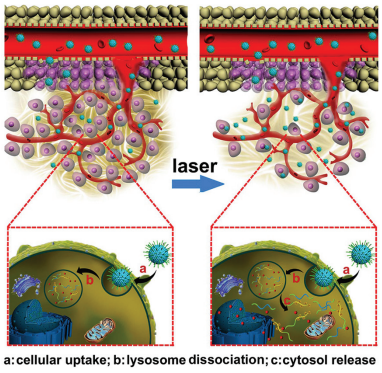
Cancer Theranostics

A smart and versatile theranostic nanoplatform with single component based on hollow mesoporous Prussian blue nanoparticles (HMPBs) realizes the in vivo highly efficient synergistic chemo-thermal tumor therapy. The method presented by J. Shi , H. Chen, and co-workers on page 2520 is guided by synchronous imaging diagnosis and therapy monitoring using ultrasound (US) and photoacoustic (PA) dual-mode imaging for the first time.



FULL PAPERS

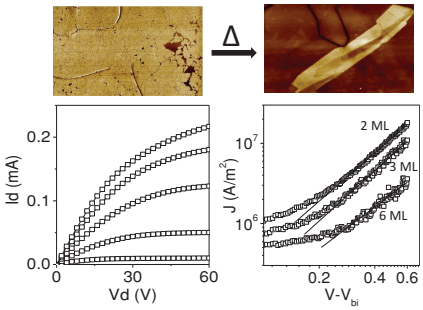
Novel pH- and near-infrared (NIR) light-responsive micelles are developed to overcome doxorubicin-resistance in breast cancer, with hyperthermia-triggered tumor penetration and cytoplasm drug release. The micelles can be specifically dissociated in acidic intracellular organelles to release chemotherapeutic payload and induce a moderate hyperthermia effect by converting NIR light into heat. This suggests a novel approach for combating multidrug-resistant cancers.



Micelles

pH- and NIR Light-Responsive Micelles with Hyperthermia-Triggered Tumor Penetration and Cytoplasm Drug Release to Reverse Doxorubicin Resistance in Breast Cancer

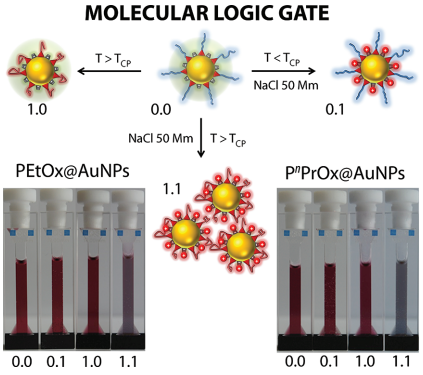
The multiscale correlation between structural and electrical properties of a prototypical n-type organic semiconductor assembled in different ordered nanoarchitectures, from Langmuir–Blodgett (LB) monolayer films to few monolayers-thin structures, is performed. The highest charge carrier mobility yet reported for a n-type LB monolayer is obtained, being one order of magnitude higher than the out-of-plane mobility measured in the multilayered structures, evidencing charge-transport anisotropy.



Electrical Junctions

The Relationship between Structural and Electrical Characteristics in Perylenecarboxydiimide-Based Nanoarchitectures

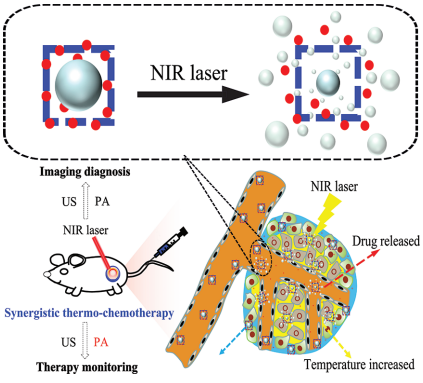
A straightforward end-capping strategy is utilized to synthesize xanthate-functional poly(2-alkyl-2-oxazoline)s (PAOx) that allows direct grafting to citrate-stabilized gold nanoparticles (AuNPs). The obtained PAOx@AuNPs exhibit dual stabilization by repulsive electrostatic and steric interactions giving access to water soluble molecular AND logic gates, wherein environmental temperature and ionic strength constitute the input signals, and the solution color the output.



Gold Nanoparticles

Colorimetric Logic Gates Based on Poly(2-alkyl-2-oxazoline)-Coated Gold Nanoparticles

A smart and versatile theranostic nanoplatform with single component based on hollow mesoporous Prussian blue nanoparticles is developed for the in vivo highly efficient synergistic chemo-thermal tumor therapy, guided by synchronous imaging diagnosis and therapy monitoring using ultrasound and photoacoustic dual-mode imaging for the first time.



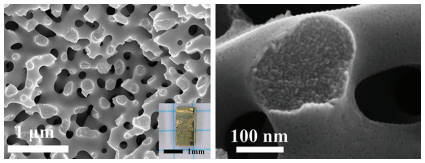
Cancer Theranostics

A Versatile Nanotheranostic Agent for Efficient Dual-Mode Imaging Guided Synergistic Chemo-Thermal Tumor Therapy

FULL PAPERS

Structural Hierarchy

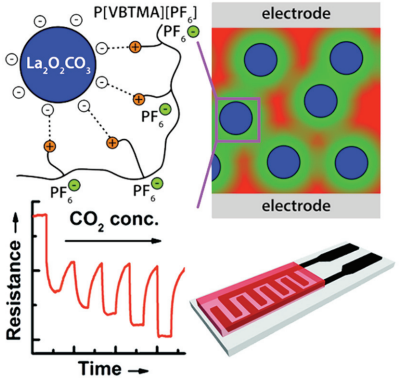
Porous Gold with a Nested-Network Architecture and Ultrafine Structure



Nanoporous gold with a hierarchical structure comprises highly ordered and geometrically similar metal networks nested on two distinctly different size scales. The underlying electrochemical dealloying protocol allows two separate corrosion steps, successively carving the two hierarchy levels from the parent crystal. Using Ag–Au–Pt master alloys brings a lower level size of 6 nm in crack-free monolithic porous bodies.

CO_2 Sensing

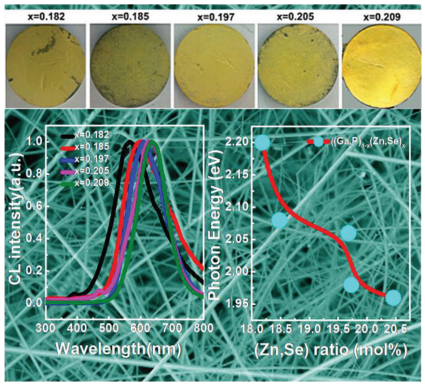
When Nanoparticles Meet Poly(Ionic Liquid)s: Chemoresistive CO_2 Sensing at Room Temperature



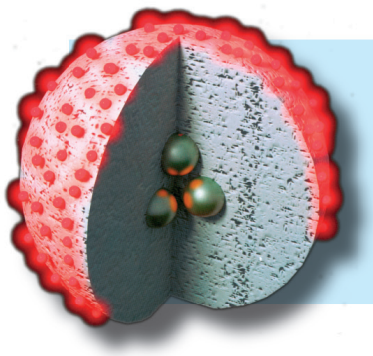
Poly(ionic liquid)-based CO_2 chemoresistive sensors are fabricated by applying a simple strategy to achieve an enhancement of the electrical properties. Advantage is taken of the electrostatic interaction at the interface between $La_2O_2CO_3$ nanoparticles and poly[(*p*-vinylbenzyl)trimethylammonium hexafluorophosphate] to boost the overall conductivity of composites at room temperature. To rationalize this unique behavior, the charge transport mechanism using impedance spectroscopy is studied.

Bandgap Engineering

Pseudobinary Solid-Solution: An Alternative Way for the Bandgap Engineering of Semiconductor Nanowires in the Case of GaP–ZnSe



GaP–ZnSe quaternary solid-solution nanowires with different ZnSe ratios are achieved through a multichannel chemical vapor deposition method. Cathodoluminescence measurements demonstrate that the bandgap of GaP–ZnSe solid-solution can be tailored in the range of 1.95–2.2 eV by tuning the ZnSe concentrations. The solid-solution of different binary semiconductor compounds provides an efficient way for modulating optoelectronic properties.



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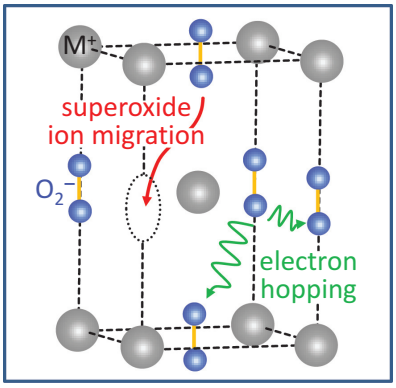
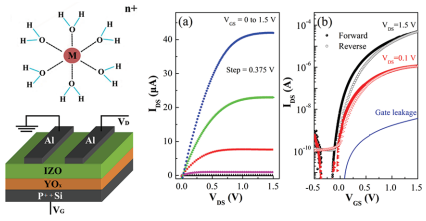
Alkali superoxides KO_2,RbO_2, CsO_2 exhibit mixed ionic/electronic conductivity (σ_{tot} = 3 × 10^{-7}–5 × 10^{-6} S cm^{-1} at 200 °C). Superoxide ions O_2^- can migrate without dissociation, and the oxygen exchange rate with the gas phase is orders of magnitude higher compared to large bandgap perovskites such as $SrTiO_3$.



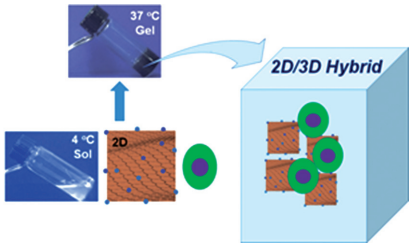
Defect Chemistry

A water-induced metal-oxide precursor route is used to fabricate low-temperature thin-film transistors (TFTs). For water-induced TFTs, the annealing temperature can be lowered by prolonging the annealing time. Fully water-induced $InZnO/YO_x$ TFTs exhibit excellent performance with operating voltage of 1.5 V and mobility of 25 cm^2 V^{-1} s^{-1}.



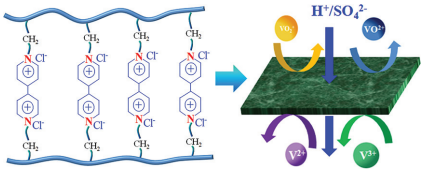
Thin-Film Transistors

Tonsil tissue-derived mesenchymal stem cells are cultured in a 2D/3D hybrid cell culture system prepared by graphene oxide, or reduced graphene oxide, suspended aqueous solution of polypeptide thermogel. The cells aggregate extensively, and the expression of the chondrogenic biomarkers of COL II A1, COL II, and COL X significantly increases in the 2D/3D hybrid system compared to in the 3D hydrogel systems.



Cell Cultures

Anion exchange membranes with internal cross-linking networks are fabricated successfully. The prepared membranes demonstrate excellent chemical stability and high ion conductivity under acidic medium.



Anion Exchange

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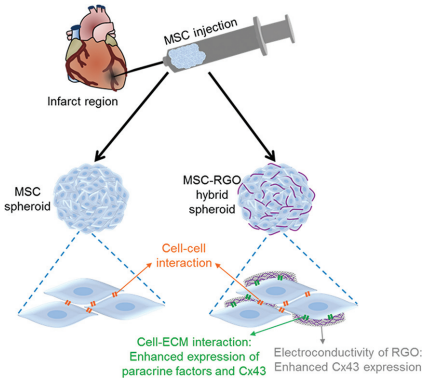
Cardiac Repair

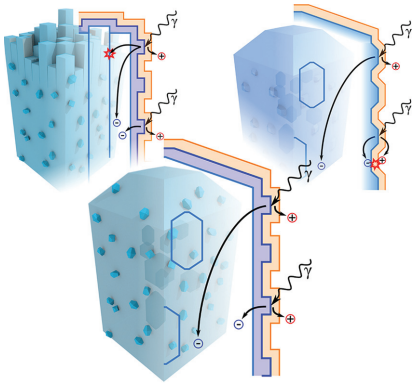
Graphene Potentiates the Myocardial Repair Efficacy of Mesenchymal Stem Cells by Stimulating the Expression of Angiogenic Growth Factors and Gap Junction Protein



Reduced graphene oxide flakes can stimulate the expression of angiogenic growth factors and a gap junction protein in mesenchymal stem cells. Therefore, the incorporation of reduced graphene oxide flakes into mesenchymal stem cell spheroids can enhance the therapeutic efficacy of the stem cells for the treatment of myocardial infarction.

Semiconductors

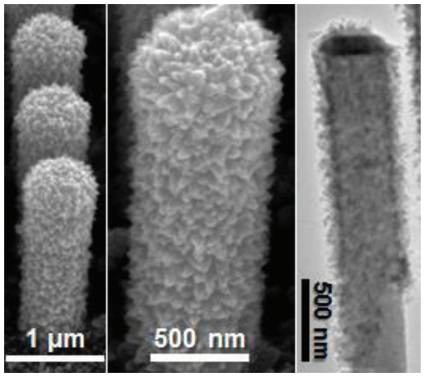
Defeating Loss Mechanisms in 1D TiO_2-Based Hybrid Solar Cells



The nature and influence of loss mechanisms in metal oxide-based electrodes is elucidated on the basis of a 1D TiO_2-based hybrid solar cell. Device performance is correlated to crystal quality through electron microscopy, optical and electronic characterization methods, ultimately opening solutions to avoid detrimental charge trapping and recombination.

Nanocrystals

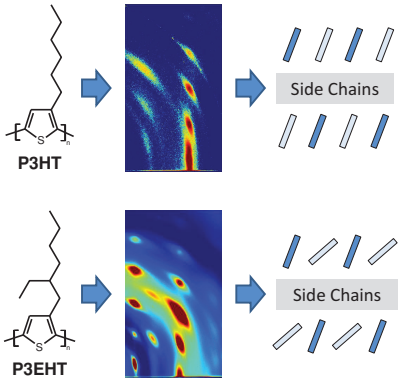
p-Si/SnO_2/Fe_2O_3 Core/Shell/Shell Nanowire Photocathodes for Neutral pH Water Splitting



Fabrication and characterization of novel p-Si/n-SnO_2/n-Fe_2O_3 core/shell/shell nanowire arrays, consisting of Si nanowire backbones coated with a thin SnO_2 layer and a dense Fe_2O_3 nanocrystals shell, are presented. The core/shell/shell nanowires functioning as photocathode show significantly enhanced solar water reduction in a neutral pH water than bare p-Si nanowires, and a long stability of hours without any significant morphological change.

Semiconducting Polymers

Role of Side-Chain Branching on Thin-Film Structure and Electronic Properties of Polythiophenes



The effect of side-chain engineering on structural and electronic properties in two semiconducting polythiophenes is studied using a combination of grazing incidence X-ray diffraction and Monte Carlo crystallographic refinement calculations. The refinement explains the large experimentally observed difference in charge carrier mobility between the two materials and provides a general method for determining the precise structure of other semicrystalline polymers.