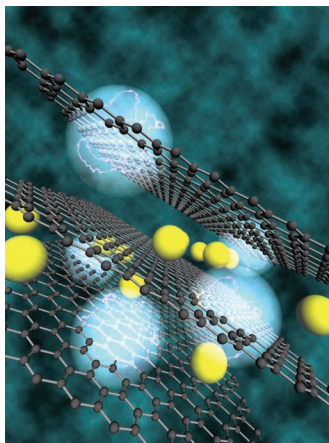


ADVANCED FUNCTIONAL MATERIALS

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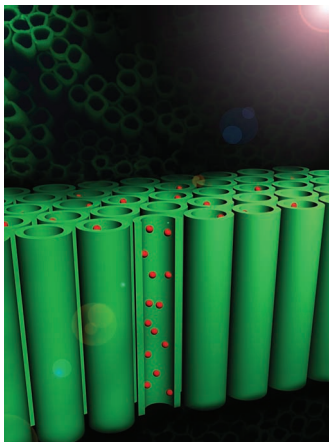


Lithium Ion Batteries

On page 2682 Xi Wang, Huiqiao Li, Tianyou Zhai and co-workers report a new facile route to fabricate N-doped graphene-SnO₂ sandwich paper with the aid of the 7,7,8,8-tetracyanoquinodimethane anion (TCNQ⁻). If used in lithium-ion batteries (LIBs), the material exhibits a large capacity, high rate capability, and excellent cycling stability because of its unique features.

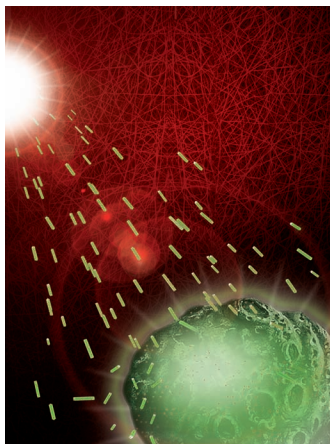
Drug Delivery

Up-conversion luminescent and porous NaYF₄:Yb³⁺, Er³⁺@SiO₂ nanocomposite fibers are prepared via an electrospinning process. As reported by Ping'an Ma, Jun Lin, and co-workers on page 2713, the fibers can be used as anticancer drug delivery host carriers and the drug release shows sustained, pH-sensitive release patterns. The fiber fragments loaded with drug show near-infrared up-conversion emission and this can be applied in the field of cell imaging.



Solar Cells

On page 2821, Wey Yang Teoh and co-workers report that the interfacing of CdTe and CdSe quantum dots (QD) on aligned TiO₂ nanotube (TNT) arrays enables the fabrication of efficient, low-cost, photo-electrochemical solar cells. By improving the quality of the QD-TNT interface, multiple-fold enhancement in photoconversion efficiency can be achieved and the charge injection efficiencies of QDs of different sizes are exhibited.



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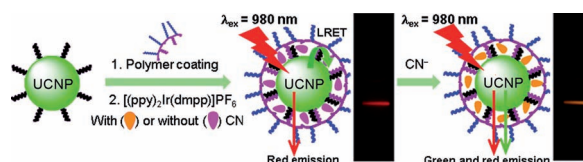
FULL PAPERS

Nanoparticles

L. M. Yao, J. Zhou, J. L. Liu, W. Feng,*
F. Y. Li*2667–2672

Iridium-Complex-Modified Upconversion Nanophosphors for Effective LRET Detection of Cyanide Anions in Pure Water

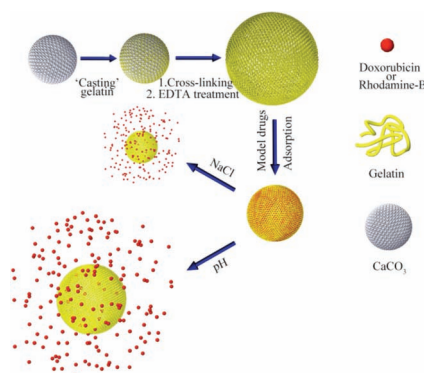
Iridium-complex-modified upconversion nanophosphors are fabricated using a polymer coating method. The nanoparticles produce a colorimetric and upconversion luminescence detection method for cyanide anions in pure water with high selectivity.



Drug Delivery

A. Wang, Y. Cui, J. Li,*
J. C. M. van Hest*2673–2681

Fabrication of Gelatin Microgels by a “Cast” Strategy for Controlled Drug Release

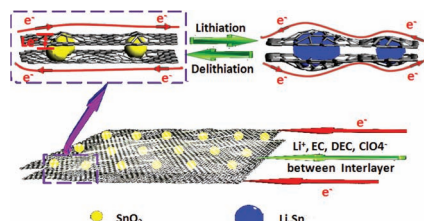


A “cast” strategy is applied to fabricate biodegradable and biocompatible gelatin microgels with a uniform size and porous structure. The manufacturing process involves no organic solvents and surfactants. Model drugs with a low molecular weight and positive charge can be loaded into the microgels via electrostatic interaction and release is automatically triggered by changing the salt concentration and pH, respectively.

Batteries

X. Wang,* X. Cao, L. Bourgeois,
H. Guan, S. Chen, Y. Zhong,
D.-M. Tang, H. Li,* T. Zhai,*
L. Li, Y. Bando,
D. Golberg.....2682–2690

N-Doped Graphene-SnO₂ Sandwich Paper for High-Performance Lithium-Ion Batteries

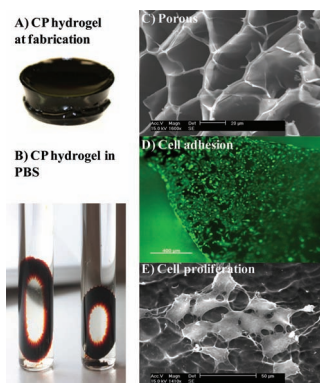


Superior electrochemical performance of lithium-ion batteries is obtained using N-doped graphene-SnO₂ sandwich papers. Using this novel material as the anode for lithium-ion batteries results in a larger capacity, better high rate capability, and excellent cycling stability. These results can be attributed to the unique structure of the material.

Scaffolds

D. Mawad,* E. Stewart, D. L. Officer,
T. Romeo, P. Wagner, K. Wagner,
G. G. Wallace*2692–2699

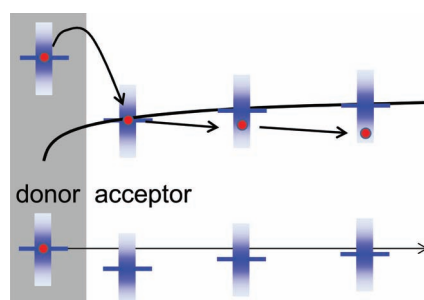
A Single Component Conducting Polymer Hydrogel as a Scaffold for Tissue Engineering



For the first time, a single component conducting polymer (CP) hydrogel is developed and shown to combine both electro-properties and hydrogel characteristics: electroactivity at physiological pH and temperature, a notable swelling ratio while maintaining 3D integrity, good mechanical properties comparable to muscle tissue, and a porous internal structure. The CP hydrogel is shown also to promote cell adhesion and proliferation, opening the way for the development of new tissue engineering scaffolds that have potential applications for nerve and muscle regeneration.

FULL PAPERS

A kinetic Monte Carlo model that quantitatively explains the high efficiency of charge separation at disordered organic heterointerfaces as a two-step process is presented. One of the carriers first hops across the interface, forming a charge transfer (CT) complex. The remaining Coulomb binding energy is subsequently overcome by further relaxation of the electron and hole in the disorder-broadened density of states.

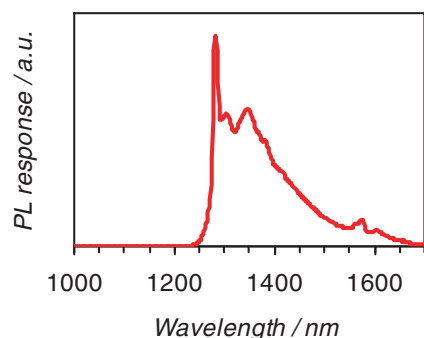


Solar Cells

H. van Eersel, R. A. J. Janssen,
M. Kemerink*2700–2708

Mechanism for Efficient Photoinduced Charge Separation at Disordered Organic Heterointerfaces

The optically active carbon related G-center can provide lasing in silicon. A technique to form the G-center that, unlike previous methods, is fully compatible with standard silicon device technology is reported. It is generated by implantation of carbon followed by proton irradiation. Photoluminescence measurements confirm the controlled formation of high levels of the G-center, which completely dominates the emission spectrum.

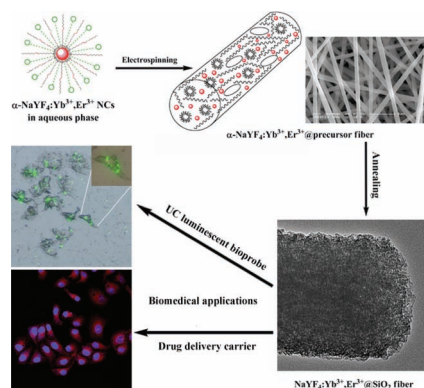


Optically Active Materials

D. D. Berhanuddin, M. A. Lourenço,*
R. M. Gwilliam,
K. P. Homewood2709–2712

Co-Implantation of Carbon and Protons: An Integrated Silicon Device Technology Compatible Method to Generate the Lasing G-Center

$\text{NaYF}_4:\text{Yb}^{3+}, \text{Er}^{3+}@\text{SiO}_2$ nanocomposite fibers, which are used as a novel anti-cancer drug carrier, are prepared using an electrospinning process. The fibers show the attractive properties of regular morphology, porous structure, good biocompatibility, and up-conversion emission. The drug loading and release properties, cytotoxicity, cellular uptake, and cell imaging of nanocomposite fibers are investigated.

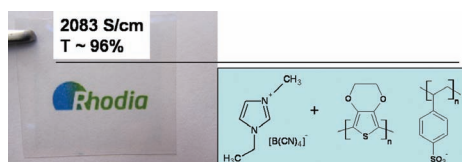


Drug Delivery

Z. Hou, C. Li, P. Ma,* Z. Cheng, X. Li,
X. Zhang, Y. Dai, D. Yang, H. Lian,
J. Lin*2713–2722

Up-Conversion Luminescent and Porous $\text{NaYF}_4:\text{Yb}^{3+}, \text{Er}^{3+}@\text{SiO}_2$ Nanocomposite Fibers for Anti-Cancer Drug Delivery and Cell Imaging

Highly conductive and transparent poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) films are obtained using 1-ethyl-3-methylimidazolium tetracyanoborate (EMIM TCB). The conductivity increases to a record value for such a polymer. The films are highly transparent and can be regarded as one of the most promising films for the preparation of indium tin oxide (ITO)-free organic devices using PEDOT:PSS/EMIM TCB as electrodes.



Ionic Liquidas

C. Badre,* L. Marquant, A. M. Alsayed,
L. A. Hough2723–2727

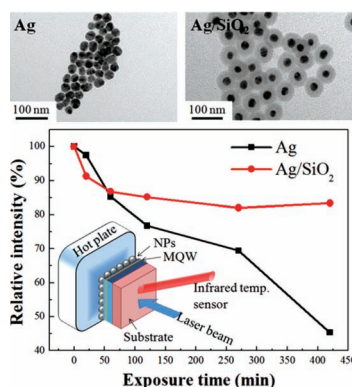
Highly Conductive Poly(3,4-ethylenedioxythiophene):Poly(styrenesulfonate) Films Using 1-Ethyl-3-methylimidazolium Tetracyanoborate Ionic Liquid

FULL PAPERS

Light-Emitting Diodes

L.-W. Jang, D.-W. Jeon, M. Kim,
J.-W. Jeon, A. Y. Polyakov, J.-W. Ju,
S.-J. Lee, J.-H. Baek, J.-K. Yang,
I.-H. Lee*2728–2734

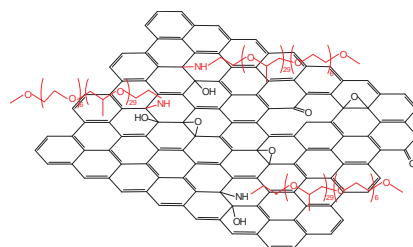
Investigation of Optical and Structural Stability of Localized Surface Plasmon Mediated Light-Emitting Diodes by Ag and Ag/SiO₂ Nanoparticles



Localized surface plasmon (LSP) effects due to Ag and Ag@SiO₂ nanoparticles (NPs) are studied. GaN/InGaN light-emitting diode (LED) structures coated with the NPs exhibit enhanced photoluminescence efficiency as a result of coupling between the LSP and the LED active region. Compared with Ag NPs, Ag@SiO₂ NPs display a much higher optical stability with respect to long-term storage and annealing because of the protection of Ag by the SiO₂ shell.

Graphene

I. Zaman, H.-C. Kuan, Q. Meng,
A. Michelmore, N. Kawashima, T. Pitt,
L. Zhang, S. Gouda, L. Luong,
J. Ma*2735–2743



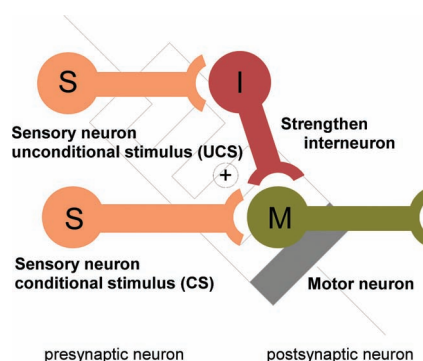
Covalently modified graphene is fabricated by grafting the end amine groups of a long-chain molecule with the epoxide groups of graphene platelets. These high C:O ratio platelets are produced by the ultrasonication and thermal treatment of a commercial graphite intercalation compound. Their epoxy nanocomposites show a low percolation threshold at 0.25 vol%.

A Facile Approach to Chemically Modified Graphene and its Polymer Nanocomposites

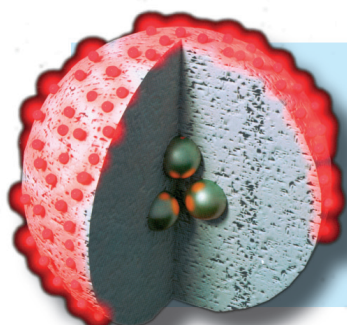
Memristance

M. Ziegler,* R. Soni, T. Patelczyk,
M. Ignatov, T. Bartsch, P. Meuffels,
H. Kohlstedt*2744–2749

An Electronic Version of Pavlov's Dog



A memristive device, together with few-cent, inexpensive analogue electronic circuitry, enables one to mimic all forms of implicit memory. Different threshold voltages for the memristive device and the analogue electronic circuitry are essential in considering memristive devices as realistic substitutes for basic building blocks in neuromorphic circuits.



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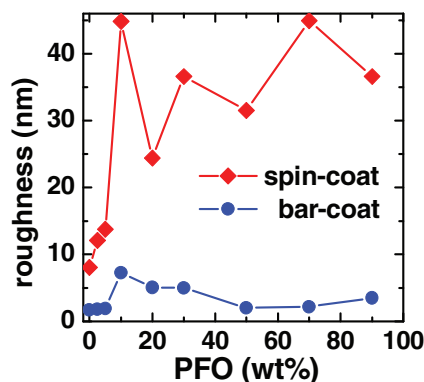
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FULL PAPERS

Resistive switches based on phase separated blends of ferroelectric and semi-conducting polymers have only been realized with thick layers due to the film roughness. Diodes with smooth blend films that switch below 5 V in high yield are demonstrated. The processing is related to the phase diagram and supported by numerical calculations. The wire-bar coating process developed is a major leap towards the industrialization of high-density, non-volatile memories.

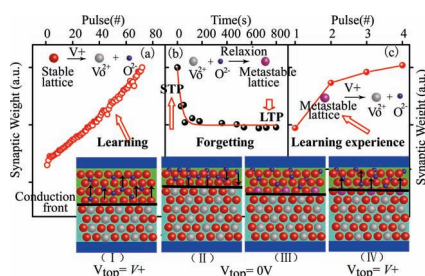


Ferroelectrics

M. Li,* N. Stingelin, J. J. Michels, M. Spijkman, K. Asadi, R. Beerends, F. Biscarini, P. W. M. Blom, D. M. de Leeuw*2750–2757

Processing and Low Voltage Switching of Organic Ferroelectric Phase-Separated Bistable Diodes

A single synaptic device with inherent learning and memory functions is demonstrated based on an amorphous InGaZnO memristor. The “learning”, “forgetting”, and “learning experience” behaviors can be understood using an oxygen ion migration/diffusion model.

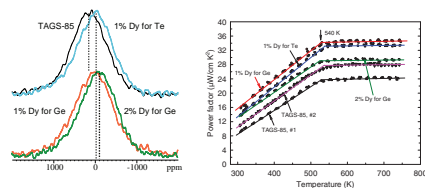


Memristors

Z. Q. Wang, H. Y. Xu,* X. H. Li, H. Yu, Y. C. Liu,* X. J. Zhu2759–2765

Synaptic Learning and Memory Functions Achieved Using Oxygen Ion Migration/Diffusion in an Amorphous InGaZnO Memristor

The doping of tellurium-antimony-germanium-silver (TAGS-85) alloy with Dy, a rare-earth element with large atomic size and localized magnetic moment, enhances the thermopower, the power factor, and the thermoelectric figure of merit significantly. This may be attributed partially to a reduction in carrier concentration and partially to energy filtering of the carriers by potential barriers associated with the Dy.

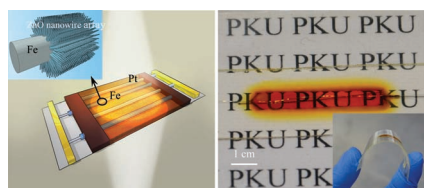


Thermoelectrics

E. M. Levin,* S. L. Bud'ko, K. Schmidt-Rohr2766–2774

Enhancement of Thermopower of TAGS-85 High-Performance Thermoelectric Material by Doping with the Rare Earth Dy

A flexible, transparent, double-sided, substrate-free, planar dye-sensitized solar cell is developed using metal wire/ZnO-nanowire arrays as the working electrode and Pt wire as the counter electrode. The two metal wires are placed in parallel and encapsulated in a poly(ethylene terephthalate) (PET) or polydimethylsiloxane (PDMS) chamber containing an electrolyte. The device shows very good transparency and can be bent to very large angles without loss of performance.



Solar Cells

W. Wang, Q. Zhao,* H. Li, H. Wu, D. Zou, D. Yu*2775–2782

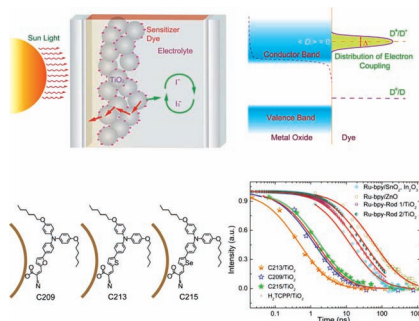
Transparent, Double-Sided, ITO-Free, Flexible Dye-Sensitized Solar Cells Based on Metal Wire/ZnO Nanowire Arrays

FULL PAPERS

Solar Cells

L. Wang, H.-Y. Wang,* H.-H. Fang,
H. Wang, Z.-Y. Yang, B.-R. Gao,
Q.-D. Chen, Wei Han,
H.-B. Sun*2783–2791

Universal Electron Injection Dynamics at Nanointerfaces in Dye-Sensitized Solar Cells

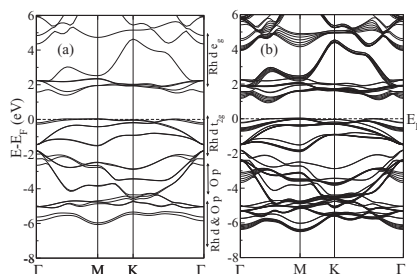


Initial nanointerfacial electron transfer dynamics are studied in dye-sensitized solar cells. The decay profiles, reflecting the electron transfer behavior, show a universal shape. In order to quantitatively comprehend the universal behavior, a static inhomogeneous electronic coupling model with a Gaussian distribution of local injection energetics is proposed in which only the electron injection rate is a variant.

Thermoelectrics

Y. Saeed, N. Singh,
U. Schwingenschlöggl*2792–2796

Colossal Thermoelectric Power Factor in $K_{7/8}RhO_2$

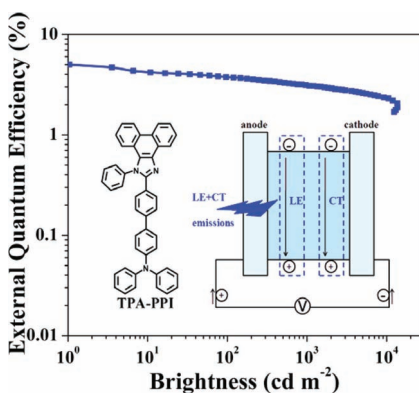


The thermoelectric properties of pristine and hydrated $K_{7/8}RhO_2$ are calculated. A colossal thermoelectric power factor is found and explained in terms of a delicate interplay between the band filling and the length of the lattice parameters. The results demonstrate the important role of hydration for enhancing the thermoelectric performance.

Organic Light-Emitting Diodes

W. J. Li, D. D. Liu, F. Z. Shen, D. G. Ma,
Z. M. Wang, T. Feng, Y. X. Xu,
B. Yang,* Y. G. Ma*2797–2803

A Twisting Donor-Acceptor Molecule with an Intercrossed Excited State for Highly Efficient, Deep-Blue Electroluminescence

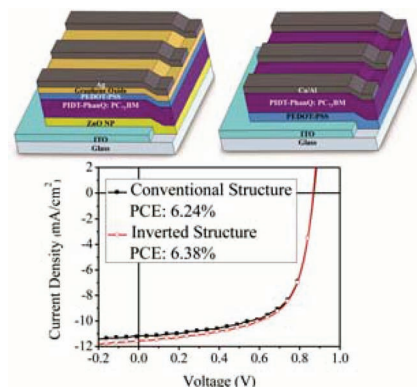


An intercrossed-excited-state (local exciton (LE) and charge transfer (CT)) character, which is identified based on the solvatochromic effect and density functional theory (DFT) calculations, endows the twisting donor-acceptor triphenylamine-imidazol molecule, TPA-PPI, with highly efficient, deep-blue electroluminescence. As one of the best results reported, the intercrossed excited state is thought to be beneficial for obtaining high-efficiency EL.

Solar Cells

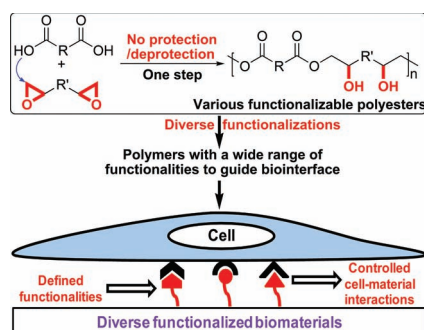
J. Zou, H.-L. Yip, Y. Zhang, Y. Gao,
S.-C. Chien, K. O'Malley, C.-C. Chueh,
H. Chen, A. K.-Y. Jen*2804–2811

High-Performance Inverted Polymer Solar Cells: Device Characterization, Optical Modeling, and Hole-Transporting Modifications



A comprehensive characterization and optical modeling of polymer solar cells is performed on a series of conventional and inverted structure devices to understand the effect of device geometry on photovoltaic performance. Excellent device performance could be achieved by optimizing the optical field distribution and spatial profiles of excitons generation within the active layer in these device configurations.

A simple synthetic platform produces biodegradable and functionalized biomaterials with a wide range of physical, chemical, mechanical, and biological properties. The polymerization can be applied to a wide range of substrates and produces polyesters with free functional groups in one step without protection or deprotection. This provides a simple, versatile, and powerful way to tailor the properties of biomaterials for specific biomedical applications.

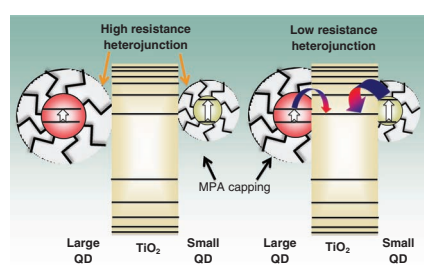


Biomaterials

Z. You, Y. Wang*2812–2820

A Versatile Synthetic Platform for a Wide Range of Functionalized Biomaterials

The efficiency of interfacial photoelectron injection from quantum dots (CdTe and CdSe) of different sizes to metal oxide acceptor (TiO₂ nanotubes) relies on the size of the quantum dots, as well as the quality of the heterojunction. A low resistance heterojunction is essential to maximize the electron injection efficiencies from smaller size quantum dots.

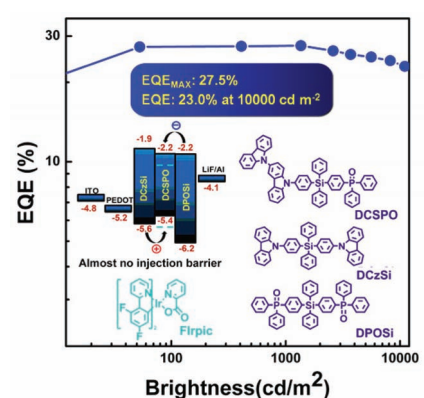


Solar Cells

H. Yang, W. Fan, A. Vaneski, A. S. Susha,
W. Y. Teoh,* A. L. Rogach2821–2829

Heterojunction Engineering of CdTe and CdSe Quantum Dots on TiO₂ Nanotube Arrays: Intricate Effects of Size-Dependency and Interfacial Contact on Photoconversion Efficiencies

A series of wide-bandgap tetraphenylsilane materials containing carbazole and phosphine oxide units with different ratios and linking arrangements are designed and synthesized. With a double blocking device structure based on Flrpic, a high external quantum efficiency of 27.5% and a maximum current efficiency of 49.4 cd A⁻¹ with very low roll-off are achieved.

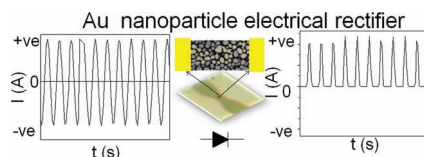


Light-Emitting Diodes

H. Liu, G. Cheng, D. H. Hu,
F. Z. Shen, Y. Lv, G. N. Sun, B. Yang,
P. Lu,* Y. G. Ma*2830–2836

A Highly Efficient, Blue-Phosphorescent Device Based on a Wide-Bandgap Host/Flrpic: Rational Design of the Carbazole and Phosphine Oxide Moieties on Tetraphenylsilane

An all-gold nanoparticle electrical rectifier fabricated using a simple direct write process exhibits a current rectification of 10^5 and tunable threshold voltage. Such a rectifier transferred to a flexible spongy substrate shows response to swelling and deswelling of the substrate due to varying interparticle coupling.



Lithography

B. Radha, G. U. Kulkarni*2837–2845

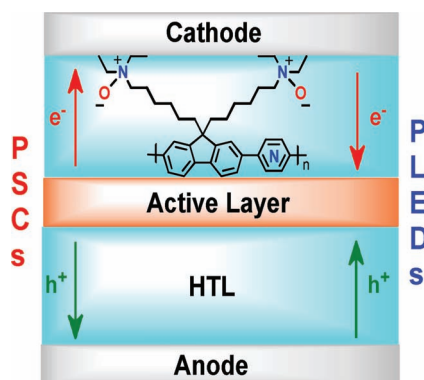
An Electrical Rectifier Based on Au Nanoparticle Array Fabricated Using Direct-Write Electron Beam Lithography

FULL PAPERS

Optoelectronic Devices

X. Guan, K. Zhang, F. Huang,*
G. C. Bazan,* Y. Cao2846–2854

**Amino *N*-Oxide Functionalized
Conjugated Polymers and their
Amino-Functionalized Precursors:
New Cathode Interlayers for High-
Performance Optoelectronic Devices**

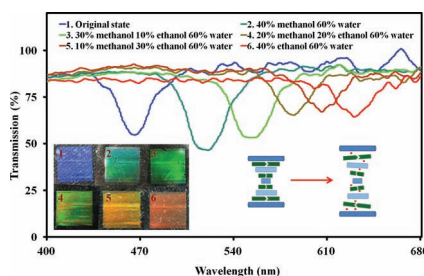


Alcohol-soluble neutral conjugated polymers with amino *N*-oxide functionalized side chains and different linkages of pyridinyl moieties in the main chain are synthesized as a cathode interlayer for polymer light-emitting diodes (PLEDs) and polymer solar cells (PSCs). High performance of PLEDs and PSCs is achieved by using these polymers as cathode interlayers, which indicates a promising pathway to PLEDs and PSCs with high efficiencies.

Liquid Crystals

C.-K. Chang,*
C. M. W. Bastiaansen, D. J. Broer,*
H.-L. Kuo2855–2859

**Alcohol-Responsive, Hydrogen-Bonded,
Cholesteric Liquid-Crystal Networks**

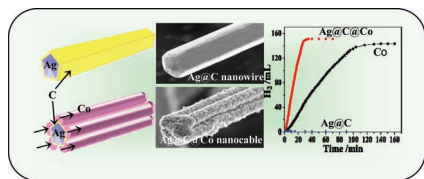


Alcohol-responsive, hydrogen-bonded, cholesteric liquid-crystal (CLC) networks are used for the detection of and distinction between ethanol and methanol molecules using a hydrogen-bridged CLC network with a controlled porosity. The reflecting color of CLC films has an obviously different response that is determined by the alcohol solution uptake.

Nanostructures

B. Sun, M. Wen,* Q. Wu,*
J. Peng2860–2866

**Oriented Growth and Assembly
of Ag@C@Co Pentagonalprism
Nanocables and their Highly Active
Selected Catalysis Along the Edges for
Dehydrogenation**

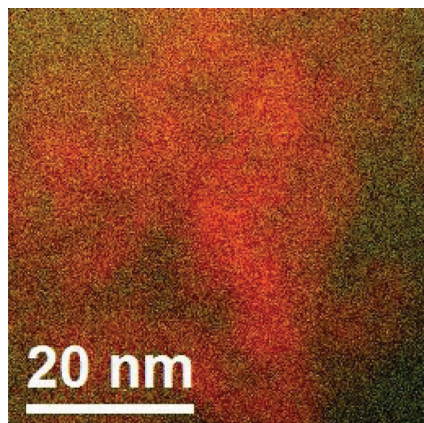


Ag@C@Co pentagonalprism nanocables, with both magnetic and catalytic functionality, are synthesized by synchronous growth and a directional assembly process. The resulting magnetically recyclable Ag@C@Co nanocables exert highly efficient selected catalytic activity along the edges for the hydrolytic dehydrogenation of ammonia borane aqueous under ambient conditions at room temperature.

Nanocrystals

M. Epifani,* T. Andreu,
S. Abdollahzadeh-Ghom,
J. Arbiol, J. R. Morante2867–2875

**Synthesis of Ceria–Zirconia
Nanocrystals with Improved
Microstructural Homogeneity and
Oxygen Storage Capacity by Hydrolytic
Sol–Gel Process in Coordinating
Environment**



Ceria–zirconia solid solutions homogeneously undergo phase transformations from cubic to tetragonal structures. This is due to the initial intimate mixing of the constituent cations, as the energy-filtered transmission electron microscopy (EFTEM) image shows.