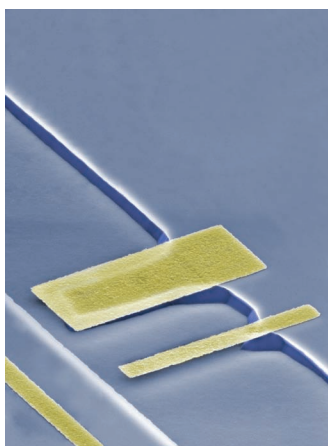


ADVANCED FUNCTIONAL MATERIALS

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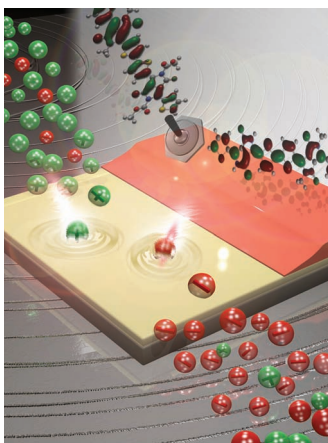


3D Patterning

On page 4004, Frank Niklaus and co-workers report on the fabrication of 3D nanostructures by alternating steps of silicon deposition and local ion implantation by focused ion beam (FIB) writing. The defined 3D nanostructures are formed in a final step by selective silicon etching.

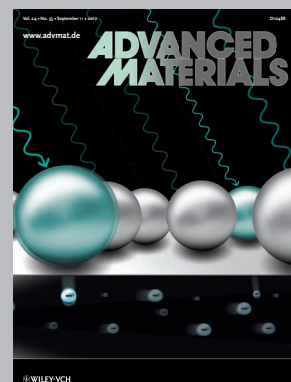
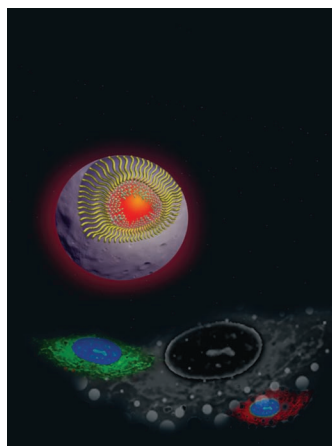
Imaging

Chemiluminescent micelles contain polyoxalate and fluorophore in the core and are capable of performing a peroxalate chemiluminescence reaction with hydrogen peroxide. Hydrogen peroxide is generated in large amounts during inflammatory responses. As reported by Dongwon Lee and co-workers on page 4038, diffusion of hydrogen peroxide into the interior of chemiluminescent micelles initiates the peroxalate chemiluminescence reaction and subsequent light emission, allowing the detection of inflammatory diseases.



Organic Transistors

A narrow bandgap polymeric semiconductor, **BOC-PTDPP**, composed of an alkyl substituted diketopyrrolopyrrole (DPP) and *tert*-butoxycarbonyl (*t*-BOC)-protected DPP, is synthesized with a view toward forming hydrogen-bonded networks after the thermal cleavage of *t*-BOC groups. On page 4128 Joon Hak Oh, Changduk Yang, and co-workers report that the dominant polarity in ambipolar organic transistors based on BOC-PTDPP changes from positive to negative after the thermal cleavage of *t*-BOC groups.



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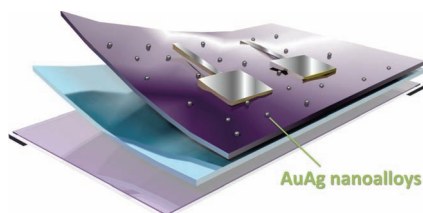
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FULL PAPERS

Solar Cells

H.-C. Chen, S.-W. Chou, W.-H. Tseng,
I.-W. P. Chen, C.-C. Liu, C. Liu,
C.-L. Liu, C.-h. Chen,* C.-I. Wu,*
P.-T. Chou*3975–3984

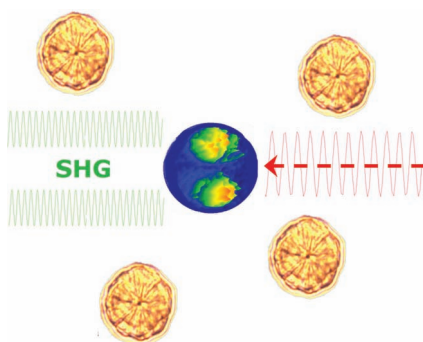


A one-pot synthesis of large size and monodispersed AuAg nanoalloys is developed in hot organic media and the mechanism of production is elaborated in detail. Simultaneous enhancements of the short circuit current density, open circuit voltage, fill factor, and incident photon-to-current efficiency are achieved in high-performance bulk heterojunction solar cells with incorporation of 1% Au₁₁Ag₈₉ nanoalloys embedded in the active layer.

Large AuAg Alloy Nanoparticles Synthesized in Organic Media Using a One-Pot Reaction: Their Applications for High-Performance Bulk Heterojunction Solar Cells

Optical Properties

H. Vigouroux, E. Fargin,*
S. Gomez, B. L. Garrec,
G. Mountrichas, E. Kamitsos,
F. Adamietz, M. Dussauze,
V. Rodriguez*3985–3993



Glass-ceramic containing spherulitic crystallization is shown to exhibit 3D isotropic second harmonic generation (SHG) signal. Transparent glass-ceramics containing spherulite are produced using a reproducible and fast technique. Combining μ -Raman and μ -SHG mapping, a radial distribution of the crystalline particles inside the spherulite is demonstrated, which leads to a macroscopic SHG signal with isotropic and efficient properties.

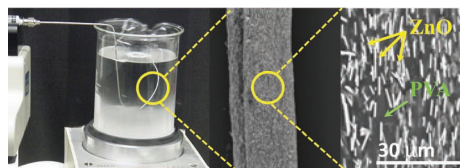
Synthesis and Multiscale Evaluation of LiNbO₃-Containing Silicate Glass-Ceramics with Efficient Isotropic SHG Response

Composites

N. Kinadjian, M.-F. Achard,
B. Julián-López,* M. Maugey, P. Poulin,
E. Prouzet, R. Backov*3994–4003

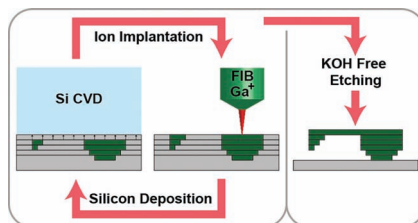
ZnO/PVA/Zn-nanorods fibers with anisotropic photonic properties are obtained through co-extrusion. Preferential nanorods alignment under hot mechanical elongation triggers both mechanical and anisotropic collective light absorption and photoluminescence properties.

ZnO/PVA Macroscopic Fibers Bearing Anisotropic Photonic Properties



Microelectromechanical Systems

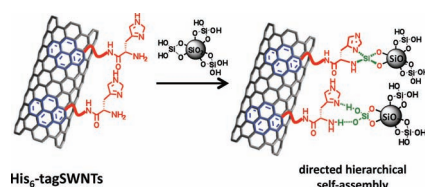
A. C. Fischer, L. M. Belova,
Y. G. M. Rikers, B. G. Malm,
H. H. Radamson, M. Kolahdouz,
K. B. Gylfason, G. Stemme,
F. Niklaus*4004–4008



3D Free-Form Patterning of Silicon by Ion Implantation, Silicon Deposition, and Selective Silicon Etching

A method for additive layer-by-layer fabrication of 3D Si micro- and nanostructures is reported. The fabrication is based on alternating chemical vapor deposition of Si and local implantation of gallium ions by focused ion beam (FIB) writing. In a final step, the defined 3D structures are formed by etching the silicon in KOH, in which the local ion implantation provides the etching selectivity.

The oligohistidine affinity tag (His_6 -tag) is successfully interfaced with single-walled carbon nanotubes (SWNTs), affording multifunctional biomimetic His_6 -tagSWNTs nanoconstructs. By virtue of the encoded specific His_6 information sequence, the versatility of the nanohybrids is demonstrated in the realization of controllable spatial supramolecular architectures and nanocomposites built from the bottom up, through hierarchical directed self-assemblies induced by β -sheets, metal coordination, and covalent bond interactions.

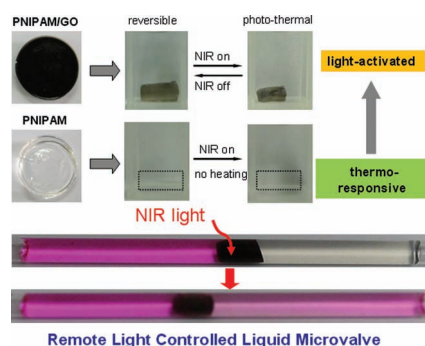


Carbon Nanotubes

R. Baati,* D. Ihiwakrim,
R. R. Mafouana, O. Ersen, C. Dietlin,
G. Duportail4009–4015

Hexahistidine-Tagged Single-Walled Carbon Nanotubes (His_6 -tagSWNTs): A Multifunctional Hard Template for Hierarchical Directed Self-Assembly and Nanocomposite Construction

Photothermally sensitive poly(*N*-isopropylacrylamide)/graphene oxide (PNIPAM/GO) nanocomposite hydrogels are synthesized on the macroscopic scale by in situ irradiation-assisted polymerization of an aqueous solution of *N*-isopropylacrylamide and graphene oxide. The swelling–shrink transition of the nanocomposite hydrogel can be controlled via near-infrared (NIR) laser exposure or non-exposure, showing a potential application as a controlled liquid microvalve.

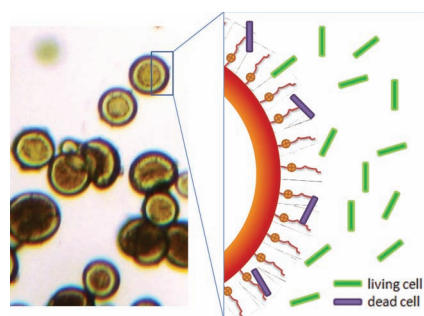


Hydrogels

C.-H. Zhu, Y. Lu, J. Peng, J.-F. Chen,*
S.-H. Yu*4017–4022

Photothermally Sensitive Poly(*N*-isopropylacrylamide)/Graphene Oxide Nanocomposite Hydrogels as Remote Light-Controlled Liquid Microvalves

An inherently biocidal shell of polyurea microcapsules (PUMCs) is formed in an oil-in-oil (dimethylformamide/cyclohexane) system without the use of surfactants. A new hydroxyl-ended quaternary ammonium salt dimethyl-dodecyl-(5-hydroxy-pentyl)-ammonium bromide (DAB) is the key to the in situ synthesis of the functional PUMCs. It serves to decrease interfacial tension of the oil/oil interface, to covalently bond to PUMC shells, and to inactivate bacteria.

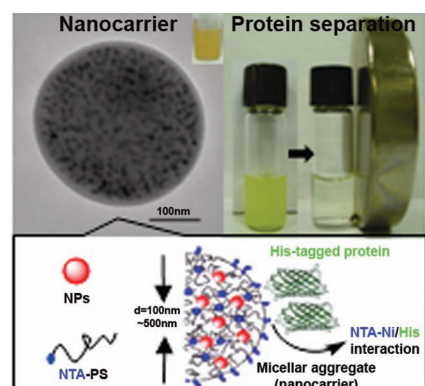


Drug Delivery

W. He, X. Gu, S. Liu*4023–4031

Surfactant-Free One-Step Synthesis of Dual-Functional Polyurea Microcapsules: Contact Infection Control and Drug Delivery

A simple method is developed for encapsulation of nanoparticles (NPs) for aqueous dispersion and selective separation of His-tagged proteins using nitrilotriacetic acid end-functionalized polystyrenes (NTA-PS). The complexation of Ni^{2+} with NTA on the surface of the nanocarrier containing magnetic NPs enables selective and smart separation of His-tagged proteins through NTA-Ni/His interaction from a multi-component solution including a cell lysate using a magnet.



Nanoparticles

M. A. Kadir, S. J. Kim, E.-J. Ha,
H. Y. Cho, B.-S. Kim, D. Choi,
S.-G. Lee, B. G. Kim, S.-W. Kim,
H.-j. Paik*4032–4037

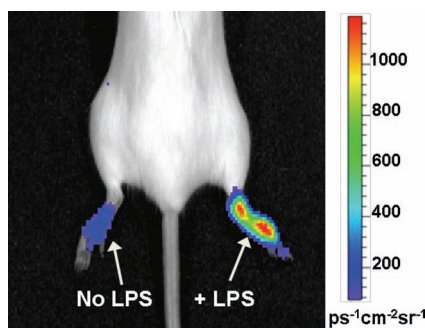
Encapsulation of Nanoparticles Using Nitrilotriacetic Acid End-Functionalized Polystyrenes and Their Application for the Separation of Proteins

FULL PAPERS

Imaging

S. Cho, O. Hwang, I. Lee, G. Lee,
D. Yoo, G. Khang, P. M. Kang,
D. Lee*4038–4043

Chemiluminescent and Antioxidant Micelles as Theranostic Agents for Hydrogen Peroxide Associated-Inflammatory Diseases

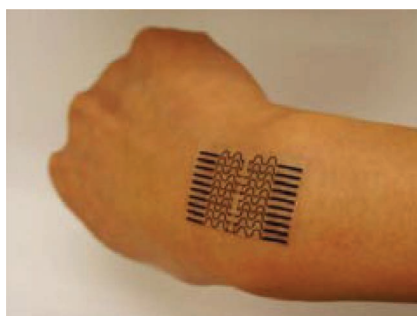


Hydrogen peroxide is generated in large amounts during inflammatory responses and therefore has great potential as a diagnostic and therapeutic marker. Chemiluminescent and antioxidant micelles are developed as novel theranostic agents for hydrogen peroxide-associated inflammatory diseases. The micelles are capable of imaging hydrogen peroxide that is endogenously generated in the lipopolysaccharide (LPS)-stimulated ankle of mice. They also exert potent antioxidant and anti-apoptotic activity.

Sensors

N. Lu, C. Lu, S. Yang,
J. Rogers*4044–4050

Highly Sensitive Skin-Mountable Strain Gauges Based Entirely on Elastomers

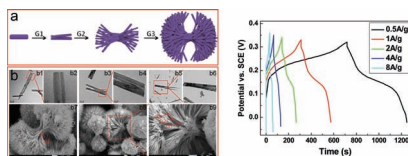


Materials and mechanics approaches are reported for an all-elastomer strain measurement device with a gauge factor as high as 29 and Young's modulus that approaches that of the human epidermis. Measurements using a system of this type laminated on the human wrist reveal that strains in the skin induced by bending of the wrist are between 11.2% and 22.6%.

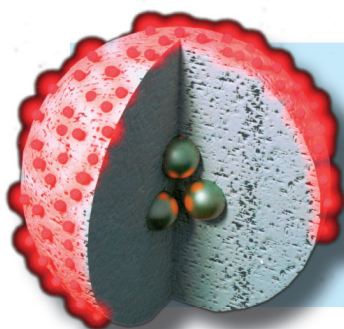
Hierarchical Structures

Y. Xiao, S. Liu, F. Li,* A. Zhang, J. Zhao,
S. Fang, D. Jia*4052–4059

3D Hierarchical Co_3O_4 Twin-Spheres with an Urchin-Like Structure: Large-Scale Synthesis, Multistep-Splitting Growth, and Electrochemical Pseudocapacitors



3D hierarchical Co_3O_4 twin-spheres with an urchin-like structure are synthesized on a large scale for the first time. A multistep splitting growth is proposed to understand the formation of the hierarchical materials. Supercapacitors fabricated with the hierarchical materials exhibit excellent performance for energy storage.



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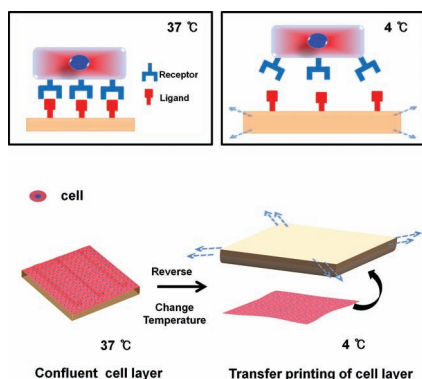
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FULL PAPERS

A simple method to harvest cell layers with anisotropic extracellular matrix (ECM) assembly is presented using cell-interactive and thermoresponsive hydrogels with anisotropic groove patterns. When the temperature is reduced from 37 °C to 4 °C, the hydrogel expands its volume, while the cell layer can be detached and transferred onto new substrate without disruption of the cell–cell junction.

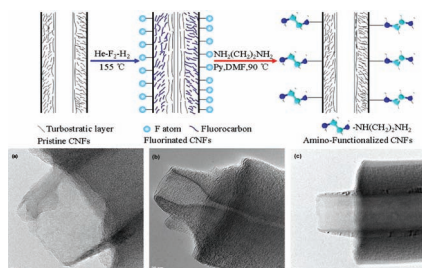


Stimuli-Responsive Materials

I. Jun, S. J. Kim, J.-H. Lee, Y. J. Lee, Y. M. Shin, E. Choi, K. M. Park, J. Park, K. D. Park, H. Shin* ...4060–4069

Transfer Printing of Cell Layers with an Anisotropic Extracellular Matrix Assembly using Cell-Interactive and Thermosensitive Hydrogels

Chemical functionalization effects on the morphology of individual carbon nanofibers (CNFs) are presented. Compared to pristine CNFs, a large discrepancy in the diameter of the hollow core between the cone section and the intact fiber section away from the fractured fluorinated CNFs surface is observed. Further, amino functional group grafting on CNFs recovers the morphology.

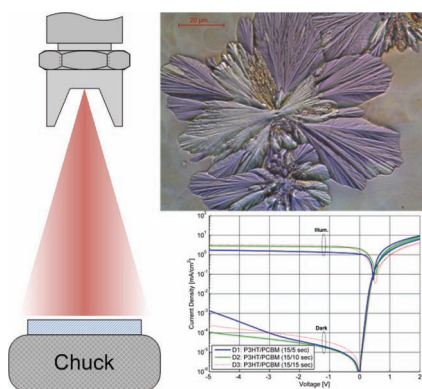


Carbon Nanofibers

J. Zhang, P. Loya, C. Peng, V. Khabashesku,* J. Lou*4070–4077

Quantitative In Situ Mechanical Characterization of the Effects of Chemical Functionalization on Individual Carbon Nanofibers

Successive spray deposition is introduced as an alternative approach for the fabrication of organic photoactive layers. Photodiodes prepared using this fabrication method exhibit a performance comparable to conventional bulk heterojunction devices in which the active layer is rigorously blended in advance. Separate handling of the individual materials and their deposition from distinct solutions enables an enhanced control of the active layer composition.

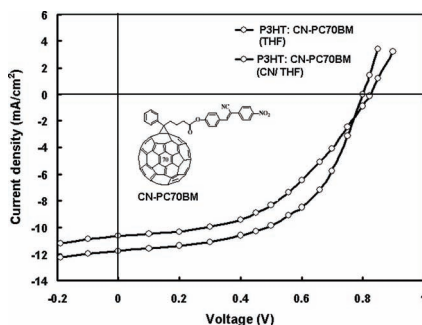


Organic Electronics

A. Abdellah,* K. S. Virdi, R. Meier, M. Döbinger, P. Müller-Buschbaum, C. Scheu, P. Lugli, G. Scarpa4078–4086

Successive Spray Deposition of P3HT/PCBM Organic Photoactive Layers: Material Composition and Device Characteristics

The photovoltaic properties of a bulk heterojunction based on poly(3-hexylthiophene) (P3HT):modified phenyl-C₇₀-butyric acid methyl ester (PC₇₀BM), a CN-PC₇₀BM blend, are studied. Polymer solar cells based on this blend demonstrate power conversion efficiencies of 5.8% with high open circuit voltages of 0.80 and short circuit current densities of 11.75 mA cm⁻². These devices benefit from the high lowest unoccupied molecular orbital (LUMO) energy level of CN-PC₇₀BM and a more balanced charge transport.



Solar Cells

S. P. Singh,* CH. P. Kumar, G. D. Sharma,* R. Kurchania, M. S. Roy4087–4095

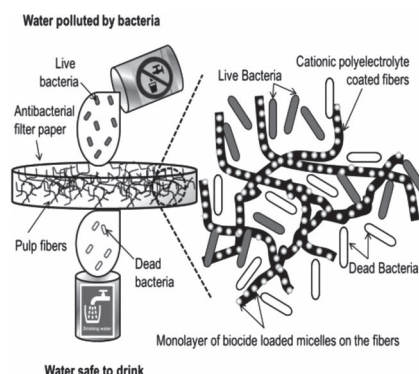
Synthesis of a Modified PC₇₀BM and Its Application as an Electron Acceptor with Poly(3-hexylthiophene) as an Electron Donor for Efficient Bulk Heterojunction Solar Cells

FULL PAPERS

Porous Materials

R. Vyhňalkova, N. Mansur-Azzam,
A. Eisenberg,
T. G. M. van de Ven*4096–4100

Ten Million Fold Reduction of Live Bacteria by Bactericidal Filter Paper

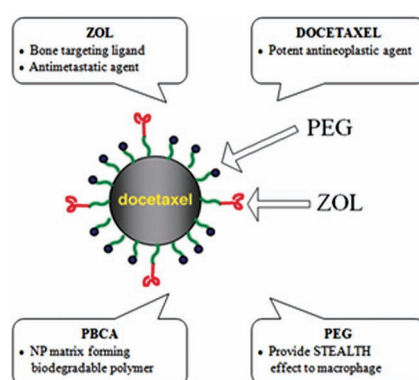


An extremely efficient bactericidal filter paper (99.99999%) based on two active, synergistically acting bactericidal components, a biocide and an antibacterial cationic polyelectrolyte binder, is designed. The biocide is incorporated into the block copolymer micelles attached to the cellulose fibers via the cationic polyelectrolyte. Passage of the bacteria polluted water by gravity through the filter paper results in potable water.

Biomedical Applications

K. R. Chaudhari, A. Kumar,
V. K. M. Khandelwal, A. K. Mishra,
J. Monkkonen,
R. S. R. Murthy*4101–4114

Targeting Efficiency and Biodistribution of Zoledronate Conjugated Docetaxel Loaded Pegylated PBCA Nanoparticles for Bone Metastasis

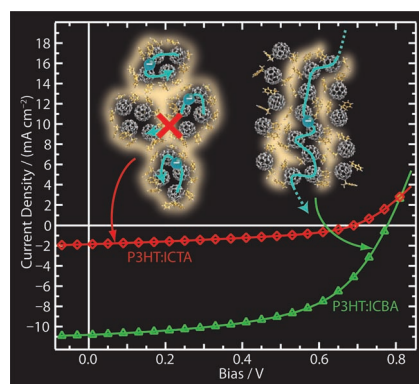


An anionic polymerization technique is used to prepare docetaxel (DTX)-loaded, zoledronic acid (ZOL)-conjugated polyethylene glycol (PEG)ylated polybutyl cyanoacrylate (PBCA) nanoparticles (NPs). The NPs show enhanced cytotoxicity due to higher uptake following ZOL-mediated endocytosis. PBCA-PEG-ZOL NP distribution in tumor infected bone is high compared to the normal bone. Thus, ZOL-conjugated NPs provide efficient and targeted delivery of DTX, with synergistic effects.

Photovoltaic Devices

A. M. Nardes, A. J. Ferguson,
J. B. Whitaker, B. W. Larson,
R. E. Larsen, K. Maturová, P. A. Graf,
O. V. Boltalina, S. H. Strauss,
N. Kopidakis*4115–4127

Beyond PCBM: Understanding the Photovoltaic Performance of Blends of Indene-C₆₀ Multiadducts with Poly(3-hexylthiophene)

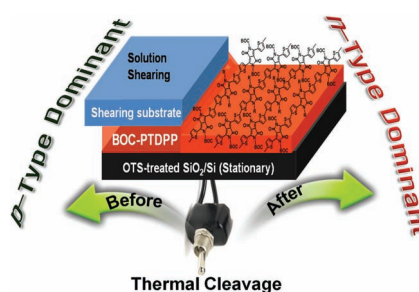


Photovoltaic devices based on a bulk heterojunction of bis-indene-C₆₀ with poly(3-hexylthiophene) show enhanced power conversion efficiency due to an improved open circuit voltage. The addition of a third indene unit to form tris-indene-C₆₀ dramatically hinders both the local and bulk electron transport in the tris-indene-C₆₀ phase due to the formation of small, isolated tris-indene-C₆₀ clusters, resulting in poor device performance.

Semiconductors

J. Lee, A.-R. Han, J. Hong, J. H. Seo,
J. H. Oh,* C. Yang*4128–4138

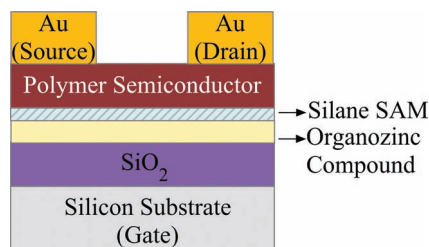
Inversion of Dominant Polarity in Ambipolar Polydiketopyrrolopyrrole with Thermally Removable Groups



A narrow bandgap polymeric semiconductor, BOC-PTDPP, comprising alkyl substituted diketopyrrolopyrrole (DPP) and *tert*-butoxycarbonyl (*t*-BOC)-protected DPP, is synthesized and used in organic field-effect transistors (OFETs). The dominant polarity of charge carriers changes from positive to negative after the thermal cleavage of *t*-BOC groups at 200 °C.

FULL PAPERS

A solution-processed organozinc compound is utilized as a dielectric modification layer in polymer field-effect transistors to improve the surface morphology and to reduce the surface polarity. Enhanced charge carrier mobility is achieved. The organozinc compound originates from the reaction between diethylzinc and the cyclohexanone solvent, which leads to formation of zinc carboxylates.

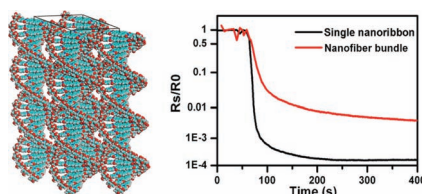


Field-Effect Transistors

X. Xu, B. Liu, Y. Zou, Y. Guo,
L. Li,* Y. Liu* 4139–4148

Organozinc Compounds as Effective Dielectric Modification Layers for Polymer Field-Effect Transistors

A new sugar-based perylenediimide derivative is synthesized and it is shown that its supramolecular structures and helicity can be tuned by kinetic and thermodynamic factors. Demonstration devices for hydrazine sensing based on single nanoribbons exhibit better performance than nanofiber bundle and other achiral nanostructure devices. This provides a pathway to tuning the structures and helicity as well as the possibility to construct high-performance nanodevices.



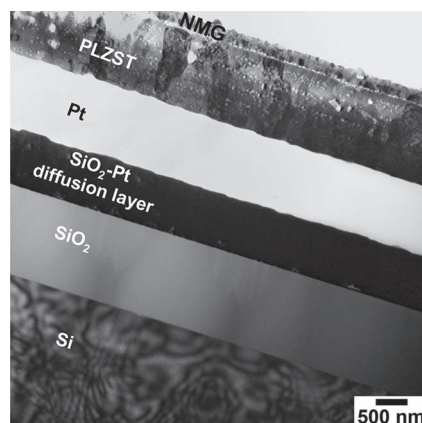
Sensors

J. C. Hu, W. F. Kuang, K. Deng,
W. J. Zou, Y. W. Huang,* Z. X. Wei,*
C. F. J. Faul 4149–4158

Self-Assembled Sugar-Substituted Perylene Diimide Nanostructures with Homochirality and High Gas Sensitivity



A new strategy to modulate the structure and function of ferroic thin films is presented. A ferroelastic strain in a magnetic shape memory alloy Ni-Mn-Ga thin film is found to completely change the stress in the antiferroelectric $(\text{Pb}_{0.97}\text{La}_{0.02})(\text{Zr}_{0.90}\text{Sn}_{0.05}\text{Ti}_{0.05})\text{O}_3$ (PLZST) thin film below, which further results in antiferroelectric to ferroelectric phase transformation in the PLZST film. This finding provides a new strategy to modulate the structure and function of ferroic thin films.

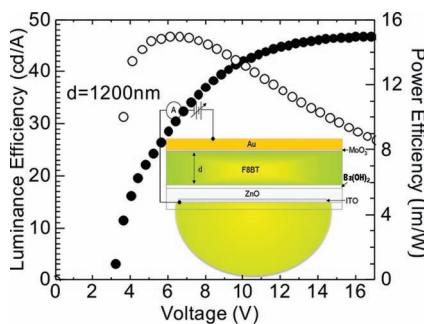


Thin Films

M. S. Mirshekarloo, K. Yao,*
T. Sritharan 4159–4164

Ferroelastic Strain Induced Antiferroelectric-Ferroelectric Phase Transformation in Multilayer Thin Film Structures

A solution-processible barium hydroxide interlayer is used in between ZnO and (9,9'-dioctylfluorene)-co-benzothiadiazole (F8BT) in highly efficient inverted hybrid light-emitting-diode structures. With the aid of an index matched hemispherical lens, luminance and power efficiency reach up to 47 cd A^{-1} and 15 lm W^{-1} , respectively, for a polymer film thickness of $\approx 1.2 \mu\text{m}$.



Light-Emitting Diodes

L. P. Lu, D. Kabra,*
R. H. Friend* 4165–4171

Barium Hydroxide as an Interlayer Between Zinc Oxide and a Luminescent Conjugated Polymer for Light-Emitting Diodes

FULL PAPER

Thin Films

A. Ponrouch, S. Garbarino, E. Bertin,
C. Andrei, G. A. Botton,
D. Guay* 4172–4181

**Highly Porous and Preferentially
Oriented {100} Platinum Nanowires
and Thin Films**



Highly porous and preferentially {100} oriented platinum nanowires and thin films ($R_f = 500$ and up to 50% of (100) surface sites) are prepared by electrodeposition on different substrates without additives. Compared to polycrystalline Pt, there is a factor of 4 and 2.7 increase of the normalized electrocatalytic activity ($\mu\text{A cm}^{-2}_{\text{Pt}}$) for the electro-oxidation of hydrazine and ammonia, respectively.