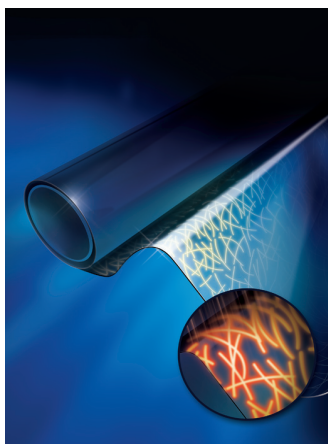


ADVANCED FUNCTIONAL MATERIALS

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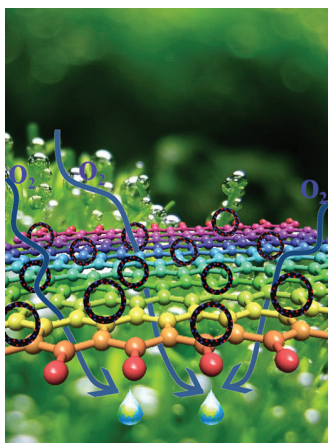
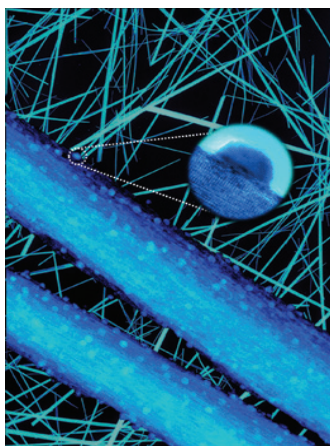


Silver Nanowires

By synthesizing silver nanowires with high aspect ratio and optimizing the nanowire network quality, highly transparent and conductive films are obtained on a large scale. These are explored as electrodes for flexible film heaters. On page 1250, Kwang S. Suh and co-workers report that the film heater based on a uniformly interconnected silver nanowire network shows an efficient heating at low input voltages.

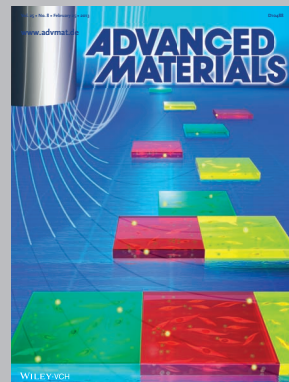
Sensors

A new gas-phase method for the one-step synthesis of metal nanoparticles supported on nanostructured metal oxides is presented by Chris Blackman and co-workers on page 1313. With no requirement for substrate pre-treatment, this provides for direct integration of the co-deposited nanomaterial with device structures and it is utilized for the fabrication of selective gas microsensor arrays based on gold and platinum decorated tungsten oxide nanorods.



Electrocatalysts

On page 1289, Wei Chen and co-workers report a method to fabricate graphene-supported PdAg nanorings. As a potential fuel cell electrocatalyst, the hybrid nanomaterial exhibits excellent catalytic performance for oxygen reduction with the clean product of water. The unique nanostructure of the material with large active surface area, low noble metal loading, and high methanol tolerance is highlighted.



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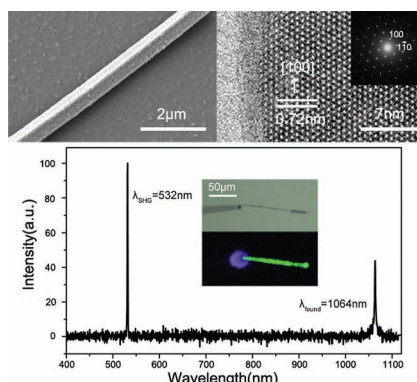
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FULL PAPERS

Nonlinear Optics

G. Qu, Z. Hu, Y. Wang, Q. Yang,
L. Tong*1232–1237

Synthesis of Optical-Quality Single-Crystal β -BaB₂O₄ Microwires and Nanowires

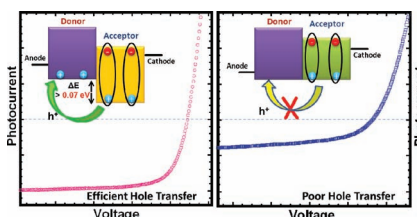


Optical-quality single-crystal β -BaB₂O₄ microwires and nanowires (MNWs) are synthesized in an organic-free hydrothermal method assisted with post-annealing at 700 °C. As-synthesized MNWs have excellent diameter uniformity and surface smoothness. Evident second-harmonic generation (SHG) response is observed in single MNWs under excitation from pulses with 1064 nm wavelength and 10 ps duration. The SHG conversion efficiency is approximately 8.4%.

Solar Cells

G. Ren, C. W. Schlenker, E. Ahmed,
S. Subramanian, S. Olthof, A. Kahn,*
D. S. Ginger,*
S. A. Jenekhe*1238–1249

Photoinduced Hole Transfer Becomes Suppressed with Diminished Driving Force in Polymer-Fullerene Solar Cells While Electron Transfer Remains Active

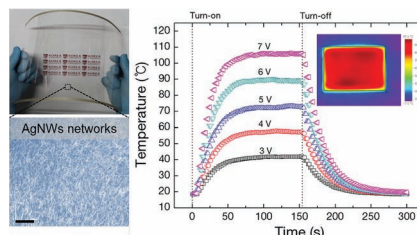


The effect of modulating the driving force for charge separation via photoinduced hole transfer from fullerene excitons in polymer:fullerene solar cells is measured. Poor photoinduced hole transfer is identified as a major limiting factor for photocurrent generation in indene-C₆₀-bis-adduct devices. These results provide a guide to materials design and device engineering for highly efficient organic solar cells.

Silver Nanowires

T. Kim, Y. W. Kim, H. S. Lee, H. Kim,
W. S. Yang, K. S. Suh*1250–1255

Uniformly Interconnected Silver-Nanowire Networks for Transparent Film Heaters



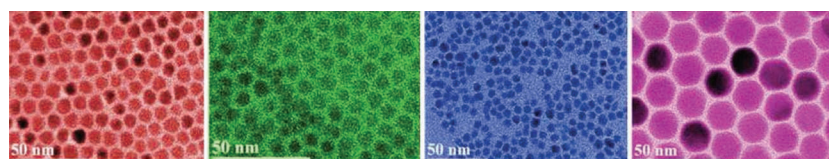
A scalable and facile method of preparing highly transparent and flexible electrodes for film heaters based on solution-processed silver-nanowire (AgNW) networks is presented. By optimizing the network structure of AgNWs, highly transparent and conductive AgNW films are demonstrated, which can yield the effective and rapid heating of the film at low input voltages.

Nanocrystals

X. Liu, X. Wang, B. Zhou,
W.-C. Law, A. N. Cartwright,
M. T. Swihart*1256–1264

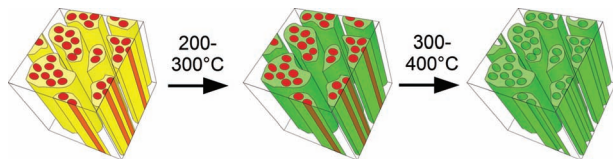
Size-Controlled Synthesis of Cu_{2-x}E (E = S, Se) Nanocrystals with Strong Tunable Near-Infrared Localized Surface Plasmon Resonance and High Conductivity in Thin Films

Preparation of self-doped Cu_{2-x}E (E = S, Se) nanocrystals (NCs) with controlled size is demonstrated. Strong near-infrared (NIR) localized surface plasmon resonance absorption demonstrates that the particles are heavily doped. The NIR localized surface plasmon resonance (LSPR) is tuned by simple changes in the synthesis conditions. This approach provides a new pathway to control both the size and the cationic deficiency of Cu_{2-x}Se and Cu_{2-x}S NCs.



FULL PAPERS

Wood that has been impregnated with tetraethyl-orthosilicate can be transformed into a material with cellulose microfibrils embedded into a silica matrix by heating to 200–300 °C. Increasing the temperature leads to helical, parallel nanopores templated by the cellulose in the remaining silica.

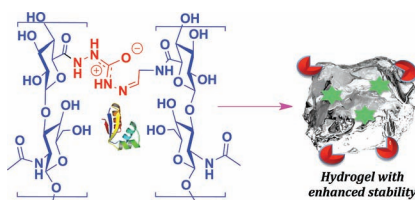


Biomimetics

G. Fritz-Popovski, D. Van Opdenbosch,
C. Zollfrank, B. Aichmayer,
O. Paris* 1265–1272

Development of the Fibrillar and Microfibrillar Structure During Biomimetic Mineralization of Wood

An intrinsically stabilized hydrazone crosslinked extracellular matrix (ECM) mimetic hyaluronan hydrogel exhibits controlled swelling, slow enzymatic degradation, and excellent mechanical properties. These properties are achieved by fine tuning the electronic character around the hydrazone linkage. This tailored ECM mimetic hydrogel demonstrates efficient recombinant human bone morphogenetic protein-2 mediated ectopic bone formation in vivo, with oriented collagen and angiogenesis.

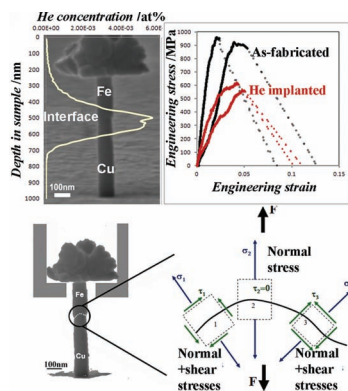


Biomedical Applications

O. P. Oommen, S. Wang, M. Kisiel,
M. Sloff, J. Hilborn,
O. P. Varghese* 1273–1280

Smart Design of Stable Extracellular Matrix Mimetic Hydrogel: Synthesis, Characterization, and In Vitro and In Vivo Evaluation for Tissue Engineering

Nanotensile experiments on as-fabricated and helium-implanted 100 nm-diameter electroplated Cu/Fe bicrystals shed light on the role of individual interfaces in improving radiation tolerance and absorbing helium. Nanotensile experiments on samples irradiated with He bubbles reveal a yield and ultimate tensile strength 60% higher than for as-fabricated ones while retaining a comparable ductility. Failure always occurs gradually, along the interfaces, with no noticeable shape localization.

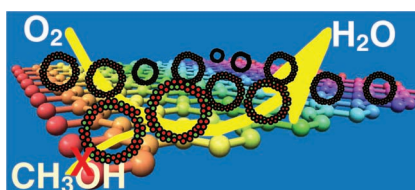


Nanocrystals

P. Landau,* Q. Guo, K. Hattar,
J. R. Greer 1281–1288

The Effect of He Implantation on the Tensile Properties and Microstructure of Cu/Fe Nano-Bicrystals

PdAg nanorings supported on graphene nanosheets are fabricated and demonstrated to be an efficient cathode electrocatalyst for direct methanol fuel cells. The resulting hybrid nanomaterial exhibits high catalytic performance with a large active surface area, low noble-metal loading, enhanced electrocatalytic activity, and excellent methanol tolerance.



Electrocatalysts

M. M. Liu, Y. Z. Lu,
W. Chen* 1289–1296

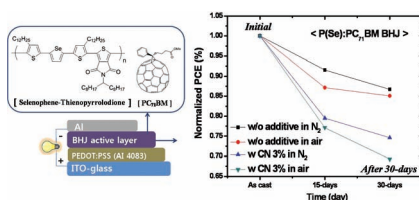
PdAg Nanorings Supported on Graphene Nanosheets: Highly Methanol-Tolerant Cathode Electrocatalyst for Alkaline Fuel Cells

FULL PAPERS

Solar Cells

D. H. Wang, A. Pron, M. Leclerc,
A. J. Heeger*1297–1304

Additive-Free Bulk-Heterojunction Solar Cells with Enhanced Power Conversion Efficiency, Comprising a Newly Designed Selenophene-Thienopyrrolodione Copolymer



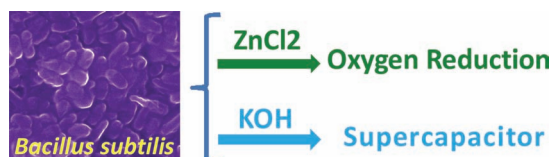
Additive-free bulk-heterojunction (BHJ) solar cells with an enhanced power conversion efficiency (PCE) are successfully fabricated with a newly designed selenophene-thienopyrrolodione copolymer. The PCE approaches 5.8% when the hole transport interlayer is Clevious P VP Al4083. Even without any passivation or electron-transport interlayer, the non-packaged BHJ solar cells exhibit a relatively long-term stability.

Porous Carbon Materials

H. Zhu, J. Yin, X. L. Wang,
H. Y. Wang,* X. R. Yang*1305–1312

Microorganism-Derived Heteroatom-Doped Carbon Materials for Oxygen Reduction and Supercapacitors

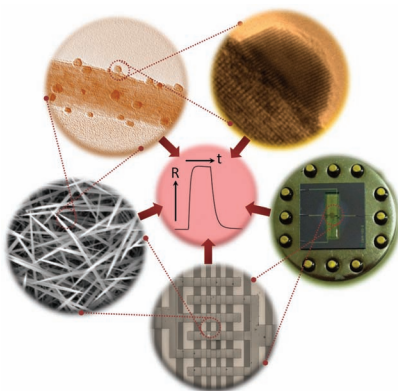
Heteroatom-doped carbon materials obtained from bacteria via an effective ionothermal process exhibit excellent electrocatalytic activity in oxygen reduction and excellent performance as supercapacitors. Their composition and porosity can be controlled with the selection of heating media.



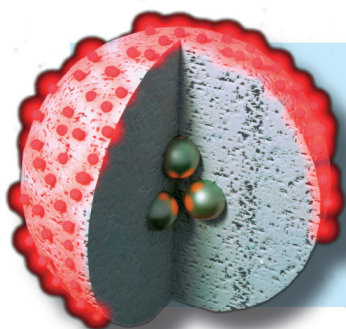
Sensors

S. Vallejos, P. Umek, T. Stoycheva,
F. Annanouch, E. Llobet, X. Correig,
P. De Marco, C. Bittencourt,
C. Blackman*1313–1322

Single-Step Deposition of Au- and Pt-Nanoparticle-Functionalized Tungsten Oxide Nanoneedles Synthesized Via Aerosol-Assisted CVD, and Used for Fabrication of Selective Gas Microsensor Arrays



Tungsten oxide nanoneedles functionalized with gold or platinum nanoparticles (NPs) are synthesized using a single-step aerosol-assisted chemical vapor deposition method. They are integrated into gas-sensor platforms, which are used to discriminate analytes present in proton-exchange fuel cells. This co-deposition method is demonstrated to be effective both for incorporating metal NPs into nanostructured materials, resulting in an attractive way of tuning functionality in metal oxides, and for directly integrating these materials with devices.



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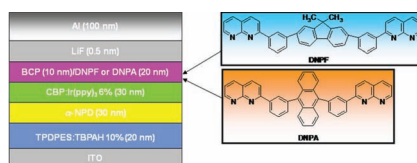
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FULL PAPERS

A series of 1,8-naphthyridine derivatives with high thermal stabilities are synthesized and their electron-transporting properties for green electrophosphorescence are investigated via a multilayered organic light-emitting device using fac-tris(2-phenylpyridine)iridium $[\text{Ir}(\text{ppy})_3]$ as the phosphorescent emitter. A maximum external quantum efficiency of 13.2–13.7% and a maximum power efficiency of 50.2–54.5 lm W^{-1} are obtained using the naphthyridine derivatives.

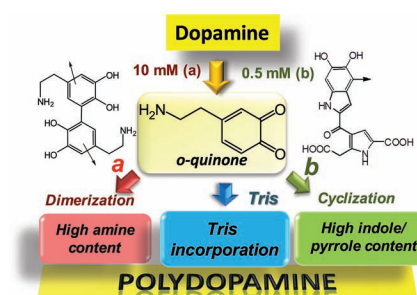


Organic Electronics

L. Xiao,* X. Xing, Z. Chen, B. Qu,
H. Lan, Q. Gong,*
J. Kido* 1323–1330

Highly Efficient Electron-Transporting/ Injecting and Thermally Stable Naphthyridines for Organic Electrophosphorescent Devices

Polydopamine is shown to consist of diverse oligomer components (up to tetramers) including uncyclized catecholamine motifs, 5,6-dihydroxyindole units, and hitherto unrecognized pyrrolecarboxylic acid moieties. Uncyclized amine units prevail with 10×10^{-3} M dopamine, and indoles/pyrroles with a 0.5×10^{-3} M concentration. Covalent incorporation of 50×10^{-3} M Tris is demonstrated. The polydopamine functionality can be tailored via *o*-quinone as a control point.

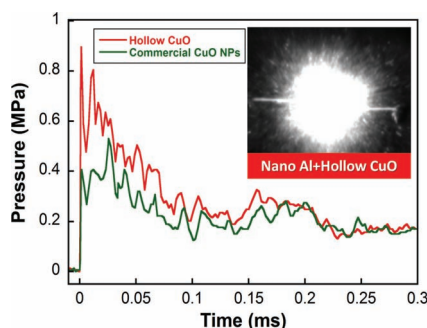


Structure-Property Relationships

N. F. Della Vecchia, R. Avolio,
M. Alfè, M. E. Errico, A. Napolitano,
M. d'Ischia* 1331–1340

Building-Block Diversity in Polydopamine Underpins a Multifunctional Eumelanin-Type Platform Tunable Through a Quinone Control Point

Hollow CuO spheres with nanosized building blocks are fabricated using a “droplet-to-particle” aerosol spray pyrolysis method. The hollow structure is produced by adding sucrose and H_2O_2 in the precursor solution as gas-blowing agents. The nanoaluminum thermite with hollow CuO as an oxidizer ignites in a very violent manner and significantly outperforms commercial CuO nanoparticles in both pressurization rate and peak pressure.



Nanostructures

G. Q. Jian, L. Liu,
M. R. Zachariah* 1341–1346

Facile Aerosol Route to Hollow CuO Spheres and its Superior Performance as an Oxidizer in Nanoenergetic Gas Generators