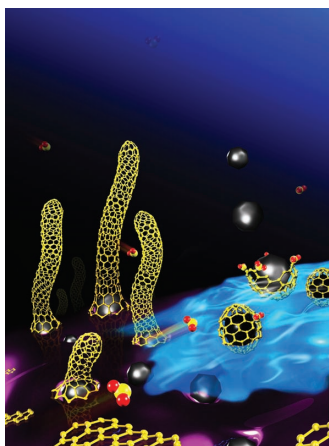


ADVANCED FUNCTIONAL MATERIALS

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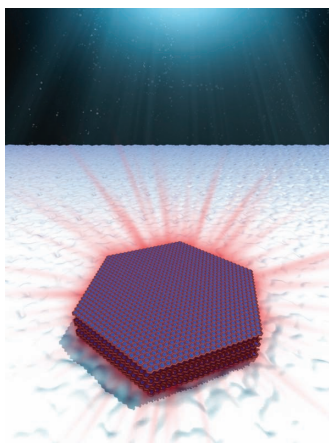


Carbon Nanotubes

The role of metal catalysts in the creation of ultrapure single-walled carbon nanotubes (SWCNTs) is explored by Q. Zhang, F. Wei, and co-workers on page 5066. They promote efficient growth of SWCNTs via partial oxidation of metal@C nanoparticles by CO_2 , and subsequent acid treatment. This in situ study of the chemical vapor deposition growth and CO_2 oxidation of SWCNTs reveals in real-time that the key lies in the low content of nanocarbon impurities and the catalytic oxidation being performed in the proper operation windows.

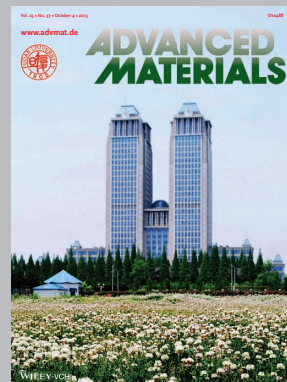
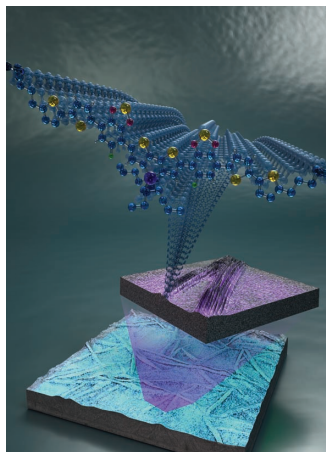
Solar Cells

Structural characterization of high-efficiency molecular organic solar cells using high resolution transmission electron microscopy is performed by G. C. Bazan, T.-Q. Nguyen, and co-workers. On page 5019, these characterizations reveal well-defined, wire-like crystalline donor domains. Single crystal diffraction experiments of the donor material provide detailed information on the solid-state molecular orientation and packing within the wires and thereby provide unprecedented molecular-level insight applicable for designing the next generation of energy conversion materials.



Graphene

The cover depicts a high-resolution transmission electron image of a graphene quantum dot. Graphene quantum dots exhibit strong photoluminescence in the visible spectral region. This photoluminescence is investigated by A. M. Rao and co-workers on page 5062, who determine that it stems from their edge states. They can be used in a wide range of applications ranging from biomedical imaging to energy-related devices. Artwork by Dr. Robert Johnson.



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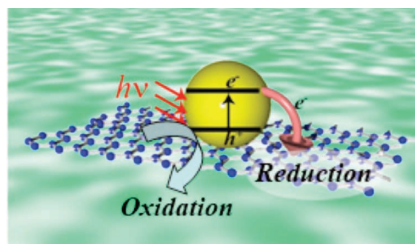
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FEATURE ARTICLE

Photocatalysis

W. Tu, Y. Zhou,* Z. Zou*4996–5008

Versatile Graphene-Promoting Photocatalytic Performance of Semiconductors: Basic Principles, Synthesis, Solar Energy Conversion, and Environmental Applications



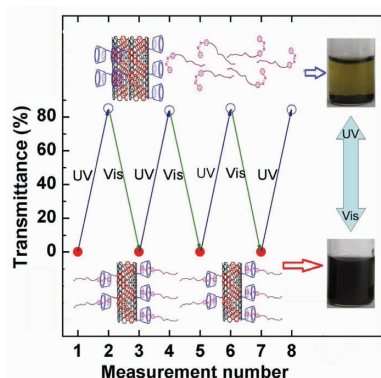
Recent progress in the photocatalysis development of **graphene-based nanocomposites** is highlighted and evaluated. The focus is on the mechanism of graphene-enhanced photocatalytic activity, the understanding of electron transport, and the applications of graphene-based photocatalysts for water splitting, degradation or oxidation of organic contaminants, photoreduction of CO_2 into renewable fuels, toxic elimination of heavy metal ions, and antibacterial applications.

FULL PAPERS

Smart Nanotubes

Z. Guo, Y. Feng,* D. Zhu, S. He, H. Liu, X. Shi, J. Sun, M. Qu5010–5018

Light-Switchable Single-Walled Carbon Nanotubes Based on Host–Guest Chemistry

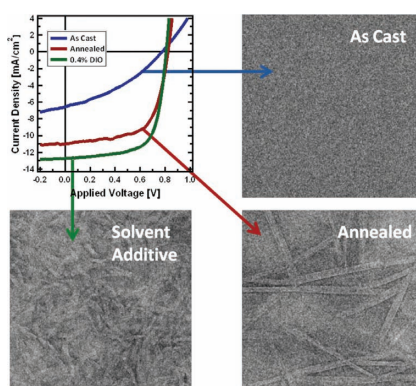


A new type of “smart” single-walled carbon nanotube (SWNT) is created by combining reversible host–guest interaction and noncovalent π – π stacking. The SWNTs hybrids not only are well dispersed in pure water, but they also exhibit switchable dispersion/aggregation states upon the alternate irradiation with UV and visible light in pure water.

Solar Cells

J. A. Love, C. M. Proctor, J. Liu, C. J. Takacs, A. Sharenko, T. S. van der Poll, A. J. Heeger, G. C. Bazan,* T.-Q. Nguyen*5019–5026

Film Morphology of High Efficiency Solution-Processed Small-Molecule Solar Cells



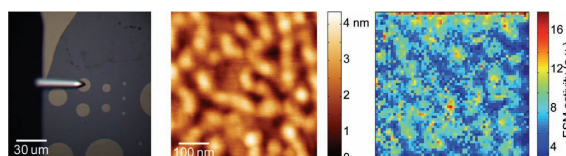
Morphological control over the bulk heterojunction (BHJ) microstructure of a small-molecule photovoltaic system is demonstrated using thermal treatment and solvent additives. Single crystal X-ray diffraction and transmission electron microscopy are utilized to investigate solid-state interactions and the BHJ morphology. Domain size and molecular order are crucial to achieving the 7.0% power conversion efficiency and over 90% internal quantum efficiency exhibited under optimized conditions.

Cathodes

A. Kumar,* F. Ciucci, D. Leonard, S. Jesse, M. Biegalski, H. Christen, E. Mutoro, E. Crumlin, Y. Shao-Horn, A. Borisevich, S. V. Kalinin*5027–5036

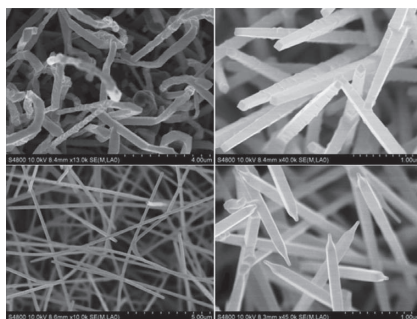
Probing Bias-Dependent Electrochemical Gas–Solid Reactions in $(\text{La}_x\text{Sr}_{1-x})\text{CoO}_{3-\delta}$ Cathode Materials

Spatial variability of bias-dependent electrochemical processes on a $(\text{La}_{0.5}\text{Sr}_{0.5})_2\text{CoO}_{4\pm\delta}$ modified $(\text{La}_x\text{Sr}_{1-x})\text{CoO}_{3-\delta}$ surface is studied using first-order reversal curve method in electrochemical strain microscopy. Reversible oxygen reduction/evolution reaction (ORR/OER) is activated at voltages as low as 3–4 V. The degree of bias-induced transformation increases with applied bias. ORR/OER is shown to be activated in grains at relatively low biases and larger voltages at grain boundaries.



FULL PAPERS

High-quality low-work-function NdB_6 nanostructures with different morphologies, e.g., curved nanowires, nanorods, nanowires, and nanoneedles, are successfully fabricated via a catalyst-free chemical vapor deposition process. The field-emission measurements are investigated systematically, and the field-enhancement factor, turn-on, and threshold field changes are analyzed as a function of morphology and temperature. These systematic experiments should facilitate NdB_6 nanomaterial application in novel field-emission devices.



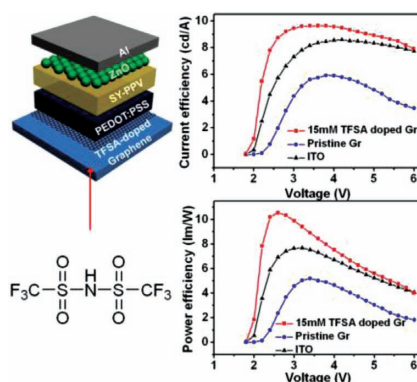
Field Emission

J. Q. Xu, G. H. Hou, T. Mori, H. Q. Li,
Y. R. Wang, Y. Y. Chang, Y. S. Luo,
B. H. Yu, Y. Ma, T. Y. Zhai*5038–5048

Excellent Field-Emission Performances of Neodymium Hexaboride (NdB_6) Nanoneedles with Ultra-Low Work Functions



A flexible polymer light-emitting diode (PLED) is demonstrated by using a bis(trifluoromethanesulfonyl)amide (TFSA, $(\text{CF}_3\text{SO}_2)_2\text{NH}$) doped graphene anode. Due to a reduced hole-injection barrier from the graphene anode to the hole-transport layer, the maximum current efficiency and power efficiency of the PLED are markedly higher than those of PLEDs fabricated on pristine graphene anode and comparable to those of an ITO anode.

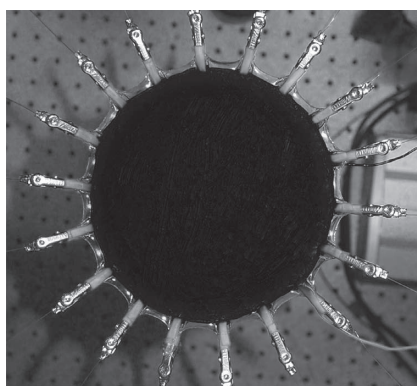


Graphene

D. Kim, D. Lee, Y. Lee,
D. Y. Jeon* 5049–5055

Work-Function Engineering of Graphene Anode by Bis(trifluoromethanesulfonyl) amide Doping for Efficient Polymer Light-Emitting Diodes

A thin sheet of acrylic elastomer, coated with black carbon conductive grease on both sides, is equi-biaxially stretched by applying radial forces to its circumference. In its unstretched state, the elastomer thickness is 0.5 mm, and the electroded radius is 2.0 cm corresponding to a mass of dielectric elastomer of 0.60 g.

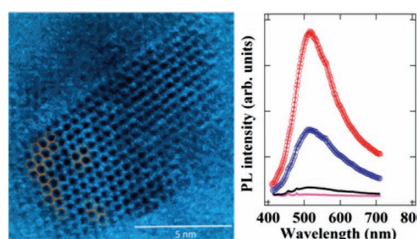


Elastomer

J. Huang, S. Shian, Z. Suo*,
D. R. Clarke*5056–5061

Maximizing the Energy Density of Dielectric Elastomer Generators Using Equi-Biaxial Loading

The origin of the photoluminescence (PL) behavior of graphene quantum dots (GQDs) is investigated. Following a series of annealing experiments designed to passivate the free edges, the PL in GQDs originates from edge-states, and an edge-passivation subsequent to synthesis quenches the PL.



Graphene

K. Lingam, R. Podila, H. Qian, S. Serkiz,
A. M. Rao*5062–5065

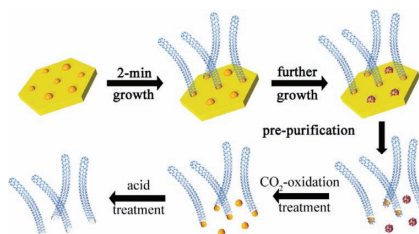
Evidence for Edge-State Photoluminescence in Graphene Quantum Dots

FULL PAPERS

Carbon Nanotubes

T.-C. Chen, M.-Q. Zhao, Q. Zhang,*
G.-L. Tian, J.-Q. Huang,
F. Wei* 5066–5073

In Situ Monitoring the Role of Working Metal Catalyst Nanoparticles for Ultrahigh Purity Single-Walled Carbon Nanotubes

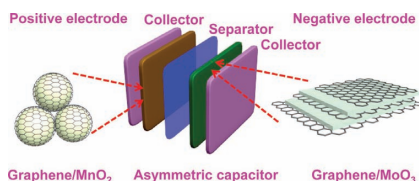


Ultrahigh purity of single-walled carbon nanotubes (SWCNTs) with a carbon content of 99.5 wt% are formed by efficient growth of SWCNTs and partial oxidation of metal@C nanoparticles that is based on the in situ monitoring the role of working metal catalyst nanoparticles during chemical vapor deposition growth and CO₂ purification of SWCNTs.

Supercapacitors

J. Chang, M. Jin, F. Yao, T. H. Kim,
V. T. Le, H. Yue, F. Gunes, B. Li,
A. Ghosh, S. Xie, Y. H. Lee*... 5074–5083

Asymmetric Supercapacitors Based on Graphene/MnO₂ Nanospheres and Graphene/MoO₃ Nanosheets with High Energy Density



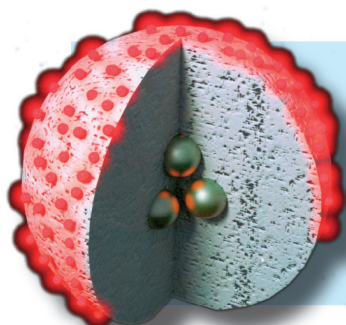
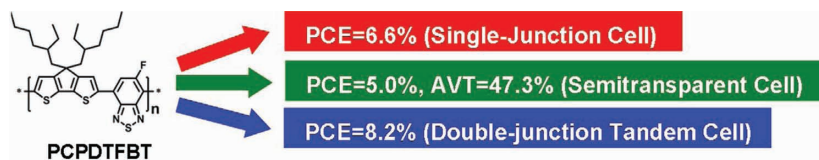
Asymmetric supercapacitors with high energy density are fabricated using self-assembled graphene/MnO₂ as a positive electrode and graphene/MoO₃ (GrMoO₃) as a negative electrode in aqueous electrolyte. Choosing metal oxides with a large work function difference, the operating voltage is expanded to 2.0 V in spite of the use of the aqueous electrolyte, with a high energy density of 42.6 Wh kg⁻¹ at a power density of 276 W kg⁻¹ and a maximum capacitance of 307 F g⁻¹.

Solar Cells

C.-Y. Chang, L. Zuo, H.-L. Yip, Y.-X. Li,
C.-Z. Li, C.-S. Hsu,* Y.-J. Cheng,
H. Z. Chen* A. K.-Y. Jen* 5084–5090

A Versatile Fluoro-Containing Low-Bandgap Polymer for Efficient Semitransparent and Tandem Polymer Solar Cells

The versatility of a fluoro-containing polymer, PCPDTFBT, in diverse organic photovoltaic applications is demonstrated. By combining morphological, interface, and device engineering, the single-junction cell shows both a high power conversion efficiency (PCE) of 6.6% and good air stability. In addition, the applications of PCPDTFBT in highly efficient semitransparent cells (PCE = 5.0%, average visible transmittance (AVT) = 47.3%) and double-junction tandem cells (PCE = 8.2%) are also demonstrated.



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FULL PAPER

Anticancer Therapies

B. Kim, E. Lee, Y. Kim, S. Park,
G. Khang, D. Lee*5091–5097

**Dual Acid-Responsive Micelle-Forming
Anticancer Polymers as New Anticancer
Therapeutics**

Cinnamaldehyde is a major component of cinnamon and is known to exert anticancer effects by generating reactive oxygen species. In this work, cinnamaldehyde is polymerized to generate polymers (PCAE) which self-assemble to form micelles. PCAE micelles exert synergistic anticancer effects with a payload of anticancer drugs and have great potential as novel anticancer therapeutics.

