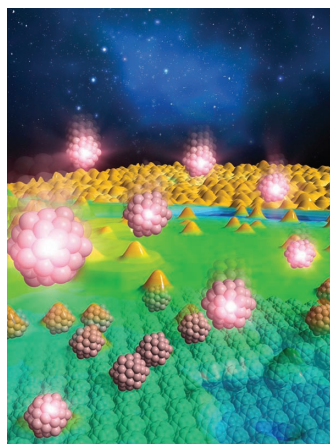


ADVANCED FUNCTIONAL MATERIALS

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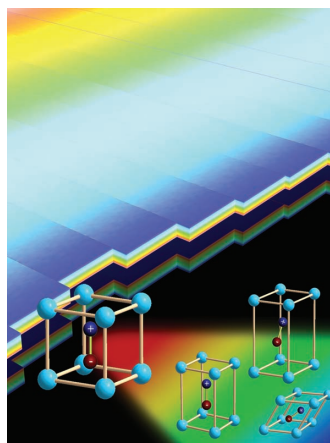


Molecular Electronics

A. Nakajima and co-workers report the controlled formation of metallic layers onto few-layer organic thin films by depositing size-selected metal nanoclusters from the gas phase. On page 1202, their results demonstrate that atomically abrupt interfaces are formed between the Ag nanoclusters and C60 films, which enable the injection of electrons and holes into the topmost layer of the C60 films. These results will contribute toward achieving high-performance organic nanodevices.

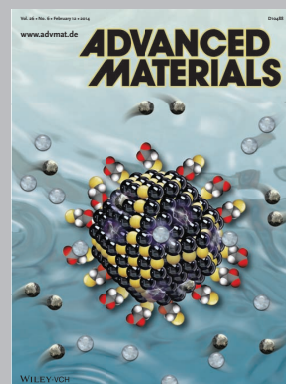
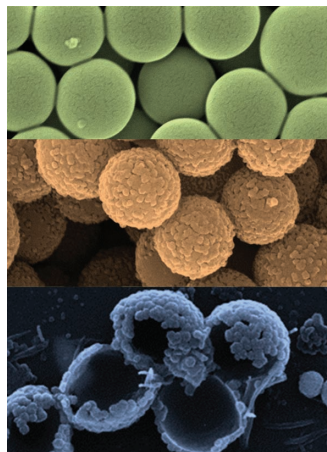
Aerosols

Near-monodisperse silica particles are surface-modified by S. P. Armes and co-workers using silanisation chemistry to aid the subsequent deposition of an ultrathin overlayer of an organic conducting polymer (polypyrrole) from aqueous solution. On page 1290, the resulting polypyrrole-coated silica particles are readily dispersed in air and can be considered model highly-absorbing aerosols, as well as synthetic mimics for silicate-based micro-meteorites. Their well-defined core-shell morphology is verified by selective digestion of the silica cores using HF to produce free-standing polypyrrole shells.



Electrocaloric Materials

On page 1300, by modifying BaTiO_3 ceramics to their invariant critical points, $\text{Ba}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ bulk ceramics exhibit a large electrocaloric effect (ECE). Q. M. Zhang and co-workers show tetragonal, orthorhombic, and rhombohedral structures behind a larger cubic structure, with dipoles inside. A flat-panel cooling device is schematically drawn as a 3D multi-layered ECE cooling device. The temperature gradient is shown by rainbow color, in which blue indicates the cold end and the other warmer colors indicate higher temperatures.



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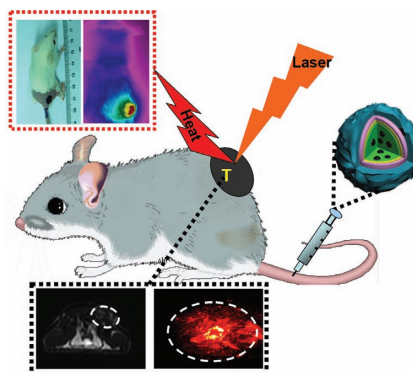
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FULL PAPERS

Cancer Theranostics

X. J. Song, H. Gong, S. N. Yin, L. Cheng,
C. Wang, Z. W. Li, Y. G. Li, X. Y. Wang,
G. Liu, Z. Liu* 1194–1201

Ultra-Small Iron Oxide Doped Polypyrrole Nanoparticles for In Vivo Multimodal Imaging Guided Photothermal Therapy

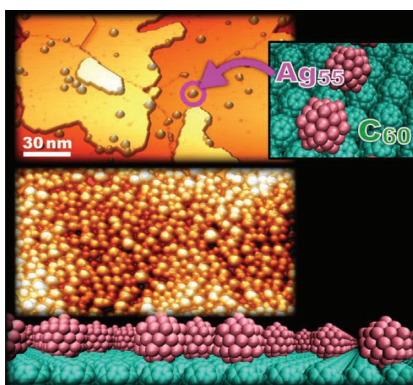


A novel type of multifunctional theranostic nanoparticles is developed by encapsulating ultra-small iron oxide nanoparticles (IONPs) with polypyrrole (PPy), on top of which polyethylene glycol (PEG) is coated. The obtained IONP@PPy-PEG nanoparticles with strong superparamagnetism and high near-infrared absorbance enable in vivo dual-modal magnetic resonance and photoacoustic imaging-guided photothermal therapy, achieving excellent cancer ablation effect in animal experiments.

Molecular Electronics

M. Nakaya, T. Iwasa, H. Tsunoyama,
T. Eguchi, A. Nakajima* 1202–1210

Formation and Control of Ultrasharp Metal/Molecule Interfaces by Controlled Immobilization of Size-Selected Metal Nanoclusters onto Organic Molecular Films

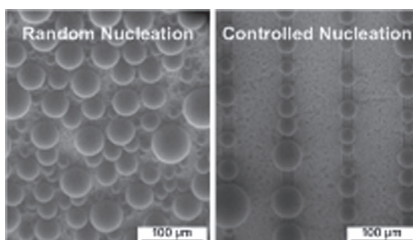


Metal/molecule heterojunctions are constructed by the controlled immobilization of size-selected Ag nanoclusters (Ag_n) from the gas phase on ultrathin C_{60} films. In such heterojunctions, electrons and holes can be precisely injected into the topmost C_{60} molecules in films via an atomically abrupt metal/molecule interface. The barrier height for carrier injection can be modified.

Nanowires

C.-W. Lo, C.-C. Wang,
M.-C. Lu* 1211–1217

Spatial Control of Heterogeneous Nucleation on the Superhydrophobic Nanowire Array



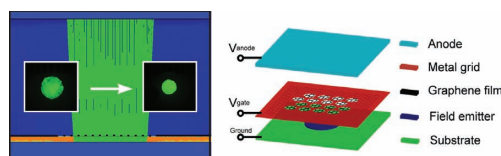
Spatial control of heterogeneous nucleation on superhydrophobic silicon nanowire array-coated surfaces is achieved by manipulating free energy barriers to nucleation through parameterizing regional roughness scale on the surface. Water droplets with a large contact angle preferentially nucleate on the designed microgrooves on the Si nanowire surface, whereas nucleation sites on an ordinary surface are randomly distributed.

Graphene

C. Li, M. T. Cole,* W. Lei,* K. Qu,
K. Ying, Y. Zhang, A. R. Robertson,
J. H. Warner, S. Y. Ding, X. B. Zhang,
B. P. Wang, W. I. Milne 1218–1227

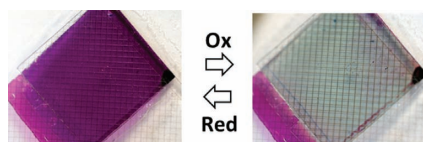
Highly Electron Transparent Graphene for Field Emission Triode Gates

A nanocarbon field emission triode with a hybrid gate electrode is developed. The graphene/Mo gate shows a high electron transparency (50–68%) which results in a reduced turn-on potential, increased beam collimation, reduced beam diameter (63%), enhanced stability (<1% variation), a 34% increase in perveance, and an amplification 7.6 times that of equivalent conventional refractory metal gate triodes.



FULL PAPERS

Thin metallic silver grids are used as electrodes in electrochromic devices, thereby replacing indium-doped tin oxide as the transparent electrode material. A conductive PEDOT:PSS coating homogenizes the electrical field between the grid lines and in addition functions as a charge balancing polymer. Electrochromic devices based on these grid electrodes show fast respond times at low voltages.

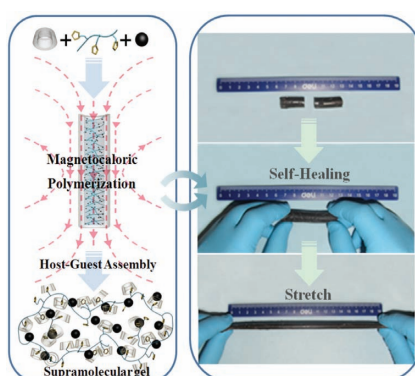


Electrochromic Polymers

J. Jensen, M. Hösel, I. Kim, J.-S. Yu,
J. Jo, F. C. Krebs* 1228–1233

Fast Switching ITO Free Electrochromic Devices

A new magnetocaloric polymerization for the fabrication of novel host–guest supramolecular gels can be performed within 5 minutes. The resulting gels possess a great autonomic healing capability and superior mechanical performance. This work develops a new platform for the rapid fabrication of diverse polymers for extensive applications.

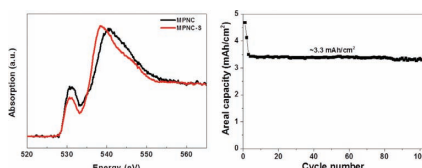


Supramolecular Gels

C. Yu, C.-F. Wang,*
S. Chen* 1235–1242

Robust Self-Healing Host–Guest Gels from Magnetocaloric Radical Polymerization

The nitrogen-doped mesoporous carbon material is found to chemically adsorb sulfur, and the related mechanism is revealed by experimental survey and density functional theory calculation. Taking full advantage of chemical adsorption of sulfur, MPNC-S cathode delivers an excellent capacity retention (95% within 100 cycles), high Coulombic efficiency (>96%), as well as high areal capacity of above 3 mAh cm⁻².

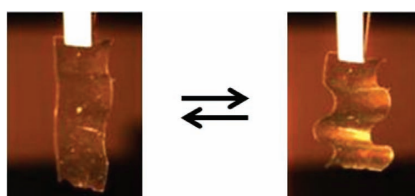


Cathodes

J. Song, T. Xu, M. L. Gordin, P. Zhu,
D. Lv, Y.-B. Jiang, Y. Chen, Y. Duan,
D. Wang* 1243–1250

Nitrogen-Doped Mesoporous Carbon Promoted Chemical Adsorption of Sulfur and Fabrication of High-Areal-Capacity Sulfur Cathode with Exceptional Cycling Stability for Lithium-Sulfur Batteries

Accordion-like deformation is achieved in polymer films consisting of crosslinked liquid crystal polymer networks having a multiple 3D pattern. The exotic deformation behavior can be induced in both heat and pH sensitive materials. A finite element analysis is used to explain the observations and to predict the strength and amplitude of the actuators.



Polymer Networks

L. T. de Haan, V. Gimenez-Pinto,
A. Konya, T.-S. Nguyen, J. M. N. Verjans,
C. Sánchez-Somolinos, J. V. Selinger,
R. L. B. Selinger,* D. J. Broer,*
A. P. H. J. Schenning* 1251–1258

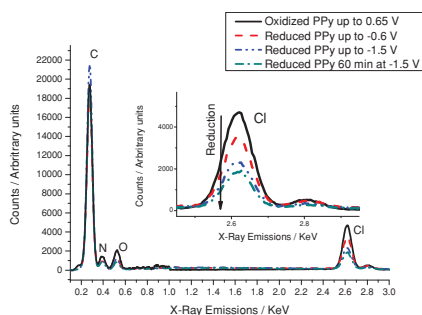
Accordion-like Actuators of Multiple 3D Patterned Liquid Crystal Polymer Films

FULL PAPERS

Conducting Polymers

T. F. Otero,* J. G. Martinez... 1259–1264

Structural Electrochemistry: Conductivities and Ionic Content from Rising Reduced Polypyrrole Films

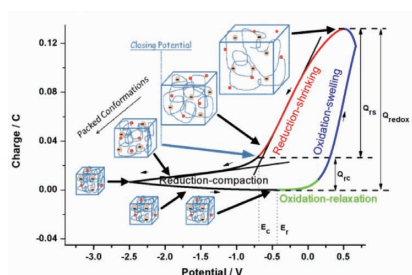


Free-standing polypyrrole films only exchange anions and polypyrrole-dodecylbenzenesulfonate (DBS) exchange mainly cations during redox processes, as corroborated by energy-dispersive X-ray spectroscopy (EDX) analysis and electronic conductivities. The lowest electronic conductivity, after reduction at -1.5 V for 60 min, was 0.0025 S cm^{-1} , corresponding to a significant counterion content.

Structural Electrochemistry

T. F. Otero,* J. G. Martinez,
M. Fuchiwaki, L. Valero 1265–1274

Structural Electrochemistry from Freestanding Polypyrrole Films: Full Hydrogen Inhibition from Aqueous Solutions

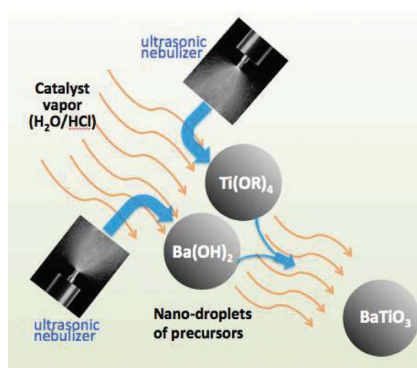


Self-supported polypyrrole and polypyrrole blend films are electroactive in aqueous solutions from very cathodic potentials (-2.5 V), inhibiting hydrogen evolution. Conducting polymers overcome any industrial hydrogen inhibitors. Coulovolammetric responses provide an easy graphical method to identify, differentiate, and quantify structural film processes driven by these reactions.

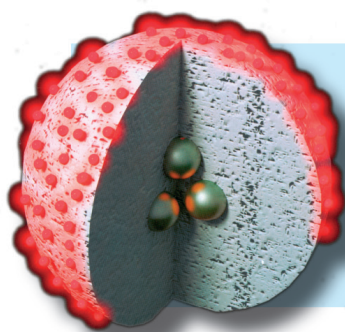
Nanocrystals

T. Ould-Ely, L. Kaplan-Reinig,
D. E. Morse* 1275–1282

High-Rate Continuous Synthesis of Nanocrystalline Perovskites and Metal Oxides in a Colliding Vapor Stream of Microdroplets



Low-cost, kilogram-scale BaTiO₃ nanopowders are produced via a high-rate synthesis, giving a particle size <30 nm under mild conditions (<100 °C). Nebulization and collision of warm microdroplets of Ba(OH)_2 and Ti(O-nBu)_4 result in total hydrolysis and conversion to BaTiO_3 , yielding 1.3 kg/day of high-purity, highly crystalline nanoparticles, as well as 2.9 kg/day TiO_2 anatase. It therefore provides a general platform for processing and scaling up functional inorganic nanomaterials under very mild conditions.



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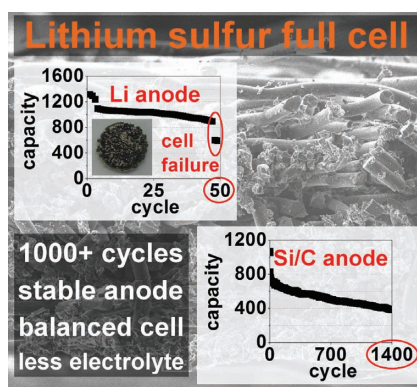
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FULL PAPERS

A balanced and stable lithium sulfur full cell using silicon-carbon as well as all-carbon anodes is presented. The alternative anodes do not suffer from electrolyte depletion, which is found to be the main cause of cell failure when using metallic lithium anodes. More than 1000 cycles, a specific capacity up to $1470 \text{ mAh g}^{-1}_{\text{sulfur}}$ ($720 \text{ mAh g}^{-1}_{\text{cathode}}$), and a high coulombic efficiency of over 99% even with a low amount of electrolyte are achieved.

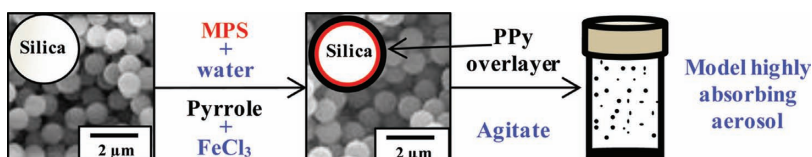


Batteries

J. Brückner, S. Thieme, F. Böttger-Hiller, I. Bauer, H. T. Grossmann, P. Strubel, H. Althues, S. Spange, S. Kaskel* 1284–1289

Carbon-Based Anodes for Lithium Sulfur Full Cells with High Cycle Stability

Near-monodisperse silica particles are surface-modified using 3-(trimethoxysilyl)propyl methacrylate and subsequently coated with a polypyrrole overlayer in a one-pot synthesis. These electrically conductive core-shell particles spontaneously form a highly absorbing model aerosol, which is a useful synthetic mimic for both inorganic-based micro-meteorites and “black carbon” particles.

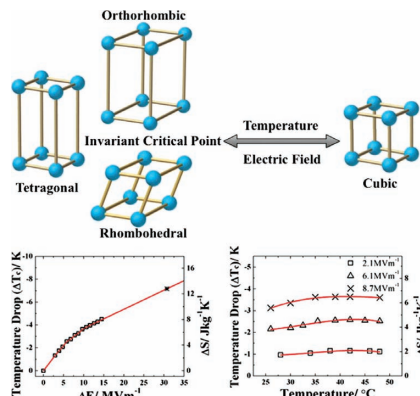


Aerosols

J. R. Lovett, L. A. Fielding, S. P. Armes,* R. Buxton 1290–1299

One-Pot Preparation of Conducting Polymer-Coated Silica Particles: Model Highly Absorbing Aerosols

A giant electrocaloric effect (ECE), i.e., a large adiabatic temperature drop (ΔT_a) with a high electrocaloric coefficient ($\Delta T_c/\Delta E$), is demonstrated in a modified lead-free ferroelectric ceramic, BaTiO_3 , over a broad temperature range near the invariant critical point (ICP). Multiphase coexistence near ICP provides a larger entropy change compared with that of a pure ferroelectric–paraelectric transition. When coupled with the relaxor behavior, this leads to the observed giant ECE in BZT ($x = 0.2$) over a broad temperature range.

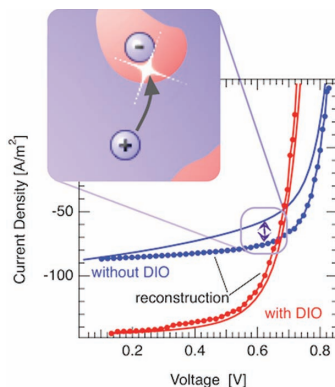


Electrocaloric Materials

X.-S. Qian, H.-J. Ye, Y.-T. Zhang, H. Gu, X. Li, C. A. Randall, Q. M. Zhang* 1300–1305

Giant Electrocaloric Response Over A Broad Temperature Range in Modified BaTiO_3 Ceramics

In bulk heterojunction solar cells based on PTB7:PC71BM, the solvent additive 1,8-diiodooctane (DIO) leads to dramatic improvement of the device performance. By studying the recombination dynamics, the measured j/V characteristics are reconstructed across the whole operational voltage range. The apparent deviation in case of the device processed without additive is discussed with respect to trapped charges in isolated fullerene domains.



Organic Semiconductors

A. Foertig, J. Kniepert, M. Gluecker, T. Brenner, V. Dyakonov,* D. Neher, C. Deibel* 1306–1311

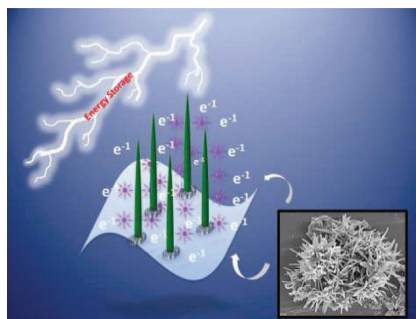
Nongeminate and Geminate Recombination in PTB7:PCBM Solar Cells

FULL PAPERS

Polymer Conductors

S. Giri, D. Ghosh,
C. K. Das* 1312–1324

Growth of Vertically Aligned Tunable Polyaniline on Graphene/ZrO₂ Nanocomposites for Supercapacitor Energy-Storage Application

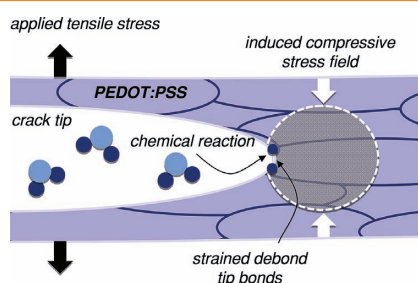


New high performance supercapacitor electrode materials are developed in a simple way. Varying the concentration of monomer while keeping the oxidant concentration constant, various shapes of vertically aligned polyaniline are grown on the metal oxide/graphene surface. The materials show high specific capacitance, high energy density, high power density, and high specific capacitance retention after 1000 cycles.

Thin Films

S. R. Dupont, F. Novoa, E. Voroshazi,
R. H. Dauskardt* 1325–1332

Decohesion Kinetics of PEDOT:PSS Conducting Polymer Films



Decohesion rate in PEDOT:PSS conducting films is studied under varied environmental conditions. The moisture content in the environment is the most important factor accelerating the decohesion in the PEDOT:PSS layer, which is detrimental for device reliability. The findings on the decohesion rate and mechanisms, elucidated by atomic kinetic models, are essential for the design of more reliable organic electronic devices containing PEDOT:PSS layers.