ADVANCED FUNCTIONAL MATERIALS

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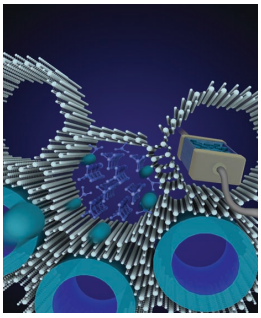
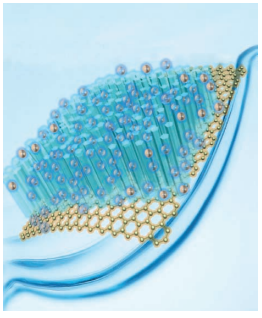


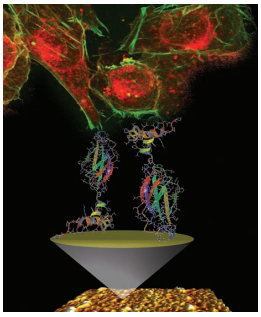
Batteries

A new type of electrolyte for all-solid-state batteries is presented by D. Blanchard, P. E. de Jongh, and team on page 184. Confining $LiBH_4$ in the nanopores of a SiO_2 scaffold leads to a room temperature conductivity of 0.1 mS cm^{-1}, three orders of magnitude higher than for crystalline $LiBH_4$. Lithium ions (blue spheres) move rapidly through $LiBH_4$ near pore walls, while the core shows more conventional $LiBH_4$ behavior, albeit with decreased phase transition temperatures.

Hierarchical Hybrids

Ternary CdS decorated 1D ZnO-2D graphene hierarchical nanostructures are constructed by Y.-J. Xu and co-workers on page 221 using a facile, low-temperature wet chemistry approach. The as-obtained hybrids are able to serve as an efficient and stable visible-light-driven photocatalyst for selective organic transformations in the green solvent of water.



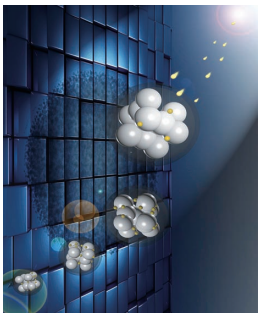


Biointerfaces

On page 193 H.-W. Kim, M. M. M. Bilek, and co-workers present a single step process that covalently immobilizes novel bi-functional proteins via highly reactive radicals embedded by plasma activation in the surface of an implant material. The thus created multifunctional interface successfully regulates the adhesion and differentiation of mesenchymal stem cells, providing an osteoinductive surface to enhance the integration of orthopaedic implants within the body.

Energy Storage

The unique structure of very-fine Sn nanoparticles (≈8 nm) embedded in porous spherical carbon network (denoted as 8-Sn@C), which is prepared on page 214 by L. Jiao, J. Chen, and co-workers using an aerosol spray pyrolysis method, can effectively suppress the volume fluctuation and particle aggregation of tin during prolonged sodiation/desodiation process and thus show high performance as anode of sodium-ion batteries.



COMMENTS

Comment on *Sponge-Templated Preparation of High Surface Area Graphene with Ultrahigh Capacitive Deionization Performance*

Water Treatment

S. Porada, P. M. Biesheuvel, V. Presser*.....179–181

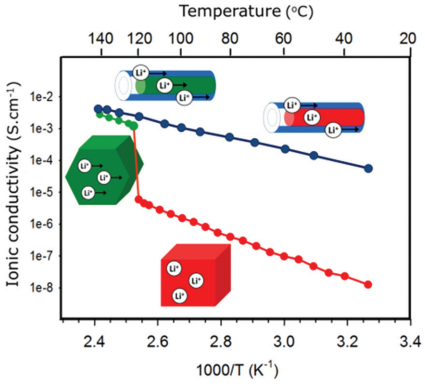
Response to Comment on *Sponge-Templated Preparation of High Surface Area Graphene with Ultrahigh Capacitive Deionization Performance*

Water Treatment

Z.-Y. Yang, L.-J. Jin, G.-Q. Lu, Q.-Q. Xiao, Y.-X. Zhang, L. Jing, X.-X. Zhang, Y.-M. Yan,* K.-N. Sun*.....182–183

FULL PAPERS

Confining $LiBH_4$ inside nanopores of mesoporous silica results in stable and high Li^+ mobilities persisting to room temperature. The mobility is associated with a $LiBH_4$ phase that does not undergo a structural phase transition, a phase probably located within 1.0 nanometer of the pore walls. This presents a new strategy to design efficient electrolytes for all solid-state rechargeable lithium batteries.

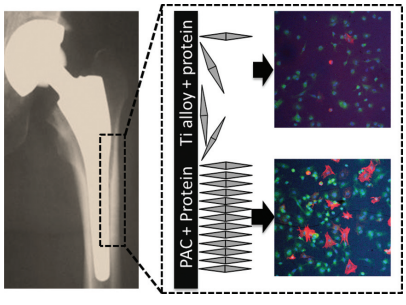


Batteries

D. Blanchard,* A. Nale, D. Sveinbjörnsson, T. M. Eggenhuisen, M. H. W. Verkuijlen, Suwarno, T. Vegge, A. P. M. Kentgens, P. E. de Jongh* 184–192

Nanoconfined $LiBH_4$ as a Fast Lithium Ion Conductor

A single step technology that activates the surfaces of biomedical implant materials is developed to enable the direct covalent immobilization of novel bifunctional proteins via the formation of highly reactive radicals embedded in the surface. This multifunctional interface successfully regulates mesenchymal stem cell adhesion and differentiation at the surface, thus resulting in an osteoinductive surface that enhances implant integration within the body.



Biointerfaces

W. Chrzanowski, J. H. Lee, A. Kondyurin, M. S. Lord, J.-H. Jang, H.-W. Kim,* M. M. M. Bilek*.....193–205

Nano-Bio-Chemical Braille for Cells: The Regulation of Stem Cell Responses using Bi-Functional Surfaces

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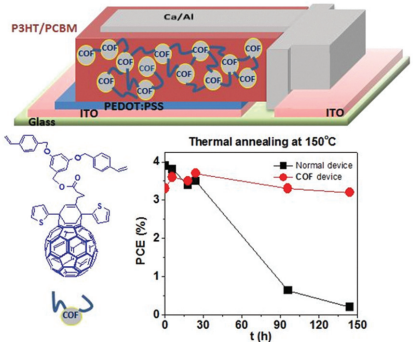
Organic Photovoltaics

C.-P. Chen,* C.-Y. Huang, S.-C. Chuang*..... 207–213

Highly Thermal Stable and Efficient Organic Photovoltaic Cells with Crosslinked Networks Appending Open-Cage Fullerenes as Additives

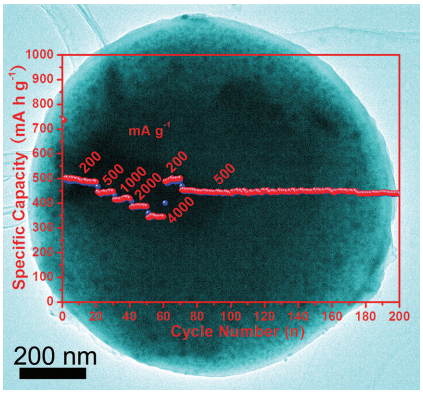


Highly thermal stable and durable organic bulk heterojunction photovoltaic cells are demonstrated with the incorporation of ≈10–15 wt% crosslinkable open-cage fullerenes (COF) as additives in the active layer (weight ratio of P3HT:$PC_{61}BM$ = 1:0.9), through building up three-dimensional local borders upon thermal treatment at 150 °C.

Energy Storage

Y. Liu, N. Zhang, L. Jiao,* Z. Tao, J. Chen* 214–220

Ultrasmall Sn Nanoparticles Embedded in Carbon as High-Performance Anode for Sodium-Ion Batteries

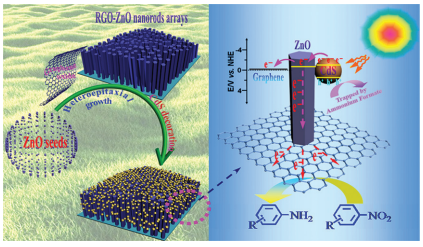


Sn@C composite with ultrasmall Sn nanoparticles (≈8 nm) homogeneously embedded in spherical carbon network is prepared by aerosol spray pyrolysis, and further evaluated as anode material for rechargeable Na-ion batteries. The nanocomposite exhibits excellent electrochemical performance with high reversible capacity, high-rate capability, and long cycling stability.

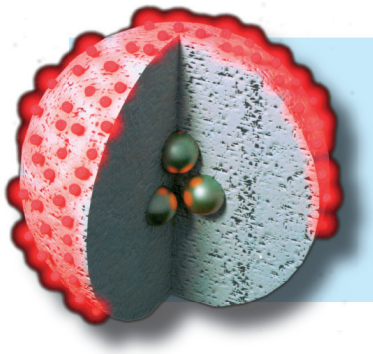
Hierarchical Hybrids

C. Han, Z. Chen, N. Zhang, J. C. Colmenares,* Y.-J. Xu* 221–229

Hierarchically CdS Decorated 1D ZnO Nanorods-2D Graphene Hybrids: Low Temperature Synthesis and Enhanced Photocatalytic Performance



A facile, low-temperature synthesis approach is reported to fabricate hierarchical CdS-1D ZnO nanorod arrays-2D graphene (GR) hybrids in a finely tailored manner in pursuit of the integration of the fast electron transport of 1D ZnO, the electron conductive platform of 2D graphene, and the desirable visible-light absorption of CdS to efficiently harvest visible light and boost the separation and transfer of the photogenerated charge carriers for specific photocatalytic applications.



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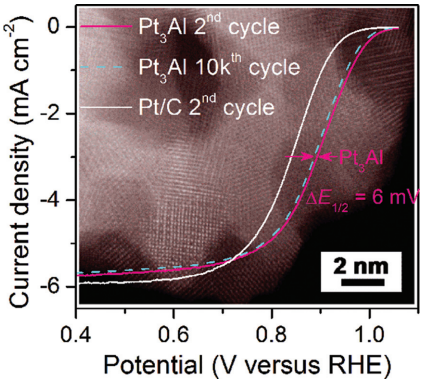
FULL PAPERS

A mesostructured ordered intermetallic of PtAl is developed by a facilely and cost-effectively alloying/dealloying approach for the high-performance ORR. The extremely strong covalent bonds between Pt and Al not only give rise to excellent kinetic stability, but also result in remarkable catalytic activity duo to the downshift of *d*-band center.

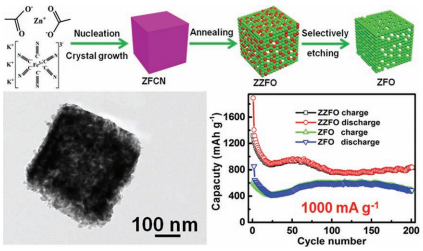


Catalysis

X.-Y. Lang, G.-F. Han, B.-B. Xiao, L. Gu, Z.-Z. Yang, Z. Wen, Y.-F. Zhu, M. Zhao, J.-C. Li, Q. Jiang*.....230–237

Mesostructured Intermetallic Compounds of Platinum and Non-Transition Metals for Enhanced Electrocatalysis of Oxygen Reduction Reaction

Hierarchical mesoporous ZnO/$ZnFe_2O_4$ sub-microcubes are rationally fabricated via an efficiently scalable self-sacrifice strategy and exhibit excellent electrochemical Li-storage performance, benefiting from their unique structural characteristics and striking synergistic effect between the bi-component-active, well-dispersed ZnO and ZFO nanophases at the nanoscale.

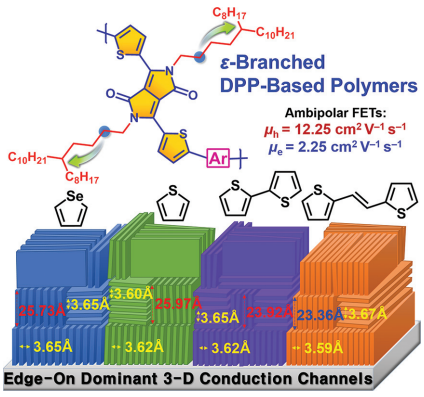


Lithium-Ion Batteries

L. Hou, L. Lian, L. Zhang, G. Pang, C. Yuan,* X. Zhang 238–246

Self-Sacrifice Template Fabrication of Hierarchical Mesoporous Bi-Component-Active ZnO/$ZnFe_2O_4$ Sub-Microcubes as Superior Anode Towards High-Performance Lithium-Ion Battery

Novel ε-branched side chains are incorporated into diketopyrrolopyrrole (DPP)-based backbone to facilitate the charge transport by modulating π-stacking and lamellar distance. A systematic investigation of the highly π-extended systems with electron-rich groups are also performed to achieve synergetic effects of the extended branching point of alkyl chains. These polymers effectively build up 3-D charge transport pathways and exhibit ultra-high mobilities.

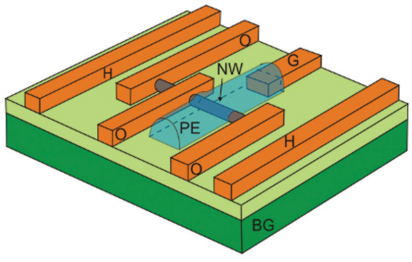


Organic Electronics

A.-R. Han, G. K. Dutta, J. Lee, H. R. Lee, S. M. Lee, H. Ahn, T. J. Shin, J. H. Oh,* C. Yang* 247–254

ε-Branched Flexible Side Chain Substituted Diketopyrrolopyrrole-Containing Polymers Designed for High Hole and Electron Mobilities

A nanoscale patterned polymer electrolyte gate is used to "freeze in" ionic charge environments at low temperatures around an indium arsenide nanowire. The low thermal conductivity of the local wrap-gate allows side-by-side investigations of the conductance and thermoelectric properties of the gated nanowire segment over a series of biases applied to the polymer electrolyte.



Nanowires

S. F. Svensson, A. M. Burke, D. J. Carrad, M. Leijnse, H. Linke, A. P. Micolich*.....255–262

Using Polymer Electrolyte Gates to Set-and-Freeze Threshold Voltage and Local Potential in Nanowire-based Devices and Thermoelectrics

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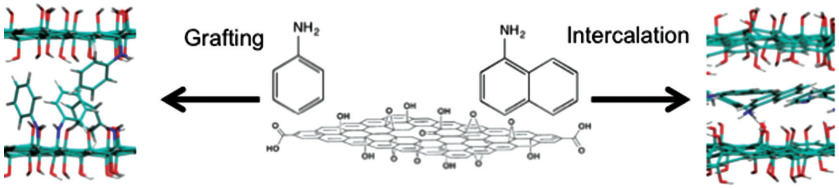
K. Spyrou, M. Calvaresi, E. K. Diamanti, T. Tsoufis, D. Gournis,* P. Rudolf,* F. Zerbetto*.....263–269

Graphite Oxide and Aromatic Amines: Size Matters

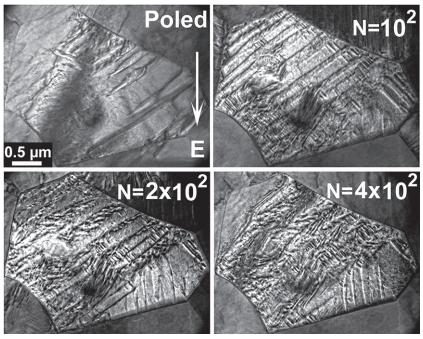
Experimental and theoretical approaches are combined to demonstrate the successful intercalation of common organic polycyclic aromatic compounds between the layers of graphite oxide, and to examine in detail the mechanism by which each molecule interacts with the graphene oxide surface. It is proved that the type of interaction for aniline and naphthalene amine with the graphene oxide layers differs according to the size of the aromatic molecules.



Ferroelectrics

H. Z. Guo, X. Liu, J. Rödel, X. Tan*.....270–277

Nanofragmentation of Ferroelectric Domains During Polarization Fatigue



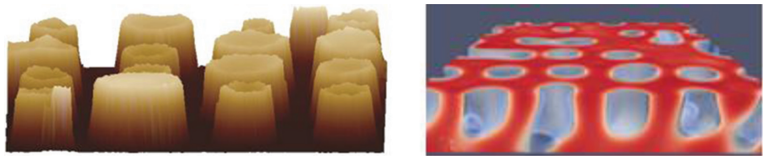
A novel mechanism of polarization fatigue is visualized in situ in polycrystalline $[(Bi_{1/2}Na_{1/2})_{0.95}Ba_{0.05}]_{0.98}La_{0.02}TiO_3$ by using transimission electron microscopy. Complementary to domain wall pinning, nanoscale domain fragmentation is found to take place during bipolar electric cycling. The broken long range polar order in the nanofragments is primarily responsible for the fatigue behavior measured from bulk specimens.

Polymer Semiconductors

A. J. J. M. van Breemen,* T. Zaba, V. Khikhlovskyi, J. J. Michels, R. A. J. Janssen, M. Kemerink, G. H. Gelinck.....278–286

Surface Directed Phase Separation of Semiconductor Ferroelectric Polymer Blends and their Use in Non-Volatile Memories

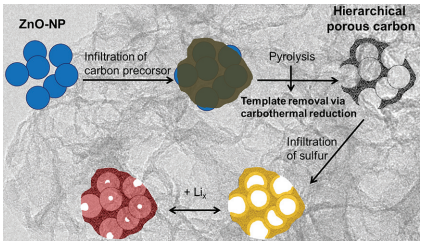
3D morphology control in polymer resistive memories by surface directed phase separation of semiconductor ferroelectric blends is presented. Full 3D numerical simulation of the surface-controlled de-mixing process provides insight in the ability of the substrate pattern to direct the phase separation. Pattern replication on a cm-scale is achieved leading to enhanced functional device performance.



Porous Carbon

P. Strubel, S. Thieme, T. Biemelt, A. Helmer, M. Oschatz, J. Brückner, H. Althues, S. Kaskel*.....287–297

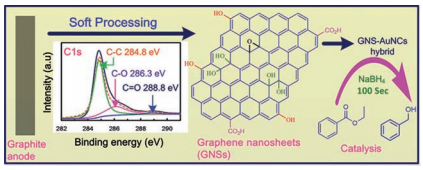
ZnO Hard Templating for Synthesis of Hierarchical Porous Carbons with Tailored Porosity and High Performance in Lithium-Sulfur Battery



Hierarchical porous carbon (HPC) prepared by a ZnO nanoparticle hard templating approach enables in situ template removal accompanied by a controllable growth of micropores within the carbon walls. Due to tailored porosity, the HPC/S composite delivers a high discharge capacity at high sulfur content and loading as well as moderate amount of electrolyte. This triggers high energy densities on cell level.

FULL PAPERS

A mild, environmentally friendly, and cost-effective soft processing approach for the continuous synthesis of high-quality, few-layer graphene nanosheets (GNSs) via the electrochemical exfoliation of graphite using an atomically economical (100%), low-cost glycine-bisulfate ionic complex is presented. The high-quality and suitability of these GNSs to catalytic applications is demonstrated through the efficient reduction of benzoate, utilizing a GNS-AuNCs hybrid.

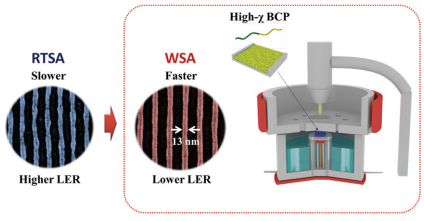


Graphene

K. S. Rao, J. Sentilnathan, H.-W. Cho, J.-J. Wu, M. Yoshimura* 298–305

Soft Processing of Graphene Nanosheets by Glycine-Bisulfate Ionic-Complex-Assisted Electrochemical Exfoliation of Graphite for Reduction Catalysis

The formation of high-resolution, high-throughput, and high-quality patterns is accomplished using a warm solvent-vapor annealing (WSA) treatment for the self-assembly of block copolymers (BCPs) with an extremely high segregation strength. A means of avoiding the undesirable trade-off between the quality and formation throughput of the self-assembled patterns is suggested. The significant improvement of pattern quality realized by WSA is attributed to the reduced degree of interfacial deformation during final solvent evaporation.

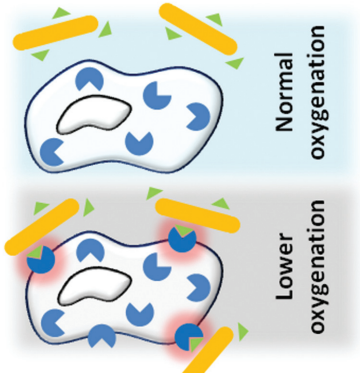


Block Polymers

J. M. Kim, Y. Kim, W. I. Park, Y. H. Hur, J. W. Jeong, D. M. Sim, K. M. Baek, J. H. Lee, M.-J. Kim, Y. S. Jung* 306–315

Eliminating the Trade-Off between the Throughput and Pattern Quality of Sub-15 nm Directed Self-Assembly via Warm Solvent Annealing

Hybrid particles are engineered to target hypoxic cells, inhibit their proliferation, and mediate their optical sensitization. These particles comprise gold nanorods and inhibitors of carbonic anhydrases, which become accessible under hypoxia. Hypoxic cells are damaged both by compromising their metabolism and overheating with a laser. Since hypoxia occurs in most aggressive tumors, this construct represents a versatile anticancer agent.

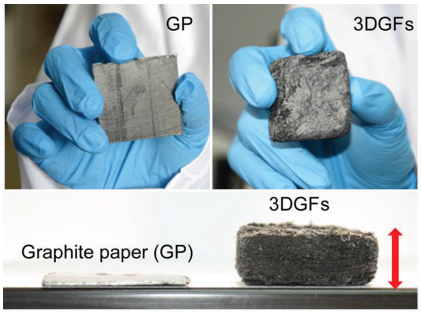


Contrast Agents

F. Ratto,* E. Witort, F. Tatini, S. Centi, L. Lazzeri, F. Carta, M. Lulli, D. Vullo, F. Fusi, C. T. Supuran, A. Scozzafava, S. Capaccioli, R. Pini.....316–323

Plasmonic Particles that Hit Hypoxic Cells

The massive fabrication of high-quality three dimensional graphene-based frameworks (3DGFs) is reported here. The as-fabricated 3DGFs exhibit a superior conductivity and large surface area. Meanwhile the application of 3DGFs as versatile 3D scaffolds to create PANI@3DGFs, Pd@3DGFs, and Pt@3DGFs composites is demonstrated, which should find applications in 3D electrode materials for supercapacitors and catalysts.



Graphene

M. H. Yu, Y. C. Huang, C. Li, Y. X. Zeng, W. Wang, Y. Li, P. P. Fang, X. H. Lu,* Y. X. Tong.....324–330

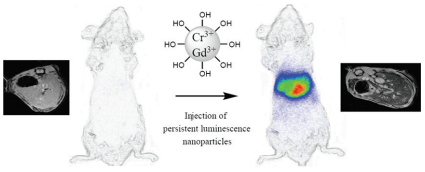
Building Three-Dimensional Graphene Frameworks for Energy Storage and Catalysis

FULL PAPER

Luminescence

T. Maldiney, B.-T. Doan,* D. Alloyeau, M. Bessodes, D. Scherman, C. Richard* 331–338

Gadolinium-Doped Persistent Nanophosphors as Versatile Tool for Multimodal In Vivo Imaging



An optical-magnetic resonance imaging nanoprobe is designed on the basis of a spinel zinc gallate structure doped with trivalent chromium and gadolinium. This nanocrystal bears the ability to serve as both a highly sensitive persistent luminescence nanoprobe for optical imaging, and a negative contrast agent for magnetic resonance imaging. Surface coverage can be modified in order to obtain stealth nanoparticles suitable for real-time in vivo application.