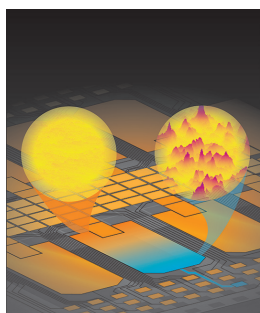


ADVANCED FUNCTIONAL MATERIALS

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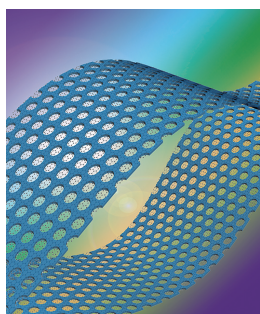
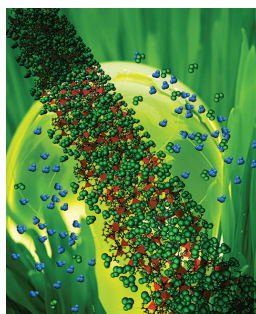


Coatings

An antifouling coating that improves digital microfluidic device lifetime up to 5.5-fold relative to the state of the art is described by A. R. Wheeler and team on page 506. The material is dynamic: under standard conditions, the surface is flat and fluorinated; upon applying an electrical potential, the surface becomes activated, forming nanometer-sized fluoropegylated structures that resist protein adhesion. (Image credit: Bill Dai.)

Porous Materials

Uniform submicrometer-sized ZIF-71 crystals are prepared via a simple mixed-solvent method for the fabrication of high quality defect-free PDMS mixed-matrix membranes. As reported by L. H. Wee, I. F. J. Vankelecom, and colleagues on page 516, these membranes demonstrate significant improvement for pervaporation recovery of bioethanol. The host-guest chemistry of ethanol-water in the cages of ZIF-71 is unraveled by the combination of FTIR spectroscopy and molecular simulations.

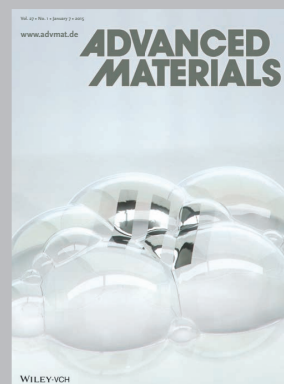
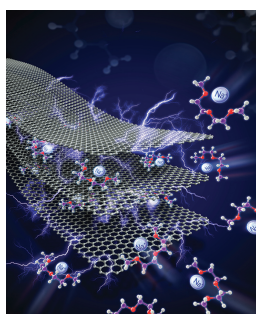


Supercapacitors

On page 526, R. L. Liu, D. Q. Wu, and co-workers develop an interface-induced co-assembly approach to fabricate hierarchically porous composites with ordered mesoporous carbon wrapping around macroporous graphene aerogels. The orientation of the mesopores in the resulting composites can be tuned by the adding amount of the starting materials. Combining the advantages of both components, the hierarchically porous composites exhibit excellent performance as the electrodes in supercapacitors.

Energy Storage

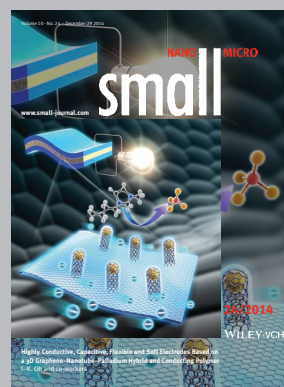
The work presented by K. Kang and team on page 534 demonstrates that natural graphite, which has been regarded electrochemically inactive as electrode for Na ion batteries, can function as an excellent anode material for Na ion batteries when ether-based electrolytes are used. The authors reveal Na storage mechanism in natural graphite in detail where Na^+ -solvent co-intercalation occurs combined with pseudocapacitive behaviors.



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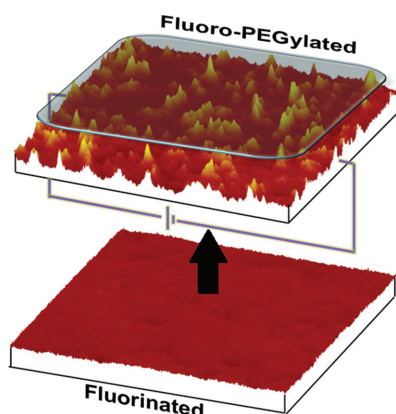
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FULL PAPERS

An antifouling coating is described that improves digital microfluidic device life-time up to 5.5-fold relative to the state of the art. The material is dynamic: under standard conditions, the surface is flat and fluorinated; upon applying an electrical potential, the surface becomes activated, forming nanometer-sized fluoropegylated structures.

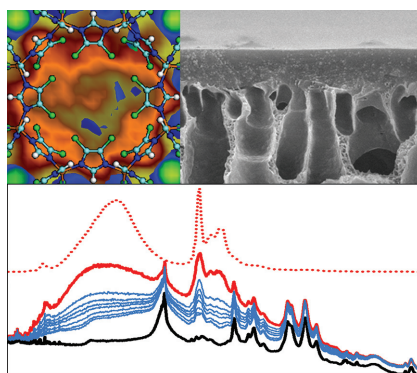


Coatings

M. K. Sarvothaman, K. S. Kim, B. Seale, P. M. Brodersen, G. C. Walker, A. R. Wheeler*506–515

Dynamic Fluoroalkyl Polyethylene Glycol Co-Polymers: A New Strategy for Reducing Protein Adhesion in Lab-on-a-Chip Devices

Gram scale synthesis of submicrometer-sized ZIF-71 crystal is demonstrated via a simple mixed solvent approach for improving mixed matrix membrane pervaporation separation of bioethanol. The host–guest chemistry at its molecular level is unravelled by grand canonical Monte Carlo simulation and FTIR spectroscopy. The results reveal a strong hydrogen interaction between the cages of ZIF-71 and ethanol, well explaining the pervaporation performance.

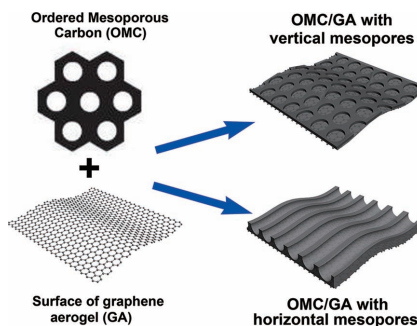


Porous Materials

L. H. Wee,* Y. Li, K. Zhang, P. Davit, S. Bordiga, J. Jiang, I. F. J. Vankelecom,* J. A. Martens516–525

Submicrometer-Sized ZIF-71 Filled Organophilic Membranes for Improved Bioethanol Recovery: Mechanistic Insights by Monte Carlo Simulation and FTIR Spectroscopy

When ordered mesoporous carbons meet graphene aerogel, the resulting hierarchically porous composites conglomerating the advantages of both components are obtained and exhibit excellent performance in electrochemical energy devices. More importantly, the synthesis strategy provides an ideal platform for hierarchically porous graphene composites with potential for energy storage and conversion applications.

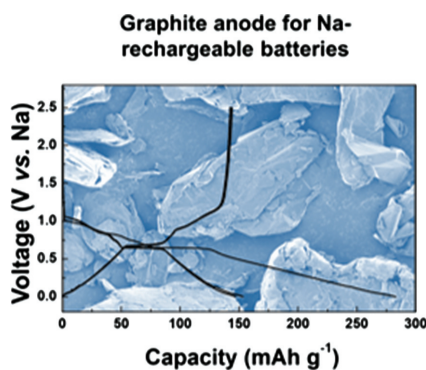


Supercapacitors

R. L. Liu,* L. Wan, S. Q. Liu, L. X. Pan, D. Q. Wu,* D. Y. Zhao526–533

An Interface-Induced Co-Assembly Approach Towards Ordered Mesoporous Carbon/Graphene Aerogel for High-Performance Supercapacitors

This study reports an unusual Na storage behavior in natural graphite through Na⁺-solvent co-intercalation combined with pseudocapacitive behaviors using ether-based electrolytes which is confirmed by electrochemical and ex situ analyses. This work can be used as a foundation for further studies on graphite as a promising anode for NIBs in conjunction with its straightforward advantages, such as low costs, earth abundance, environmental friendliness, and non-toxicity.



Energy Storage

H. Kim, J. Hong, Y.-U. Park, J. Kim, I. Hwang, K. Kang*534–541

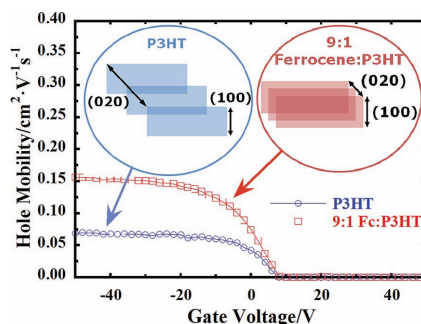
Sodium Storage Behavior in Natural Graphite using Ether-based Electrolyte Systems

FULL PAPERS

Charge Transport

B. H. Smith, M. B. Clark Jr., H. Kuang,
C. Grieco, A. V. Larsen, C. Zhu, C. Wang,
A. Hexemer, J. B. Asbury, M. J. Janik,
E. D. Gomez* 542–551

Controlling Polymorphism in Poly(3-Hexylthiophene) through Addition of Ferrocene for Enhanced Charge Mobilities in Thin-Film Transistors

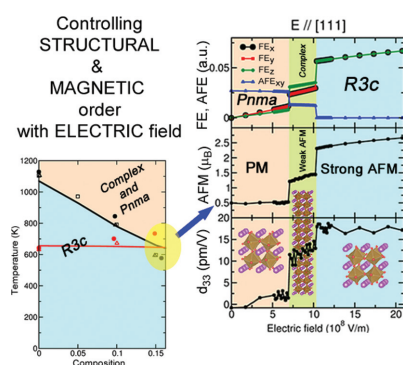


The electrical performance of poly(3-hexylthiophene) thin-film transistors increases with addition of ferrocene. Intermediate-to-high concentrations of ferrocene included in poly(3-hexylthiophene) spin casting solutions produces transistors demonstrating roughly three times higher source-drain current and charge mobility than neat components. Interactions between the polymer and metallocene lead to the formation of polymorphs with closer π -stacking that decreases the charge hopping distance.

Multiferroics

B. Xu,* D. Wang, J. Íñiguez,
L. Bellaiche* 552–558

Finite-Temperature Properties of Rare-Earth-Substituted BiFeO₃ Multiferroic Solid Solutions

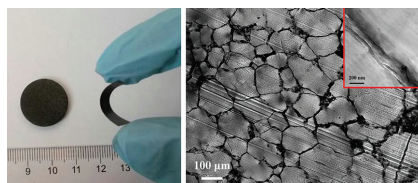


Rare-earth substituted BiFeO₃ (BFO) holds great promise as a piezoelectric and magnetoelectric material. A first-principles based scheme is developed to investigate the structural and magnetic transitions of Nd-doped BFO at finite temperatures. Thanks to this new method, the nature of the composition-induced transformations is unveiled, and the possibility to control the magnetic order by an applied electric field is demonstrated.

Electrical Conductivity

D.-X. Yan, H. Pang, B. Li, R. Vajtai,
L. Xu, P.-G. Ren, J.-H. Wang,
Z.-M. Li* 559–566

Structured Reduced Graphene Oxide/Polymer Composites for Ultra-Efficient Electromagnetic Interference Shielding

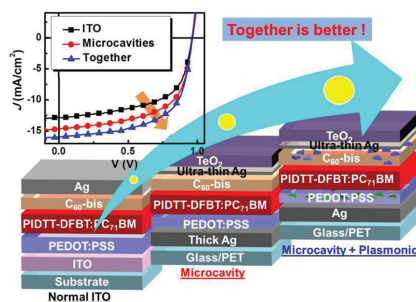


The rGO/PS composite with segregated architecture is realized via high-pressure solid-phase compression molding for efficient EMI shielding. The highest EMI SE of 45.1 dB among rGO based polymer composites is achieved with only 3.47 vol% rGO loading. The high-pressure molded composite shows 94% and 40% enhancement in compressive strength and modulus compared to conventional-pressure molded composite.

Solar Cells

K. Yao, X.-K. Xin, C.-C. Chueh,
K.-S. Chen, Y.-X. Xu,
A. K.-Y. Jen* 567–574

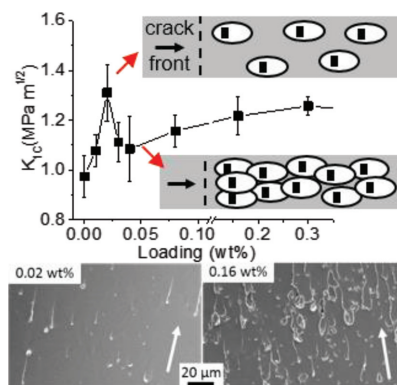
Enhanced Light-Harvesting by Integrating Synergetic Microcavity and Plasmonic Effects for High-Performance ITO-Free Flexible Polymer Solar Cells



Highly efficient ITO-free, flexible polymer solar cells are successfully demonstrated by integrating the plasmonic effect into microcavity-based devices. By carefully controlling the embedded Ag nanoprisms sizes, the power conversion efficiency of the devices can be significantly enhanced to as high as 9.4% on both glass and flexible (PET) substrates.

FULL PAPERS

Epoxy toughening by graphene is demonstrated at graphene loadings as low as 0.02 wt%. Functionalization of graphene can further improve the toughening effect at such a small loading level. A mechanism based on the formation and coalescence of microcracks generated by graphene is proposed to explain the fracture behavior of epoxy/graphene nanocomposites.

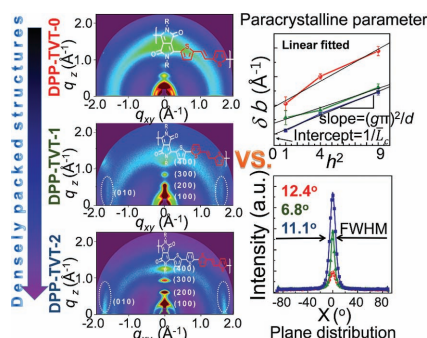


Composite Materials

Y. T. Park, Y. Qian, C. Chan, T. Suh, M. G. Nejhad, C. W. Macosko,* A. Stein*575–585

Epoxy Toughening with Low Graphene Loading

A tactically chosen set of DPP-TVT-n polymers involving biaxially extended thienylenevinylene (TVT) and diketopyrrolopyrrole (DPP) units is synthesized by tuning the thiophene-to-vinylene ratio in the backbone. This in-depth study uncovers that the degrees of the paracrystalline nature and the (*h*00) plane distribution, rather than densely packed organization, play a critical role in facilitating charge transport.

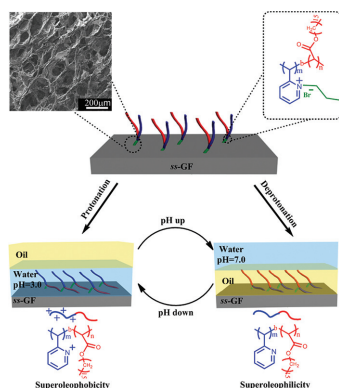


Semiconducting Polymers

D. H. Yoo, B. Nketia-Yawson, S.-J. Kang, H. Ahn, T. J. Shin, Y.-Y. Noh,* C. Yang*586–596

A Timely Synthetic Tailoring of Biaxially Extended Thienylenevinylene-Like Polymers for Systematic Investigation on Field-Effect Transistors

The pH-responsive material based on graphene foam coated poly(2-vinylpyridine) and polyhexadecyl acrylate is successfully prepared for removing oil and organic solvents from water. It can switch its adsorption and desorption of oil and organic solvents in response to the change of pH. In addition, it exhibits high adsorption capacity and excellent reusability.

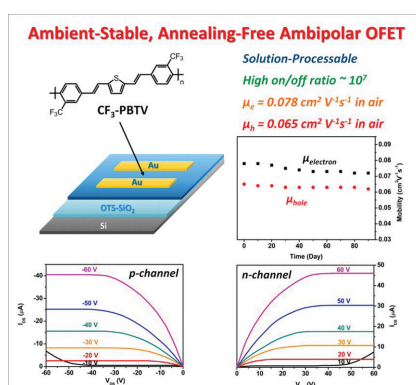


Water Treatment

H. Zhu, D. Chen,* N. Li, Q. Xu, H. Li, J. He, J. Lu*597–605

Graphene Foam with Switchable Oil Wettability for Oil and Organic Solvents Recovery

An ambipolar organic field-effect transistor based on a solution-processable conjugated polymer, CF₃-PBTB, is developed. The solution-processability is achieved without long alkyl side chains. The organic field-effect transistor shows well-equivalent ambipolarity with hole mobility of 0.065 cm² V⁻¹ s⁻¹ and electron mobility of 0.078 cm² V⁻¹ s⁻¹ in air. This annealing-free OFET also demonstrates very high on/off ratio (≈10⁷) and excellent ambient-stability over 90 days.



Organic Electronics

C.-J. Chiang, J.-C. Chen,* H.-Y. Tsao, K.-Y. Wu, C.-L. Wang*606–614

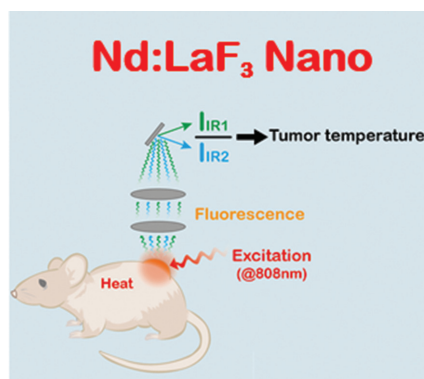
Ambient-Stable, Annealing-Free, and Ambipolar Organic Field-Effect Transistors Based on Solution-Processable Poly(2,2'-bis(trifluoromethyl)biphenyl-*alt*-2,5-divinylthiophene) without Long Alkyl Side Chains

FULL PAPERS

Cancer Treatment

E. Carrasco, B. del Rosal,
F. Sanz-Rodríguez, Á. J. de la Fuente,
P. H. Gonzalez, U. Rocha, K. U. Kumar,
C. Jacinto, J. G. Solé,
D. Jaque* 615–626

**Intratumoral Thermal Reading
During Photo-Thermal Therapy
by Multifunctional Fluorescent
Nanoparticles**

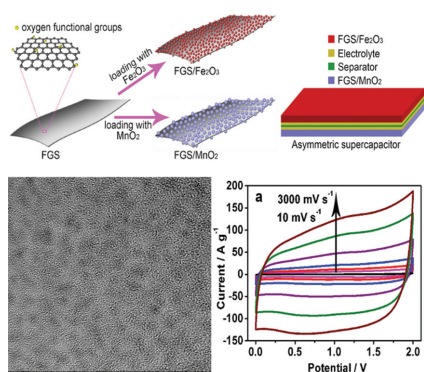


The unique ability of Neodymium-doped LaF_3 nanoparticles for simultaneous heating and temperature sensing is used here for the development of efficient and damage-free photo-thermal treatment of cancer tumors with real time intratumoral thermal reading.

Supercapacitors

H. Xia,* C. Hong, B. Li, B. Zhao,
Z. Lin, M. Zheng,* S. V. Savilov,
S. M. Aldoshin 627–635

**Facile Synthesis of Hematite
Quantum-Dot/Functionalized
Graphene-Sheet Composites as
Advanced Anode Materials for
Asymmetric Supercapacitors**

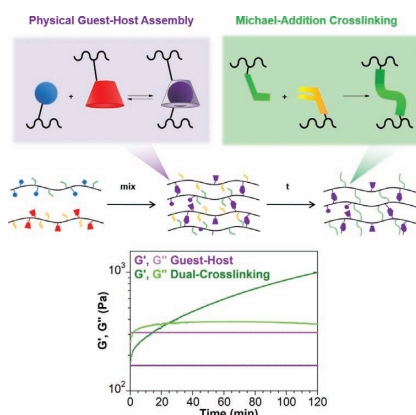


Hematite quantum-dot/functionalized graphene-sheet composites are prepared and the composite electrode can reach a maximum specific capacitance of 347 F g^{-1} , which is much larger than the reported values for the Fe_2O_3 -based electrodes in neutral aqueous electrolyte. A high-performance 2 V asymmetrical supercapacitor is fabricated using $\text{Fe}_2\text{O}_3/\text{FGS}$ as anode and MnO_2/FGS as cathode in $1 \text{ M Na}_2\text{SO}_4$ electrolyte.

Hydrogels

C. B. Rodell, J. W. MacArthur Jr.,
S. M. Dorsey, R. J. Wade, L. L. Wang,
Y. J. Woo, J. A. Burdick* 636–644

**Shear-Thinning Supramolecular
Hydrogels with Secondary Autonomous
Covalent Crosslinking to Modulate
Viscoelastic Properties In Vivo**

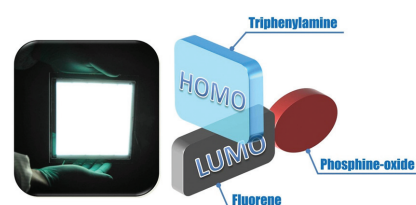


Injectable hyaluronic acid hydrogels with high target site retention, tunable properties, and potential for percutaneous delivery are developed through a tandem crosslinking approach. Supramolecular crosslinking provides initial hydrogel formation and shear-thinning delivery, while secondary covalent crosslinking stabilizes the hydrogel in situ. Material properties and treatment of myocardial infarct are examined.

Organic Electronics

L. Ding, S.-C. Dong, Z.-Q. Jiang,*
H. Chen, L.-S. Liao* 645–650

**Orthogonal Molecular Structure
for Better Host Material in Blue
Phosphorescence and Larger OLED
White Lighting Panel**



Over 25% external quantum efficiency in blue phosphorescence by spiro-bipolar host diphenyl(10-phenyl-10H-spiro[acridine-9,9'-fluorene]-2'-yl)phosphine oxide is achieved and over 75 lm W^{-1} large white organic light-emitting diodes lighting panel is fabricated.