

ADVANCED FUNCTIONAL MATERIALS

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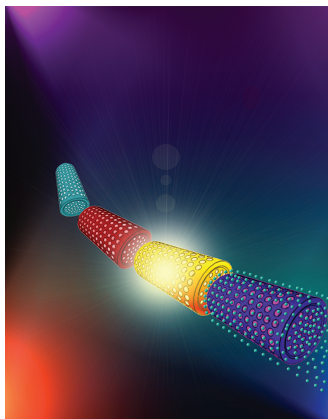
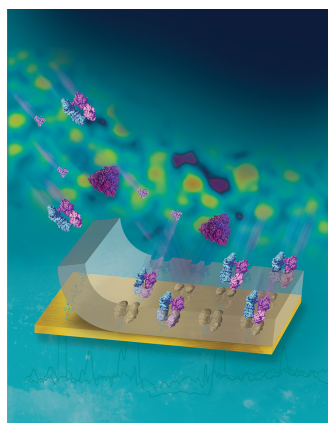


Transient Electronics

The functions and characteristics of electronic devices are modified on-demand by wirelessly triggered etching via the use of wireless microfluidic devices. J. A. Rogers and co-workers show, on page 5100, that functional transformations of target constituent components are achieved by dissolving the strategy point of circuit with etching solution injected through microfluidic channels on demand.

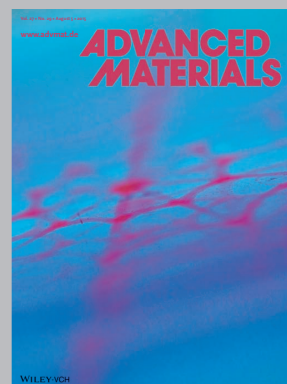
Biomimetic Sensors

On page 5178, R. E. Gyurcsányi, F. W. Scheller, and co-workers demonstrate specific recognition of acetylcholinesterase, a potential marker of Alzheimer's disease, by a hybrid material which shows threefold selectivity gain by the "shape-specific" electrosynthesized molecularly imprinted polymer, oriented binding to the propidium layer and signal generation exclusively by the enzyme bound to the nanofilm. Acetylcholinesterase is detected in the nanomolar range, whilst interfering proteins are effectively suppressed.



Microcarriers

A. Santos, D. Losic, and co-workers demonstrate on page 5107 the preparation of luminescent silicon diatom replicas with unique porous microcapsule structures, by conversion from silica diatoms using a reduction process. These silicon diatoms are biodegradable and have intrinsic luminescence, sensing and drug-releasing properties which make them outstanding candidates for low-cost micro-carriers for drug delivery, theranostics, and guided micro-robotic devices.



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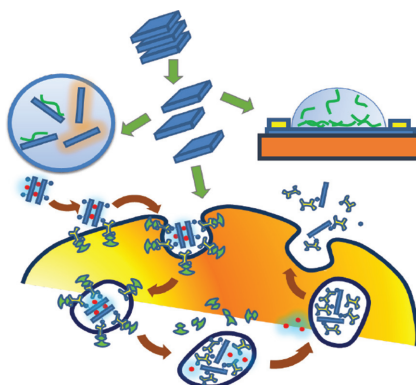
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FEATURE ARTICLE

Two-dimensional transition metal dichalcogenides demonstrate a plethora of unique properties, including tunable electronic and optical characteristics, stability in aqueous environments, large surface areas that can be manipulated and functionalized, and intercalatable layered structures. Relatively low levels of toxicity and facile synthesis routes make these materials suitable for future biological systems.



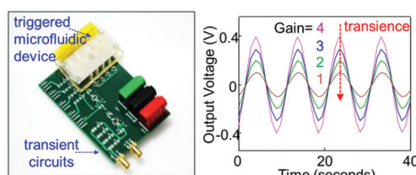
Dichalcogenides

K. Kalantar-zadeh,* J. Z. Ou, T. Daeneke, M. S. Strano, M. Pumera,*
S. L. Gras.....5086–5099

Two-Dimensional Transition Metal Dichalcogenides in Biosystems

FULL PAPERS

Unusual materials and designs for electronics enable systems with the ability for on-demand, triggered functional transformations via the use of wireless microfluidic devices that initiate dissolution of targeted constituent components in a sequential, selective manner. Demonstration examples involve reconfigurable circuits for signal processing and data encryption.

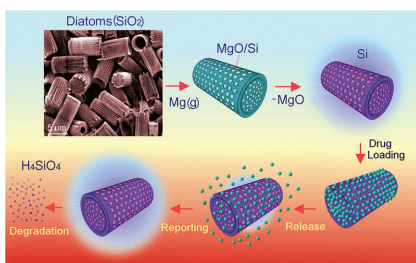


Transient Electronics

C. H. Lee, S.-K. Kang, G. A. Salvatore, Y. Ma, B. H. Kim, Y. Jiang, J. S. Kim, L. Yan, D. S. Wie, A. Banks, S. J. Oh, X. Feng, Y. Huang, G. Troester, J. A. Rogers*5100–5106

Wireless Microfluidic Systems for Programmed, Functional Transformation of Transient Electronic Devices

Toward the development of advanced self-reporting microcarriers with biologically derived shapes for sustained drug delivery. Luminescent silicon diatom replicas prepared from silica diatoms by a simple magnesiothermic reduction process feature outstanding drug delivery capacity, biodegradability, and self-reporting capabilities, which make them outstanding candidates for advanced microcarriers for intravitreal and other medical therapies.

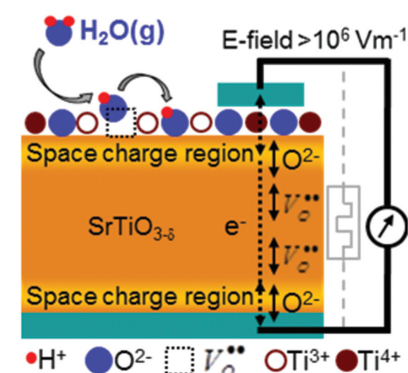


Microcarriers

S. Maher, M. Alsawat, T. Kumeria, D. Fathalla, G. Fetih, A. Santos,*
F. Habib, D. Losic*5107–5116

Luminescent Silicon Diatom Replicas: Self-Reporting and Degradable Drug Carriers with Biologically Derived Shape for Sustained Delivery of Therapeutics

The memristive response in anionic-electronic resistive switching devices is incontestably related to the humidity level of the surrounding air. Water molecules present in the air are incorporated into the oxide thin film and interfere strongly with the space-charge region at the metal|oxide interface, thus affecting the resistive switching of the device operating under high local electric fields.



Resistors

F. Messerschmitt, M. Kubicek, J. L. M. Rupp*5117–5125

How Does Moisture Affect the Physical Property of Memristance for Anionic–Electronic Resistive Switching Memories?

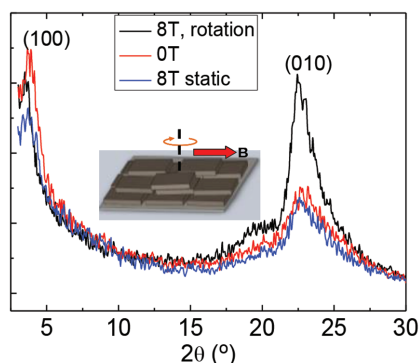


FULL PAPERS

Semiconducting Polymers

G. Pan, F. Chen, L. Hu, K. Zhang,
J. Dai, F. Zhang* 5126–5133

Effective Controlling of Film Texture and Carrier Transport of a High-Performance Polymeric Semiconductor by Magnetic Alignment

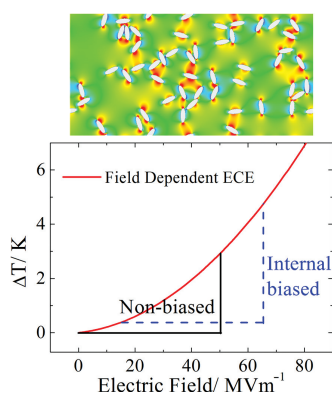


Molecular orientation and film texture of n-type semicrystalline polymer P(NDI2OD-T2) at both in-plane and out-of-plane directions is controlled effectively via the improved solution-processings under high magnetic field. The mechanism on magnetically induced film growth is also elucidated. The magnetically aligned P(NDI2OD-T2) films exhibit remarkably enhanced electron mobility and high mobility anisotropy.

Ferroelectrics

X. Qian, H.-J. Ye, T. Yang, W.-Z. Shao,
L. Zhen, E. Furman, L.-Q. Chen,
Q. M. Zhang* 5134–5139

Internal Biasing in Relaxor Ferroelectric Polymer to Enhance the Electrocaloric Effect

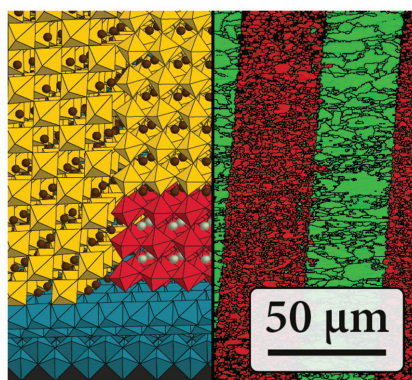


By internal biasing a relaxor ferroelectric polymer, it is demonstrated numerically and experimentally that both electrocaloric effect and electrocaloric coefficient can be enhanced. This approach provides a general route to enhance low-field electrical performances of such square-rule materials and thus pave the way to develop smart electroactive devices with better electrical reliability and safety.

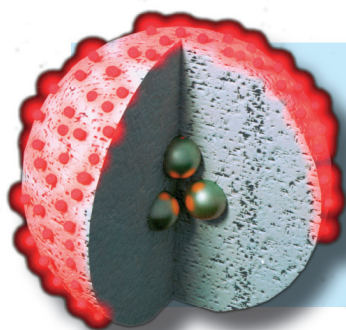
Film Growth

M. Nijland, S. Thomas, M. A. Smithers,
N. Banerjee, D. H. A. Blank,
G. Rijnders, J. Xia, G. Koster*,
J. E. ten Elshof 5140–5148

Epitaxy on Demand



Perovskite thin films are deposited on Si substrates covered with inorganic nanosheets of $\text{Ca}_2\text{Nb}_3\text{O}_{10}$ or $\text{Ti}_{0.87}\text{O}_2$. These nanosheets are used to control the nucleation of films that consist of a SrTiO_3 buffer layer and a SrRuO_3 top layer. The two types of nanosheets are micropatterned to locally tailor the crystallographic orientation, allowing lateral control of the magnetic properties of SrRuO_3 .



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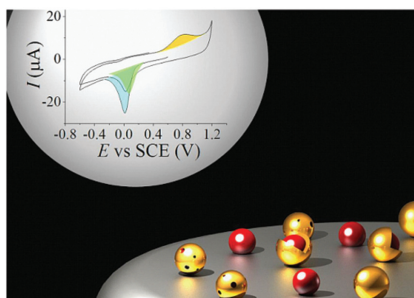
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FULL PAPERS

A method of characterizing multifunctional materials beyond imaging is presented, distinguishing and quantifying intact and broken or cracked core-shell nanoparticles by using the different redox reactivities of the core and the shell material. $\text{Fe}_3\text{O}_4@\text{Au}$ and $\text{Au}@\text{SnO}_2$ samples are studied as two proof-of-concept systems.

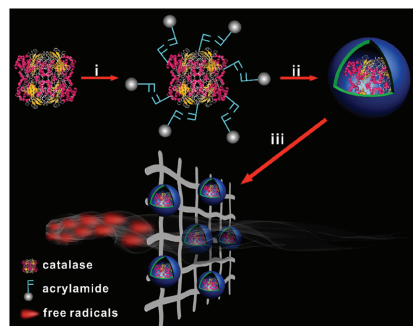


Core-Shell Nanoparticles

K. Tschulik,* K. Ngamchuea, C. Ziegler, M. G. Beier, C. Damm, A. Eychmueller, R. G. Compton*5149–5158

Core-Shell Nanoparticles: Characterizing Multifunctional Materials beyond Imaging—Distinguishing and Quantifying Perfect and Broken Shells

The catalytic activity of catalases can be retained by encapsulating the enzymes in rigid polymer shells. The covalent bonding with the polymer shells protects the catalases from dissociating into subunits under high operational temperature. As-prepared catalase nanocapsules can be incorporated in cigarette filters as scavengers to clean free radicals from tobacco smoke.

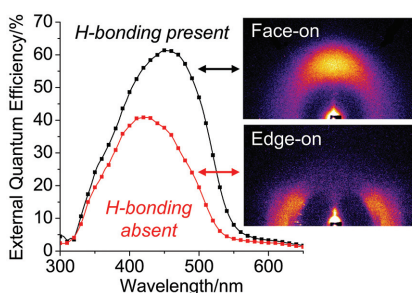


Core-Shell Structures

L. Z. Liu, W. Yu, D. Luo, Z. J. Xue, X. Y. Qin, X. H. Sun, J. C. Zhao, J. L. Wang,* T. Wang*5159–5165

Catalase Nanocapsules Protected by Polymer Shells for Scavenging Free Radicals of Tobacco Smoke

Tailored hydrogen-bonding interactions between molecular donors in blends with C_{60} result in vertically aligned π -stacks, shorter π -stacking distances, higher charge collection efficiency, and redshifted absorption relative to non-H-bonding comparator molecules. For two quaterthiophene families, the benefits result in a twofold enhancement in power conversion efficiency and a maximum external quantum efficiency of 64% in photovoltaic devices.

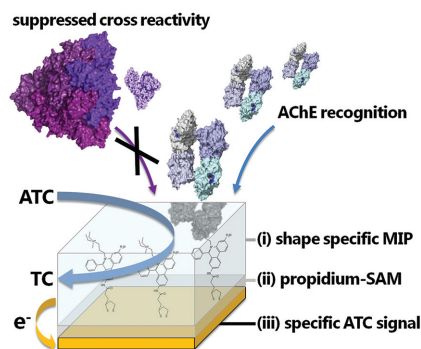


Photovoltaics

N. T. Shewmon, D. L. Watkins, J. F. Galindo, R. B. Zerdan, J. Chen, J. Keum, A. E. Roitberg, J. Xue,* R. K. Castellano*5166–5177

Enhancement in Organic Photovoltaic Efficiency through the Synergistic Interplay of Molecular Donor Hydrogen Bonding and π -Stacking

Recognition of tetrameric acetylcholinesterase (AChE), a potential marker of Alzheimer's disease, is accomplished by a hybrid nanofilm consisting of a propidium-terminated self-assembled monolayer (SAM) and an ultrathin electrosynthesized molecularly imprinted polymer (MIP) cover layer. A threefold selectivity gain is provided by i) the "shape-specific" MIP filter, ii) the propidium-SAM, and iii) signal generation only by the AChE bound to the nanofilm.



Biomimetic Sensors

K. J. Jetzschmann, G. Jágerszki, D. Dechtrirat, A. Yarman, N. Gajovic-Eichelmann, H.-D. Gilsing, B. Schulz, R. E. Gyurcsányi,* F. W. Scheller*5178–5183

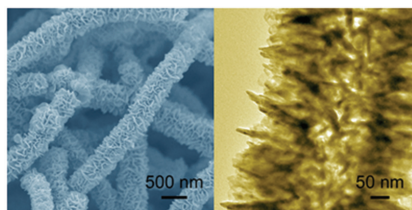
Vectorially Imprinted Hybrid Nanofilm for Acetylcholinesterase Recognition

FULL PAPERS

Electrode Materials

Y. Guo, L. Yu, C.-Y. Wang, Z. Lin,*
X. W. Lou* 5184–5189

**Hierarchical Tubular Structures
Composed of Mn-Based Mixed Metal
Oxide Nanoflakes with Enhanced
Electrochemical Properties**

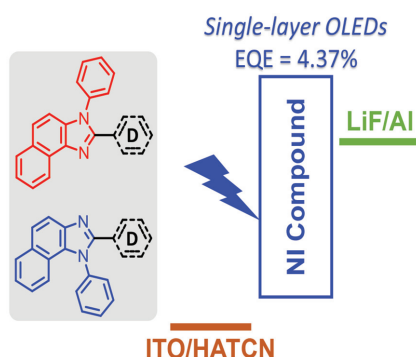


A **general strategy** is developed for the synthesis of hierarchical tubular structures of Mn-based mixed metal oxides. The derived Co-Mn mixed oxide hierarchical tubular structures manifest enhanced electrochemical properties as electrodes for both hybrid supercapacitors and lithium ion batteries.

Organic Electronics

M. Liu, X. L. Li, D. C. Chen, Z. Z. Xie,
X. Y. Cai, G. Z. Xie, K. K. Liu, J. X. Tang,
S.-J. Su,* Y. Cao 5190–5198

**Study of Configuration Differentia and
Highly Efficient, Deep-Blue, Organic
Light-Emitting Diodes Based on Novel
Naphtho[1,2-*d*]imidazole Derivatives**

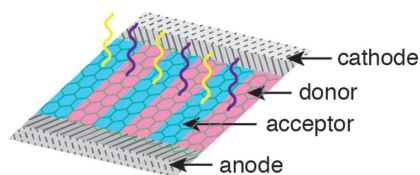


Novel naphtho[1,2-*d*]imidazole derivatives are developed as light-emitting materials for OLEDs. 1*H*-naphtho[1,2-*d*]imidazole based compounds exhibit a significantly superior performance than their isomeric counterparts in the single-layer devices owing to the much higher electron injection ability directly from the cathode. However, in the multi-layer devices, uniformly high efficiencies are obtained with a desirable bluecolor that is more pure than that of their benzimidazole and phenanthro[9,10-*d*]imidazole analogues.

Graphene Heterostructures

H. Li, D. A. Strubbe,
J. C. Grossman* 5199–5205

**Functionalized Graphene Superlattice as
a Single-Sheet Solar Cell**

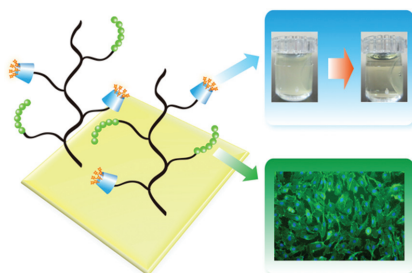


The device performance of a **single-sheet solar cell made of graphene sheet functionalized into 1D stripes** is analyzed using a combination of ab initio simulation and scaling analysis, as a prototype system of in-plane heterostructure engineering. The results suggests highly correlated optoelectronic properties can be optimized simultaneously via independent tuning of the partition width, device length, and functionalizations.

Hemocompatible Surfaces

W. Zhan, X. Shi, Q. Yu,* Z. Lyu, L. Cao,
H. Du, Q. Liu, X. Wang, G. Chen, D. Li,
J. L. Brash, H. Chen* 5206–5213

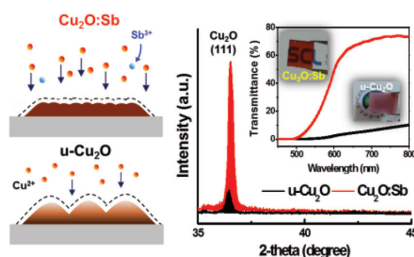
**Bioinspired Blood Compatible Surface
Having Combined Fibrinolytic and
Vascular Endothelium-Like Properties via
a Sequential Coimmobilization Strategy**



A **bioinspired, blood compatible surface** is developed with the capability to both lyse nascent clots and promote endothelialization. The surface is fabricated by sequential coimmobilization of two biomolecules with respective properties via host-guest interaction and covalent bonding, respectively. Neither function of the two biomolecules is compromised by the presence of the other.

FULL PAPERS

Highly stable p-type cuprous oxide films with extremely improved optical performance are achieved by simple low-temperature electrochemical deposition in the presence of antimony dopants. The $\text{Cu}_2\text{O}:\text{Sb}$ films demonstrate single-domain-like crystallinity with low angle tilted boundaries and exhibit semitransparent properties.

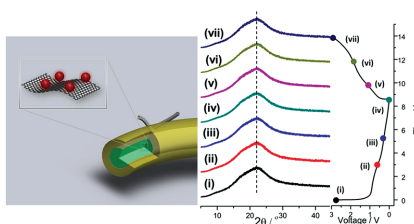


Cuprous Oxides

S. K. Baek, Y. H. Kwon, J. H. Shin,
H. S. Lee, H. K. Cho*5214–5221

Low-Temperature Processable High-Performance Electrochemically Deposited p-Type Cuprous Oxides Achieved by Incorporating a Small Amount of Antimony

Li-ion and Na-ion storage behaviors of ultrafine amorphous SnO_x particles embedded in carbon nanofiber/carbon nanotube composites are investigated. They reveal an anomalous electrochemical mechanism with all intermediate phases maintaining an amorphous state during the entire charge/discharge process, which gives rise to excellent reversibility of the electrodes.

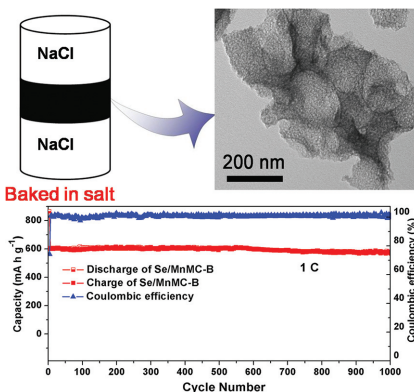


Battery Electrodes

B. Zhang, J. Huang,
J.-K. Kim*5222–5228

Ultrafine Amorphous SnO_x Embedded in Carbon Nanofiber/Carbon Nanotube Composites for Li-Ion and Na-Ion Batteries

A new baked-in-salt approach to let Se infiltrate into porous carbon is proposed, without the need for a protective argon or vacuum environment. The use of NaCl, which has a higher specific heat capacity than Se, assures an almost constant fabrication temperature, by reducing temperature fluctuations in the system. The Se/C sample exhibits excellent electrochemical performance both in Li–Se and Na–Se batteries. Furthermore, this approach should also be effective for confining other low melting point materials into porous carbon.



Batteries

X. N. Li, J. W. Liang, Z. G. Hou,
W. Q. Zhang, Y. Wang, Y. C. Zhu,*
Y. T. Qian*5229–5238

A New Salt-Baked Approach for Confining Selenium in Metal Complex-Derived Porous Carbon with Superior Lithium Storage Properties