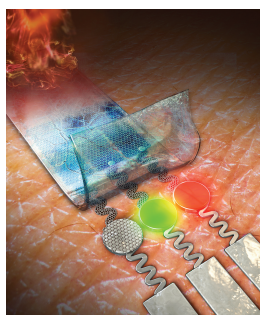


ADVANCED FUNCTIONAL MATERIALS

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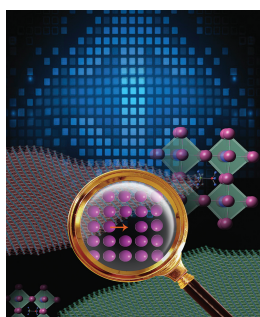
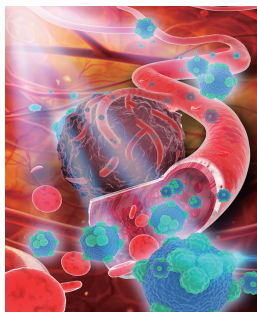


Wearable Electronics

On page 7109, J.-H. Kim, D.-H. Kim, and co-workers report a novel graphene transfer technique that allows multiple patterned-graphene transfers at desired locations. Using the thermal-expansion mismatch between the viscoelastic sacrificial layer and the elastic stamp, a “heating and cooling” process precisely positions patterned graphene layers with high transfer yields. The proposed transfer printing successfully integrates graphene-based stretchable sensors, actuators, and LEDs, paving the way toward transparent and wearable multifunctional electronic systems.

Tumor Detection

On page 7119, S. J. Zeng, J. H. Hao, and co-workers present a multifunctional upconversion nanoprobe with remarkable enhancement of near-infrared emission for trimodal bioimaging, combining upconversion optical, T_2 -weighted magnetic resonance, and computed tomography imaging. Importantly, these nanoprobes are successfully used for in vivo diagnosis of small tumors (down to 4 mm) based on upconversion optical and T_2 -weighted magnetic resonance imaging.



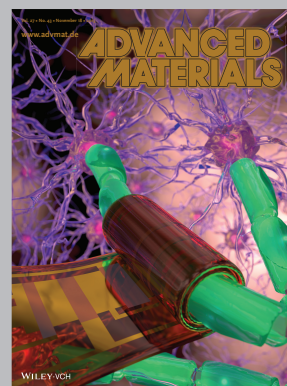
Hierarchical Zeolite

Superior catalysts are formed from ultra-stable Y zeolite are post-synthetic treatment with NH_4OH . On page 7130, D. Verboekend, B. F. Sels, and co-workers show that this process results in the selective creation of small mesopores by partial zeolite densification without significant material leaching, similar to digging moles creating an interconnected network of accessible mole runs.



Solid Electrolytes

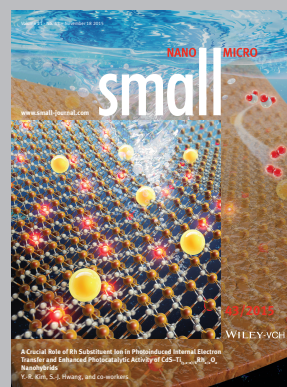
C. Liang, Z. He, W. C. H. Choy, and co-workers demonstrate on page 7226 a new type of perovskite device: perovskite light-emitting electrochemical cells. Organic–inorganic halide perovskites used as solid electrolytes are shown to have an ionic conductivity comparable to polymer electrolytes, which is important for understanding the operation mechanisms and electrical properties of perovskite devices. This suggests future applications for perovskites in energy storage devices.



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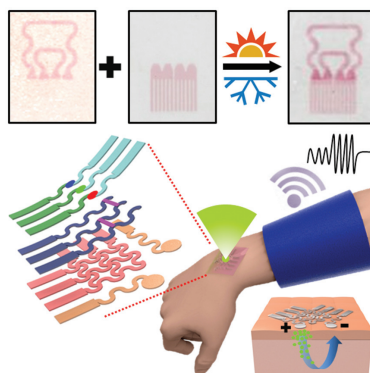
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FULL PAPERS

A thermally controlled transfer printing method that is specially designed for the multiple aligned transference of patterned graphene is developed. Through this approach, accurate and high-yield transference of patterned graphene onto diverse substances is achieved, allowing a transparent, stretchable, and wearable all-graphene electronic/optoelectronic system to be fabricated.

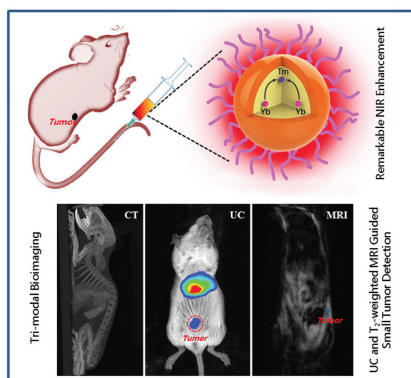


Wearable Electronics

M. K. Choi, I. Park, D. C. Kim, E. Joh, O. K. Park, J. Kim, M. Kim, C. Choi, J. Yang, K. W. Cho, J.-H. Hwang, J.-M. Nam, T. Hyeon, J. H. Kim,* D.-H. Kim* 7109–7118

Thermally Controlled, Patterned Graphene Transfer Printing for Transparent and Wearable Electronic/Optoelectronic System

A remarkable enhancement of NIR emission of multifunctional PEGylated upconversion nanoparticles (UCNPs) is developed. The nanoparticles serve as bioprobes and contrast agents for up-conversion (UC) optical, magnetic resonance imaging (MRI), and CT trimodal bioimaging. Impressively, the developed UCNPs are successfully used for UC and T_2 -weighted MRI-guided early-stage diagnosis of small tumors.

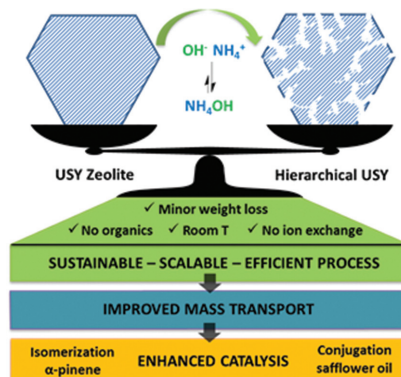


Tumor Detection

Z. G. Yi, X. L. Li, Z. L. Xue, X. Liang, W. Lu, H. Peng, H. R. Liu, S. J. Zeng,* J. H. Hao* 7119–7129

Remarkable NIR Enhancement of Multifunctional Nanoprobes for In Vivo Trimodal Bioimaging and Upconversion Optical/ T_2 -Weighted MRI-Guided Small Tumor Diagnosis

Postsynthetic NH_4OH treatment is performed on USY (ultra-stable Y) zeolite to sustainably develop superior catalysts. Extensive characterization shows the selective creation of small mesopores by partial zeolite densification without significant material leaching. The hierarchical zeolite outperforms the conventional USY for acid-catalyzed isomerization of α -pinene and metal-catalyzed conjugation of safflower oil, which is attributed to its enhanced intracrystalline mass transport capacity.

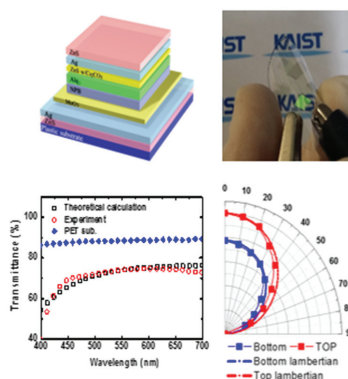


Hierarchical Zeolite

J. Van Aelst, D. Verboekend,* A. Philippaerts, N. Nuttens, M. Kurttepli, E. Gobechiya, M. Haouas, S. P. Sree, J. F. M. Denayer, J. A. Martens, C. E. A. Kirschhock, F. Taulelle, S. Bals, G. V. Baron, P. A. Jacobs, B. F. Sels* 7130–7144

Catalyst Design by NH_4OH Treatment of USY Zeolite

Highly transparent and flexible organic light-emitting diodes (TFOLEDs) are fabricated using dielectric layer/metal/dielectric layer (multilayer) electrodes for use as both anodes and cathodes. The structure of multilayer electrodes is optimized to maximize transmittance and to provide flexibility. The fabricated TFOLEDs are highly transparent and show a nearly Lambertian emission pattern without a microcavity effect.



Organic LEDs

D.-Y. Kim, Y. C. Han, H. C. Kim, E. G. Jeong, K. C. Choi* 7145–7153

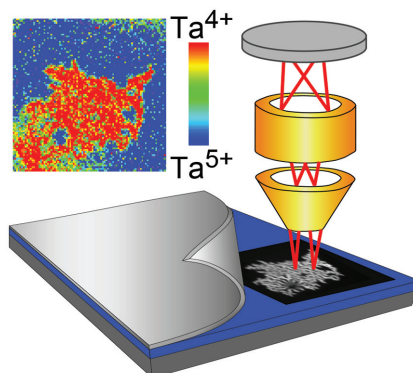
Highly Transparent and Flexible Organic Light-Emitting Diodes with Structure Optimized for Anode/Cathode Multilayer Electrodes

FULL PAPERS

Resistive Switching

K. Skaja, C. Bäumer, O. Peters, S. Menzel,
M. Moors, H. Du, M. Bornhöfft,
C. Schmitz, V. Feyer, C.-L. Jia,
C. M. Schneider, J. Mayer,
R. Waser, R. Dittmann*..... 7154–7162

**Avalanche-Discharge-Induced Electrical
Forming in Tantalum Oxide-Based
Metal–Insulator–Metal Structures**

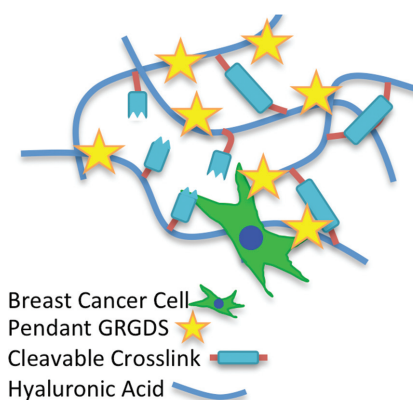


It is experimentally demonstrated that a pronounced interface adsorbate layer in $\text{Ta}_2\text{O}_{5-x}$ -based resistive switching devices leads to an avalanche-discharge-induced breakdown instead of a breakdown within a single filament. Moreover, it is explicitly proven that the switching between the low and high resistance state is caused by the reduction/oxidation of $\text{Ta}_2\text{O}_{5-x}/\text{TaO}_2$ in the entire former $\text{Pt}/\text{Ta}_2\text{O}_{5-x}$ interface of the dendrite-like structure.

Biomimetics

S. A. Fisher, P. N. Anandakumaran,
S. C. Owen, M. S. Shoichet*... 7163–7172

**Tuning the Microenvironment: Click-
Crosslinked Hyaluronic Acid-Based
Hydrogels Provide a Platform for
Studying Breast Cancer Cell Invasion**

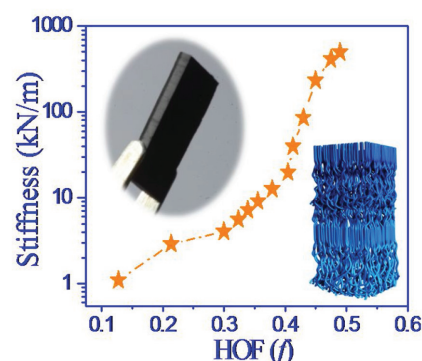


A hyaluronic acid-based hydrogel crosslinked with protease cleavable crosslinks is shown to support breast cancer cell invasion. The crosslink and adhesive ligand densities of the hydrogel are decoupled, allowing the effect of each parameter on cell invasion to be studied. A platform is developed capable of recapitulating a wide range of microenvironments.

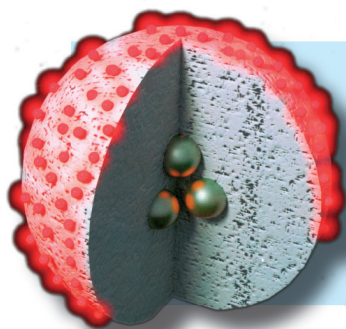
Carbon Nanotube Films

Z. Lin, X. Gui,* Z. Zeng, B. Liang,
W. Chen, M. Liu, Y. Zhu, A. Cao,*
Z. Tang..... 7173–7179

**Biomimetic Carbon Nanotube Films with
Gradient Structure and Locally Tunable
Mechanical Property**



A macroscopic carbon nanotube (CNT) film with gradient structure is synthesized by one-step CVD. The CNT arrangement gradually changes from well aligned to random distribution in a continuous and smooth way along the thickness direction. Local deformation and mechanical properties such as stiffness and elastic modulus are determined by the Herman's orientation factor and span over three orders of magnitude.



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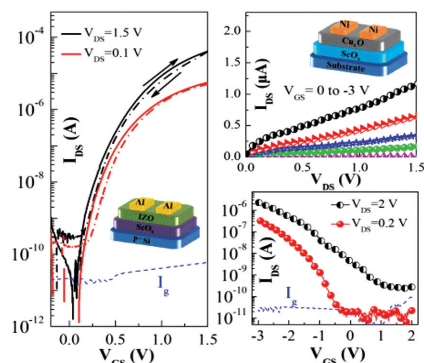
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FULL PAPERS

A novel way of preparing low-voltage n-type and p-type oxide thin-film transistors (TFTs) with improved electrical performance is shown. The water-induced, high- k ScO_x is proven to be an attractive channel-insulator interface constituent and exhibits excellent electrical properties. The solution-processed p-type CuO/ScO_x TFTs exhibit superior hole-transport characteristics with a field-effect mobility of $0.8 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ at the low operating voltage of 3 V.

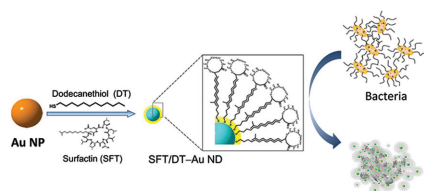


Thin-Film Transistors

A. Liu, G. X. Liu, H. H. Zhu, H. J. Song, B. C. Shin, E. Fortunato, R. Martins, F. Shan* 7180–7188

Water-Induced Scandium Oxide Dielectric for Low-Operating Voltage n- and p-Type Metal-Oxide Thin-Film Transistors

Surfactin, an antimicrobial lipopeptide, when self-assembled on photoluminescent gold nanodots (Au NDs) exhibits an >80-fold improvement in its antimicrobial activity against multidrug-resistant bacteria. Antibacterial wound-healing assays further reveal that the surfactin–Au ND hybrid material is superior to that of surfactin alone on a bacteria-infected flesh wound in rats.

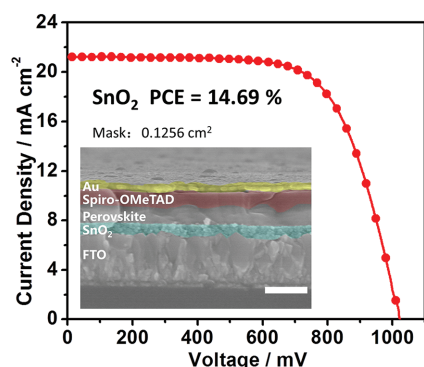


Wound Healing

W.-Y. Chen, H.-Y. Chang, J.-K. Lu, Y.-C. Huang, S. G. Harroun, Y.-T. Tseng, Y.-J. Li, C.-C. Huang,* H.-T. Chang* 7189–7199

Self-Assembly of Antimicrobial Peptides on Gold Nanodots: Against Multidrug-Resistant Bacteria and Wound-Healing Application

SnO_2 nanocolloids are synthesized for planar $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite solar cells. A champion efficiency of 14.69% is achieved for the SnO_2 -based solar cell, which is superior to the TiO_2 -based solar cell (13.38%) due to a higher electron mobility and negative conduction band, facilitating the electron injection, charge separation, and collection, which contribute to the improvement of photovoltaic performance.

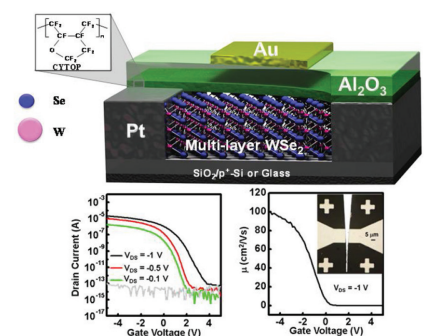


Perovskite Solar Cells

H.-S. Rao, B.-X. Chen, W.-G. Li, Y.-F. Xu, H.-Y. Chen, D.-B. Kuang,* C.-Y. Su 7200–7207

Improving the Extraction of Photogenerated Electrons with SnO_2 Nanocolloids for Efficient Planar Perovskite Solar Cells

A bilayer gate dielectric composed of a high- k Al_2O_3 layer and a low- k fluoropolymer layer yields field-effect transistors (FETs) with excellent gating properties. The proposed top-gate p-channel WSe_2 FETs demonstrate a high hole mobility of $100 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ and an $I_{\text{ON}}/I_{\text{OFF}}$ ratio of $>10^7$ on a glass substrate. Furthermore, the top-gate FET shows a very good stability in ambient air up to 7 days after device fabrication.



Field-Effect Transistors

S. H. Hosseini Shokouh, P. J. Jeon, A. Pezeshki, K. Choi, H. S. Lee, J. S. Kim, E. Y. Park, S. Im* 7208–7214

High-Performance, Air-Stable, Top-Gate, p-Channel WSe_2 Field-Effect Transistor with Fluoropolymer Buffer Layer

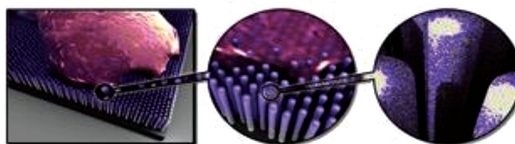
FULL PAPERS

Gene Delivery

R. Elnathan, B. Delalat, D. Brodoceanu, H. Alhmoud, F. J. Harding, K. Buehler, A. Nelson, L. Isa, T. Kraus, N. H. Voelcker* 7215–7225

Maximizing Transfection Efficiency of Vertically Aligned Silicon Nanowire Arrays

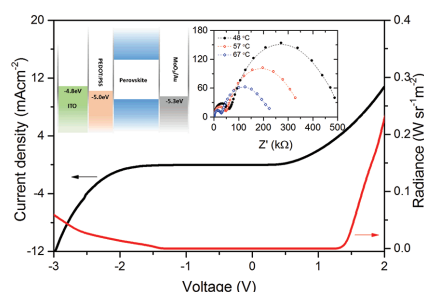
An easy-to-implement approach to control geometrical parameters in vertically aligned silicon nanowire arrays—which are used in gene delivery by means of mechanical transfection—is provided. This is realized by combining nanosphere lithography and templated metal-assisted wet chemical etching. Optimized nanowire array configurations produce transfection efficiencies approaching 95%.



Solid Electrolytes

H. Zhang, H. Lin, C. Liang,* H. Liu, J. Liang, Y. Zhao, W. Zhang, M. Sun, W. Xiao, H. Li, S. Polizzi, D. Li, F. Zhang, Z. He,* W. C. H. Choy* 7226–7232

Organic–Inorganic Perovskite Light-Emitting Electrochemical Cells with a Large Capacitance

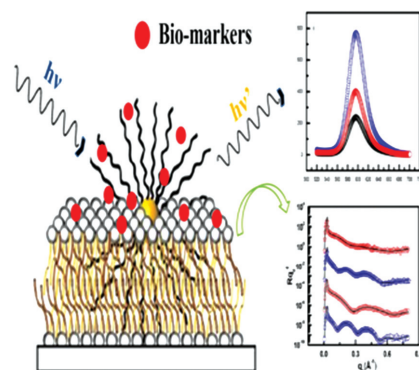


Light-emitting electrochemical cells (LECs) of organic–inorganic perovskite ($\text{CH}_3\text{NH}_3\text{PbI}_3$) with two high work function electrodes are demonstrated. Results indicate that $\text{CH}_3\text{NH}_3\text{PbI}_3$ has an ionic conductivity of $\approx 10^{-8} \text{ S cm}^{-1}$. The accumulated ions at the interfaces result in a large capacitance, which suggests a potential application in electrochemical energy-storage devices, such as solid-state supercapacitors and batteries.

Biomarkers

R. Bhattacharya,* C. Indukuri, N. Begam, O. H. Seeck, J. K. Basu* 7233–7242

Plasmonic Lipid Bilayer Membranes for Enhanced Detection Sensitivity of Biolabeling Fluorophores



A novel method for ultrasensitive bio-marker sensing is achieved by plasmonic bio-membrane templates for a wide range of fluorophores. Gold nanoparticle assemblies are used on lipid bilayer to get an emission enhancement through Förster resonance energy transfer. Furthermore, the role of nanoparticle membrane binding and penetration as well as its consequence on observed enhanced bio-fluorophore detection sensitivity is elucidated.