ADVANCED FUNCTIONAL MATERIALS

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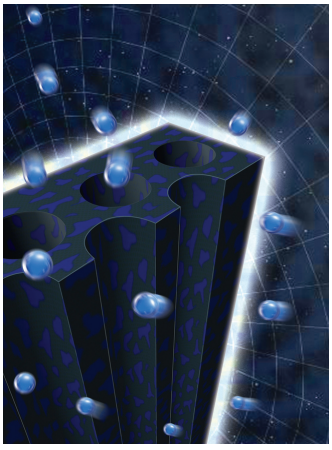
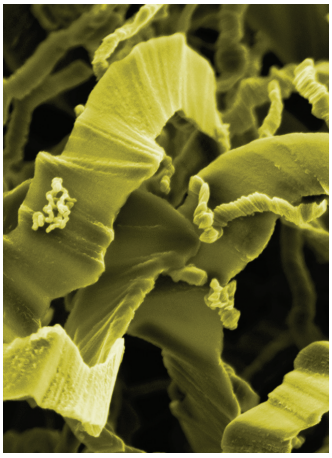


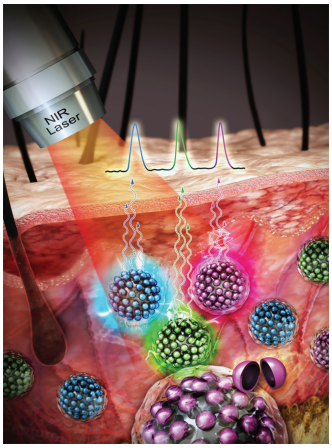
Capacitors

A study by S. Yoon, J. Lee, and co-workers on the improvement of rate performance highlights an important issue for pseudocapacitor electrode materials. On page 3747, the synthesis of an ordered mesoporous tungsten oxide–carbon nanocomposite is presented via a 'one-pot' soft-template method. The ordered mesoporous structure, partial reduction of the metal oxide, and the nanosized mixing of the metal oxide/carbon result in both high power and energy density.

Nanoribbons

Nitrogen-doped graphitic nanoribbons are synthesized by a single-step chemical vapor deposition method using pyrazine as the nitrogen source. As M. Terrones and co-workers report on page 3755, the morphology of the nanoribbons is correlated to the presence of N atoms within the graphitic structure. Spectroscopy results, in conjunction with transport measurements on individual nanoribbons and DFT theoretical simulations, indicate that nitrogen-doped graphitic nanoribbons possess features that are potentially useful for the development of sensors and other electronic components.





Nanoprobes

NIR-sensitive SERS nanoprobes are fabricated by J.-H. Kim, H.-Y. Lee, D. H. Jeong, Y.-S. Lee and co-workers, who form hollow plasmonic Au/Ag shells, assembled on the surface of a silica nanosphere. On page 3719, it is shown that the signals from these NIR SERS nanoprobes are detectable through deep tissues of up to 8 mm, and exhibit the capability for in vivo multiplex detection.

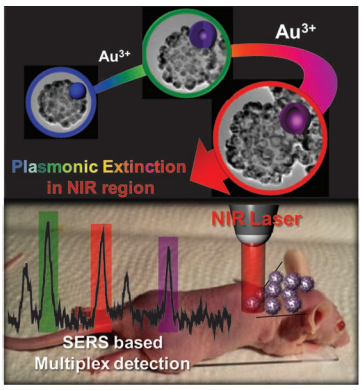
CONTENTS

FULL PAPERS

Nanoprobes

H. Kang, S. Jeong, Y. Park, J. Yim, B.-H. Jun, S. Kyeong, J.-K. Yang, G. Kim, S. G. Hong, L. P. Lee, J.-H. Kim,* H.-Y. Lee,* D. H. Jeong,* Y.-S. Lee*..... 3719–3727

Near-Infrared SERS Nanoprobes with Plasmonic Au/Ag Hollow-Shell Assemblies for In Vivo Multiplex Detection

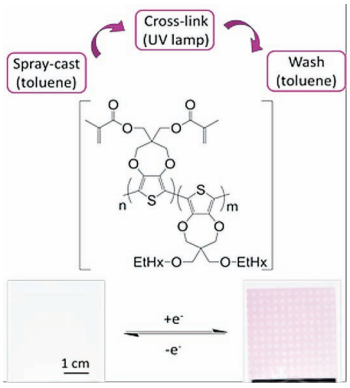


Near-infrared-sensitive surface-enhanced Raman scattering nanoprobes (NIR SERS dots) are fabricated by forming plasmonic Au/Ag hollow-shells, which assemble on silica nanospheres. A single NIR SERS dot is capable of generating a strong SERS signal (average SERS enhancement factor value 2.8×10^5) with high reproducibility. In addition, the signals from NIR SERS dots are effectively detected from deep tissues of up to 8 mm depth and have exhibited a capability for in vivo multiplex detection in a live animal study.

Electrochromic Polymers

J. Jensen, A. L. Dyer,* D. E. Shen, F. C. Krebs, J. R. Reynolds ...3728–3737

Direct Photopatterning of Electrochromic Polymers

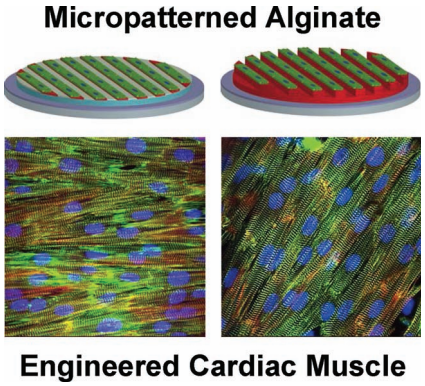


Direct photopatterning of a conjugated electroactive dioxythiophene-based polymer is presented. Thin films of the polymer are spray-cast from organic solvents, followed by insolubilization via photocrosslinking. The crosslinking process does not cause any detriment to the electroactivity or optical properties of the polymer, which can be redox switched between a colored and bleached state, as desired for electrochromic displays and windows.

Micropatterning

A. Agarwal, Y. Farouz, A. P. Nesmith, L. F. Deravi, M. L. McCain, K. K. Parker*.....3738–3746

Micropatterning Alginate Substrates for In Vitro Cardiovascular Muscle on a Chip

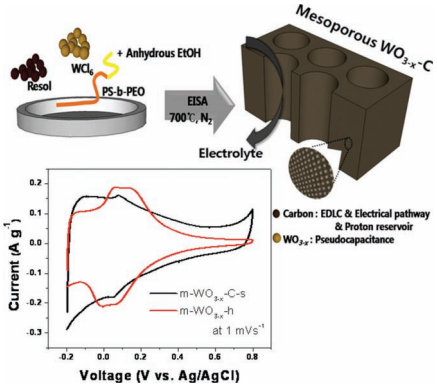


Two new techniques to create chemical and structural heterogeneities within soft alginate substrates are presented and employed to engineer anisotropic cardiac and vascular smooth muscle monolayers. These micropatterned hydrogel substrates are ideally suited for building in vitro models of muscle contractility and tissue engineering applications as they recapitulate the mechanical properties of muscle microenvironment and their anisotropic structure.

Capacitors

C. Jo, J. Hwang, H. Song, A. H. Dao, Y.-T. Kim, S. H. Lee, S. W. Hong, S. Yoon,* J. Lee*.....3747–3754

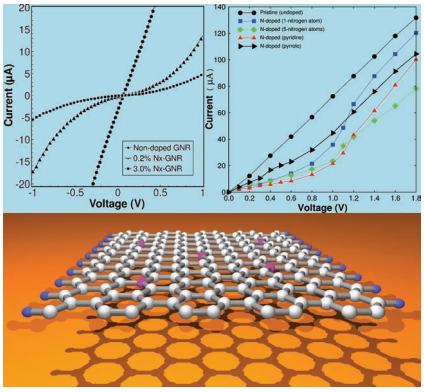
Block-Copolymer-Assisted One-Pot Synthesis of Ordered Mesoporous WO_{3-x}/Carbon Nanocomposites as High-Rate-Performance Electrodes for Pseudocapacitors



An ordered mesoporous tungsten-oxide/carbon (m-WO_{3-x}-C-s) nanocomposite is synthesized using a block-copolymer-assisted one-pot self-assembly method. As a pseudocapacitor electrode, m-WO_{3-x}-C-s exhibits a high average volumetric capacitance of 340 F cm^{-3} and a gravimetric capacitance of 103 F g^{-1}. The amorphous carbon in the m-WO_{3-x}-C-s decreases the internal resistance of m-WO_{3-x}-C-s electrode by facilitating electric conduction.

FULL PAPERS

Synthesis by chemical vapor deposition of nitrogen-doped graphitic nanoribbons (N_x-GNRs) is reported using pyrazine as a N precursor. Morphological, physico-chemical, and electrical characterization of nitrogen-doped graphitic nanoribbons reveal unique characteristics associated with doping sites, such as increased reactivity and changes in the electrical response towards semiconducting-like features. These results are confirmed using first-principle theoretical studies of N-doped graphene nanoribbons.

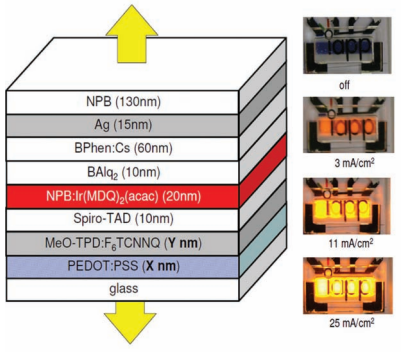


Nanoribbons

J. Ortiz-Medina, M. L. García-Betancourt, X. Jia, R. Martínez-Gordillo, M. A. Pelagio-Flores, D. Swanson, A. L. Elías, H. R. Gutiérrez, E. Gracia-Espino, V. Meunier, J. Owens, B. G. Sumpter, E. Cruz-Silva, F. J. Rodríguez-Macías, F. López-Urías, E. Muñoz-Sandoval, M. S. Dresselhaus, H. Terrones, M. Terrones* 3755–3762

Nitrogen-Doped Graphitic Nanoribbons: Synthesis, Characterization, and Transport

Transparent organic light-emitting diodes (OLEDs) with conductive, transparent poly(3,4-ethylenedioxythiophene): poly(styrenesulfonate) (PEDOT:PSS) electrodes are carefully optimized by tuning the device structure. The efficiency of PEDOT:PSS-based OLEDs is comparable to that of conventional indium tin oxide-based OLEDs. Long-term stability of OLEDs with PEDOT:PSS is significantly improved, showing a promising future for practical applications.

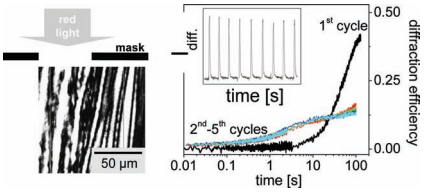


Light-Emitting Diodes

Y. H. Kim,* J. Lee,* S. Hofmann, M. C. Gather, L. Müller-Meskamp, K. Leo 3763–3769

Achieving High Efficiency and Improved Stability in ITO-Free Transparent Organic Light-Emitting Diodes with Conductive Polymer Electrodes

The fabrication strategy and underlying mechanisms of a highly photoisomerizable sol–gel material is investigated. Glycidoxypropyl groups and thermal annealing decisively improve the material properties for better dye photoresponse. Molecular photo-orientation promotes cooperative alignment of microscopic domains, enhancing the material response and explaining intriguing features of photoisomerization gratings, such as their potential nonlocal nature. Holographic performance is selectively exploited for either long-term or dynamic holography.

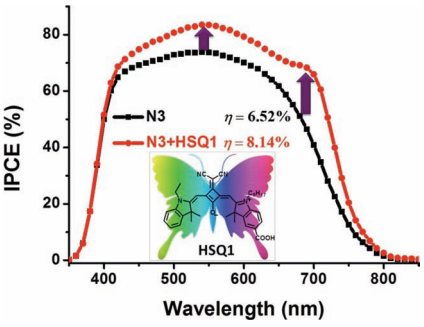


Sol–Gel Films

F. Gallego-Gómez,* F. del Monte, K. Meerholz*..... 3770–3781

Mechanisms for High-Performance and Non-Local Photoisomerization Gratings in a Sol–Gel Material

The absorption maximum of a *cis*-configured squaraine dye (HSQ1) is red-shifted to 686 nm using a simple molecular design strategy. Dye-sensitized solar cells (DSCs) co-sensitized with HSQ1 and N3 (a Ru bipyridyl complex) show an energy-conversion efficiency of 8.14%. HSQ1 is the first squaraine dye to possess such a broad incident photon-to-current conversion efficiency (IPCE) response spectrum and high conversion efficiency at long wavelengths.



Structure-Property Relationships

C. Qin, Y. Numata, S. Zhang, A. Islam, X. Yang, K. Sodeyama, Y. Tateyama, L. Han*..... 3782–3789

A Near-Infrared *cis*-Configured Squaraine Co-Sensitizer for High-Efficiency Dye-Sensitized Solar Cells

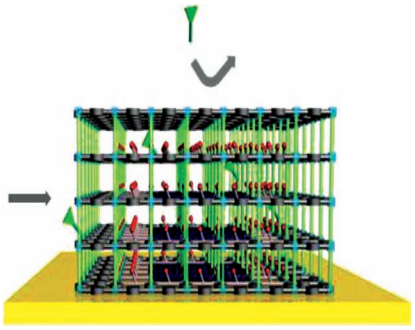
CONTENTS

FULL PAPERS

Metal–Organic Frameworks

B. Liu, M. Tu, D. Zacher,
R. A. Fischer* 3790–3798

Multi Variant Surface Mounted Metal–Organic Frameworks

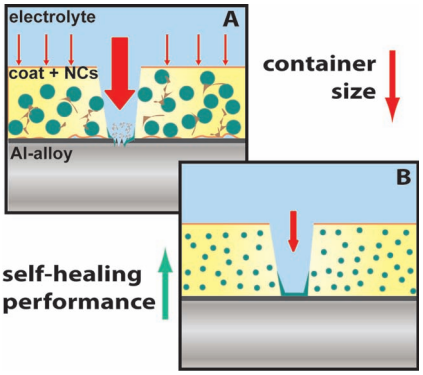


Multi variant surface mounted metal–organic frameworks (SURMOFs) are fabricated by sequential and stepwise growth of different MOF sub-layers on a functionalized substrate. Varied pore structures and environments in the hybrid SURMOF result in multiplex adsorption kinetics of guest molecules and thus reveal the excellent potential for advanced separation tasks.

Functional Coatings

D. Borisova,* D. Akçakayıran,
M. Schenderlein, H. Möhwald,
D. G. Shchukin 3799–3812

Nanocontainer-Based Anticorrosive Coatings: Effect of the Container Size on the Self-Healing Performance

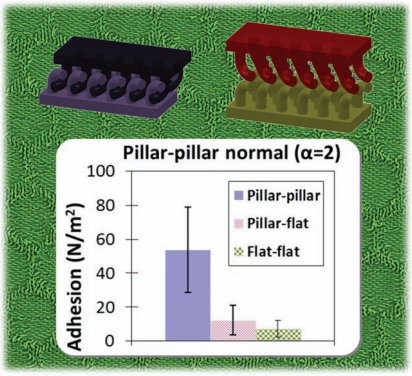


Nanocontainer-based anticorrosive coatings are formed by dispersing inhibitor-loaded mesoporous silica particles throughout an epoxy primer. They offer self-healing functionality and outperform the unmodified primer. Such coatings demonstrate worse passive and active protection. Coatings containing smaller nanocontainers offer enhanced self-healing performance due to homogeneous distribution and preservation of the coating integrity.

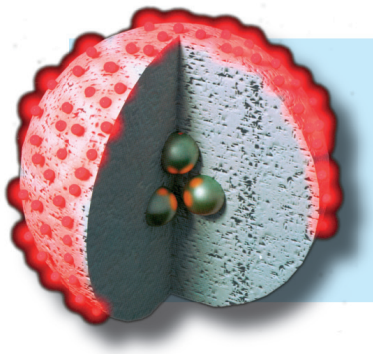
Shape-Memory Polymers

C.-M. Chen, C.-L. Chiang, C.-L. Lai,
T. Xie, S. Yang* 3813–3823

Buckling-Based Strong Dry Adhesives Via Interlocking



A strong dry adhesive based on interlocking of buckled shape-memory polymer (SMP) pillars is designed and investigated. The strong adhesion originates from pillar interweaving and indenting with each other, as well as the elastic energy stored in the deformed SMP pillars at room temperature. The adhesion strength and anisotropy can be tuned using the detachment temperature and pillar spacing.



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