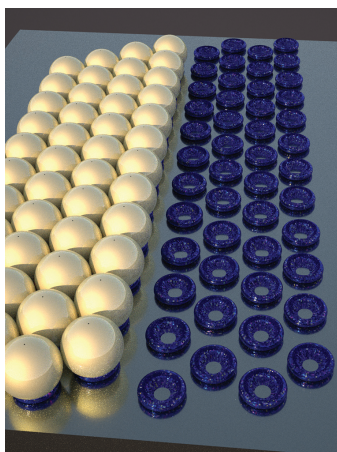


ADVANCED FUNCTIONAL MATERIALS

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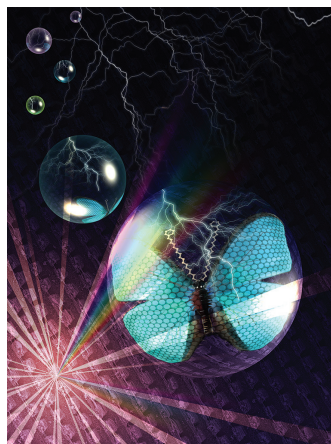


Antireflection

An interfacial energy-driven colloidal lithography technique to fabricate periodic nanostructure ensembles from a solution phase is demonstrated by A. Dev et al. on page 4577. It exploits different interfacial forces to periodically trap a liquid precursor under a monolayer of colloidal silica spheres arranged on a Si substrate. Using this technique, circular and ring-shaped patterns of ZnO nanowire ensembles and thin films are fabricated. The method described here can be adopted to make periodic patterns from a wide variety of soluble materials.

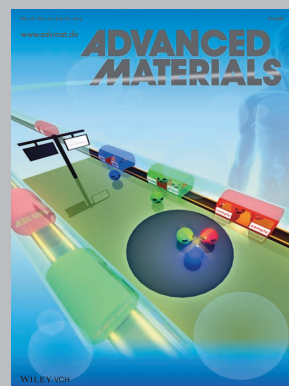
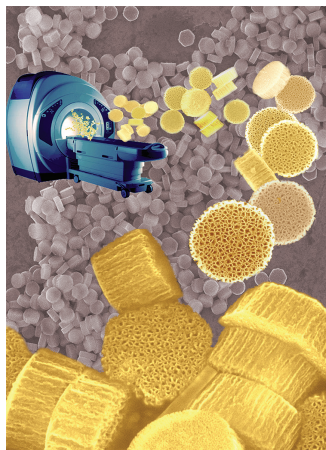
Magnetic Nanoparticles

Nanoconstructs are realized by P. Decuzzi and co-workers by confining ultra-small (5 nm) superparamagnetic iron oxide nanoparticles (USPIOs) within two different mesoporous structures (silicon and polymers). On page 4584, they exhibit transversal relaxivities up to around 10 times higher than conventional USPIOs and, under external magnetic fields, collectively cooperate to amplify tumor accumulation in mice to provide an MRI contrast enhancement at much smaller doses of iron as compared to current practice.



Biomimetics

Inspired from butterfly wings that feature brilliant structural color and unique dewetting properties, micro-nanostructured graphene surfaces with superhydrophobicity and iridescence are fabricated on page 4595 by Y.-L. Zhang, H.-B. Sun, and co-workers using a two-beam laser interference treatment of graphene oxide films. As a mask-free, chemical-free, highly efficient and cost-effective method, two-beam laser interference treatment processing of GO may open up a new way to biomimetic graphene surfaces, and thus hold great promise for the development of novel graphene-based microdevices.



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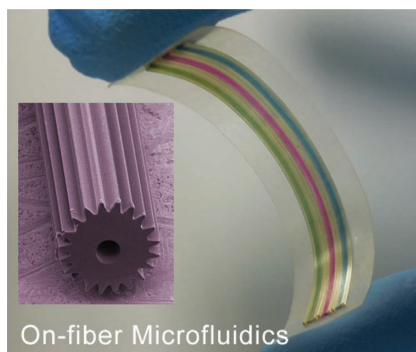
www.small-journal.com

FULL PAPERS

Microfluidics

A. Yildirim, M. Yunusa, F. E. Ozturk,
M. Kanik, M. Bayindir* 4569–4576

Surface Textured Polymer Fibers for Microfluidics

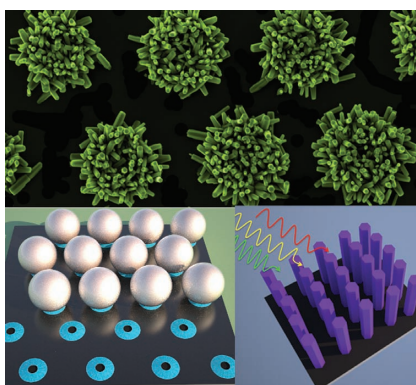


On-fiber microfluidics are introduced as a new platform for the fabrication of disposable microfluidic devices. Well-ordered, perfectly aligned microchannels on polymer fibers are obtained using thermal fiber drawing. Spontaneous capillary flow along three-dimensional fiber geometries, switch systems that allow precise control on fluid flow, and a proof of concept colorimetric protein assay are demonstrated.

Antireflection

A. Dev,* B. D. Choudhury, A. Abedin,
S. Anand 4577–4583

Fabrication of Periodic Nanostructure Assemblies by Interfacial Energy Driven Colloidal Lithography

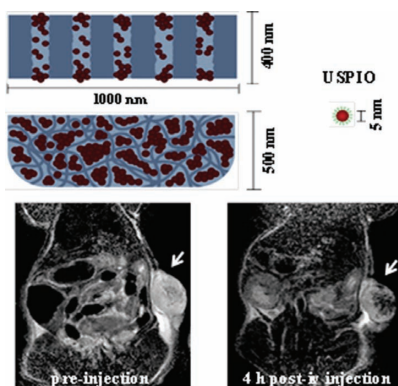


An unique approach to fabricate periodic nanostructures using solution-based synthesis is demonstrated by employing self-developed periodic wettability on a hydrophobic Si substrate in presence of colloidal silica spheres. The feasibility is demonstrated by fabricating circular and ring-shaped patterns of ZnO nanowire ensembles arranged in a hexagonal lattice. Antireflection properties of the fabricated structures are evaluated as a function of feature sizes.

Magnetic Nanoparticles

A. Gizzatov, J. Key, S. Aryal, J. Ananta,
A. Cervadoro, A. L. Palange, M. Fasano,
C. Stigliano, M. Zhong, D. D. Mascolo,
A. Guven, E. Chiavazzo, P. Asinari,
X. Liu, M. Ferrari, L. J. Wilson,
P. Decuzzi* 4584–4594

Hierarchically Structured Magnetic Nanoconstructs with Enhanced Relaxivity and Cooperative Tumor Accumulation

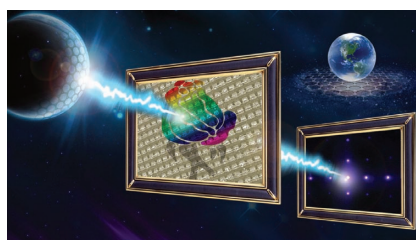


Nanoconstructs are realized by confining 5 nm ultra-small superparamagnetic iron oxide nanoparticles (USPIOs) within two different mesoporous structures (silicon and polymers). They exhibit transversal relaxivities up to ≈ 10 times higher than conventional USPIOs and, under external magnetic fields, collectively cooperate to amplify tumor accumulation in mice to provide MRI contrast enhancement at much smaller doses of iron as compared to current practice.

Biomimetics

H.-B. Jiang, Y.-L. Zhang,* D.-D. Han,
H. Xia, J. Feng, Q.-D. Chen, Z.-R. Hong,
H.-B. Sun* 4595–4602

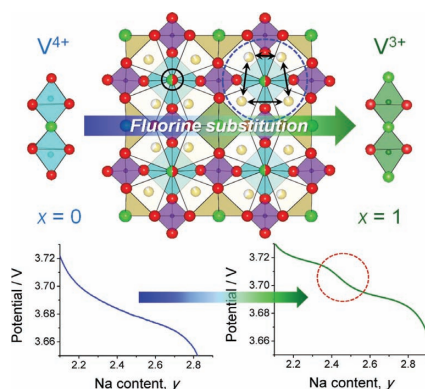
Bioinspired Fabrication of Superhydrophobic Graphene Films by Two-Beam Laser Interference



A bioinspired fabrication of superhydrophobic graphene surfaces by means of laser holographic treatment of graphene oxide (GO) films is presented. Microscale grating-like structures with nanoscale roughness are created on graphene films, and hydrophilic oxygen groups on GO sheets are drastically removed. The synergistic effect endows the resultant graphene films with unique superhydrophobicity and unique optical properties that mimic butterfly wings.

FULL PAPERS

A full solid solution of $\text{Na}_3(\text{VO}_{1-x}\text{PO}_4)_2\text{F}_{1+2x}$ ($0 \leq x \leq 1$) compounds as a promising cathode group for Na-ion batteries is introduced. A systematic study using a combined theoretical and experimental approach explains the electrochemical properties of the $\text{Na}_y(\text{VO}_{1-x}\text{PO}_4)_2\text{F}_{1+2x}$ electrodes and reveals their reaction mechanism in terms of $\text{V}^{3+}/\text{V}^{4+}/\text{V}^{5+}$ redox reactions, the effect of fluorine, and Na^+-Na^+ interactions.

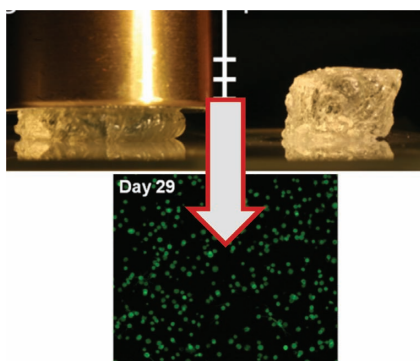


Cathode Materials

Y.-U. Park, D.-H. Seo, H. Kim, J. Kim, S. Lee, B. Kim, K. Kang*4603–4614

A Family of High-Performance Cathode Materials for Na-ion Batteries, $\text{Na}_3(\text{VO}_{1-x}\text{PO}_4)_2\text{F}_{1+2x}$ ($0 \leq x \leq 1$): Combined First-Principles and Experimental Study

Elastomeric silk hydrogels are easily formed by enzymatic crosslinking of tyrosine residues. The resultant gels have highly tunable mechanical properties, can withstand shear strains of 100%, are formed under all aqueous conditions, and are not cytotoxic. Modulation of cell-matrix interactions of encapsulated hMSCs can be accomplished by controlling protein concentration and gelation conditions, and the gels are biocompatible in vivo.

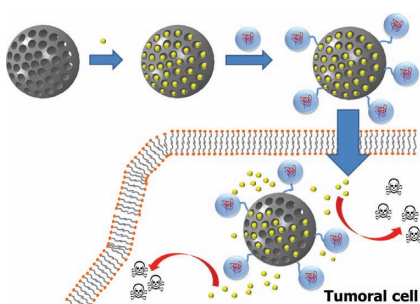


Hydrogels

B. P. Partlow, C. W. Hanna, J. Rnjak-Kovacina, J. E. Moreau, M. B. Applegate, K. A. Burke, B. Marelli, A. N. Mitropoulos, F. G. Omenetto, D. L. Kaplan*4615–4624

Highly Tunable Elastomeric Silk Biomaterials

Hybrid enzyme capsule-silica nanoparticles: A novel nanocarrier based on mesoporous silica nanoparticles loaded with a non-toxic pro-drug within the silica matrix and the enzyme responsible for its activation grafted on surface. This device is able to generate cytotoxic species once accumulated in the target place. The efficacy of this hybrid nanodevice for antitumoral purposes is tested against human tumoral cells showing significant efficacy.

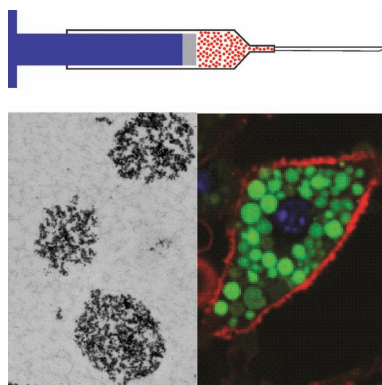


Drug Delivery

A. Baeza,* E. Guisasola, A. Torres-Pardo, J. M. González-Calbet, G. J. Melen, M. Ramirez, M. Vallet-Regí*...4625–4633

Hybrid Enzyme-Polymeric Capsules/ Mesoporous Silica Nanodevice for In Situ Cytotoxic Agent Generation

Tannic acid and poly(vinylpyrrolidone) form nanoporous microparticles in a single economically attractive assembly step involving atomization and hydrogen bonding. Vaccine antigen can be entrapped within the network of these particles and can still be internalized and presented by dendritic cells to T cells, inducing antigen-specific immune responses in vitro and in vivo.



Protein Encapsulation

M. Dierendonck, K. Fierens, R. De Rycke, L. Lybaert, S. Maji, Z. Zhang, Q. Zhang, R. Hoogenboom, B. N. Lambrecht, J. Grooten, J. P. Remon, S. De Koker, B. G. De Geest*4634–4644

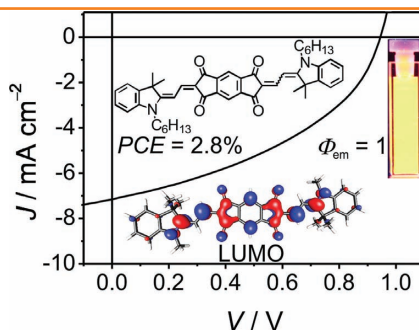
Nanoporous Hydrogen Bonded Polymeric Microparticles: Facile and Economic Production of Cross Presentation Promoting Vaccine Carriers

FULL PAPERS

Chromophores

A. Zitzler-Kunkel, M. R. Lenze,
T. Schnier, K. Meerholz,*
F. Würthner* 4645–4653

Comparative Studies on Optical, Redox, and Photovoltaic Properties of a Series of D–A–D and Analogous D–A Chromophores

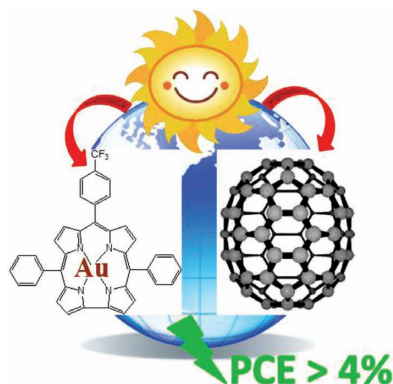


The effect of scaffold alteration on molecular and photovoltaic properties of a series of new D–A–D and their respective D–A systems is elucidated. The D–A–D dyes exhibit significantly improved luminescence and photovoltaic properties compared to those of their D–A counterparts, reaching fluorescence quantum yields of unity in nonpolar solvents and power conversion efficiencies of up to 2.8%.

Photoconversion

S.-L. Lai, L. Wang, C. Yang,
M.-Y. Chan, X. Guan, C.-C. Kwok,
C.-M. Che* 4655–4665

Gold(III) Corroles for High Performance Organic Solar Cells

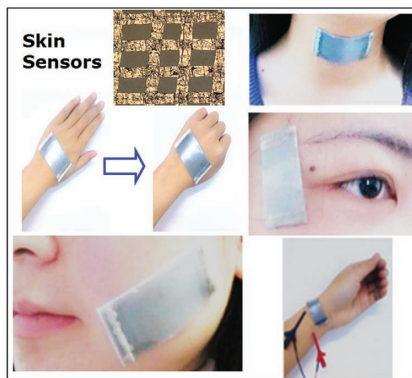


High performance OSCs comprising gold(III) corroles as donors are demonstrated with 4.0% and 6.0% PCEs realized in optimized OSCs based on Au-C2 via vacuum and solution-processes. These PCEs are among the best reported for both types of devices with triplet photo-absorber. Involvement of Au-C2 with long excited-state-lifetime $\geq 25 \mu\text{s}$ and low $\Phi_{\text{PL}} < 0.15\%$ may benefit to OSC performance.

Strain Sensors

Y. Wang, L. Wang, T. T. Yang, X. Li,
X. B. Zang, M. Zhu, K. L. Wang,
D. H. Wu, H. W. Zhu* 4666–4670

Wearable and Highly Sensitive Graphene Strain Sensors for Human Motion Monitoring

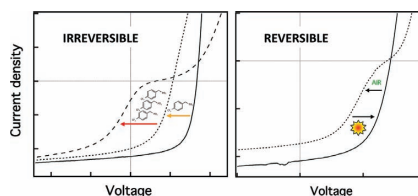


Flexible and wearable strain sensors are assembled by adhering the graphene woven fabrics on polymer/medical tape composite films. The sensors exhibit high sensitivity with notable resistance changes for any tiny deformation and can be used as electronic skin covering human body to detect weak human motions, including hand clenching, phona-tion, expression change, blink, breath, and pulse.

Photovoltaics

S. R. Cowan, P. Schulz, A. J. Giordano,
A. Garcia, B. A. MacLeod, S. R. Marder,
A. Kahn, D. S. Ginley, E. L. Ratcliff,
D. C. Olson* 4671–4680

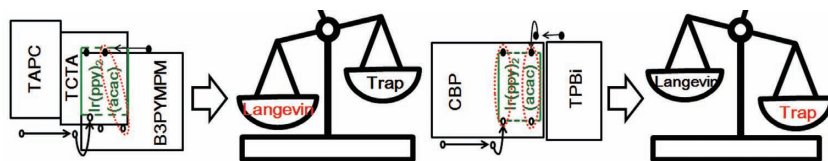
Chemically Controlled Reversible and Irreversible Extraction Barriers Via Stable Interface Modification of Zinc Oxide Electron Collection Layer in Polycarbazole-based Organic Solar Cells



Deposition of benzyl phosphonic acids and alkanethiolself-assembled monolayers improve initial device performance, and have beneficial effect at mitigating the light-soaking effect present after aging inverted architecture organic bulk heterojunction devices incorporating ZnO contact layers in air. The effect of a kinetic/transport barrier and a static energetic barrier resulting in formation of S-shaped J – V curves is isolated.

FULL PAPERS

The origin of the ultimate efficiency with extremely low efficiency roll-off in a PhOLED with exciplex-forming co-host (quasi-single host) is unveiled. Unlike the other PhOLEDs with single host which is dominantly governed by trap assisted recombination, Langevin assisted recombination is dominated in the PhOLED with quasi-single host system, resulting in low accumulation of charges in the device.

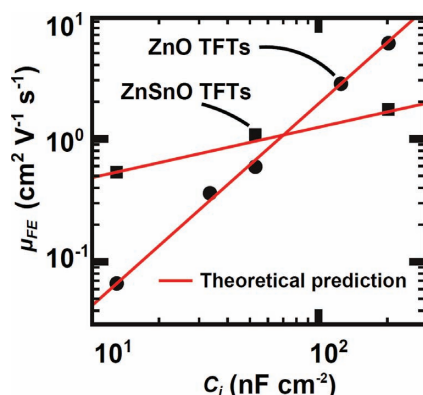


Organic Electronics

J.-H. Lee, S. Lee, S.-J. Yoo, K.-H. Kim, J.-J. Kim*4681–4688

Langevin and Trap-Assisted Recombination in Phosphorescent Organic Light Emitting Diodes

A relationship between gate capacitances (C_i) and field-effect mobility (μ_{FE}) of solution-processed oxide semiconductor thin-film transistors is systematically analyzed. A simple analytic expression, describing how μ_{FE} depends on C_i with a power law, is developed. The μ_{FE} - C_i characteristics of solution-processed ZnO and ZnSnO thin-film transistors are clearly guided by the theoretical predictions.

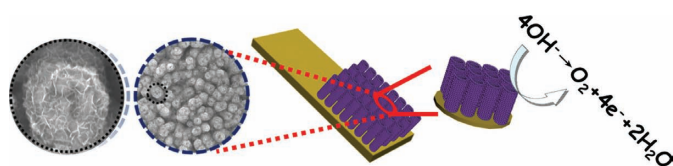


Semiconductors

E. Lee, J. Ko, K.-H. Lim, K. Kim, S. Y. Park, J. M. Myoung, Y. S. Kim*4689–4697

Gate Capacitance-Dependent Field-Effect Mobility in Solution-Processed Oxide Semiconductor Thin-Film Transistors

Binary Ni-Co hydroxide-based coaxial nanotube array electrode: A self-standing 3D electrode with coaxial nanotube array structure is fabricated by simple electro-deposition. Owing to the high surface area, enhanced electron transport, and synergistic effects, the resultant 3D electrode exhibits excellent OER performance over other nanostructured electrodes with large anodic currents and good durability in alkaline medium.

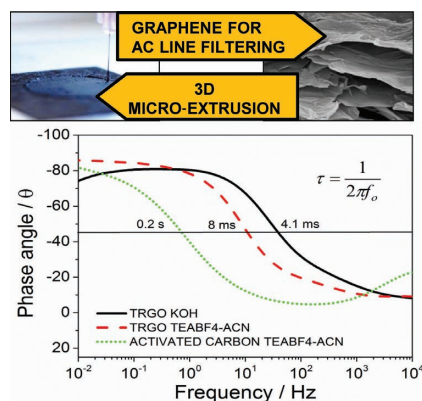


Electrochemistry

Z. L. Zhao, H. X. Wu, H. L. He, X. L. Xu, Y. D. Jin*4698–4705

A High-Performance Binary Ni-Co Hydroxide-based Water Oxidation Electrode with Three-Dimensional Coaxial Nanotube Array Structure

3D micro extrusion of binder-free graphene ink enables the printing of high rate performance electrochemical capacitor electrodes. These printed electrodes can be charged and discharged at very high voltage scan rates up to 15 V s⁻¹ yielding 4 F cm⁻³, which is very promising for AC line filtering application and could potentially replace the state of the art electrolytic capacitor technology.



Energy Storage

T. Nathan-Walleser, I.-M. Lazar, M. Fabritius, F. J. Tölle, Q. Xia, B. Bruchmann, S. S. Venkataraman, M. G. Schwab,* R. Mülhaupt*4706–4716

3D Micro-Extrusion of Graphene-based Active Electrodes: Towards High-Rate AC Line Filtering Performance Electrochemical Capacitors