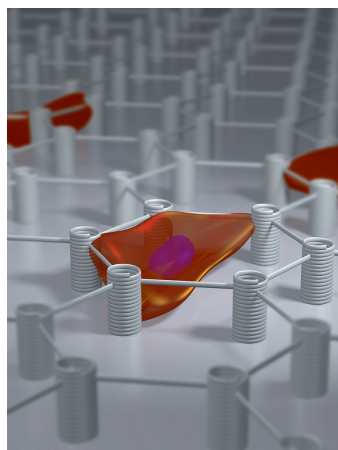


ADVANCED FUNCTIONAL MATERIALS

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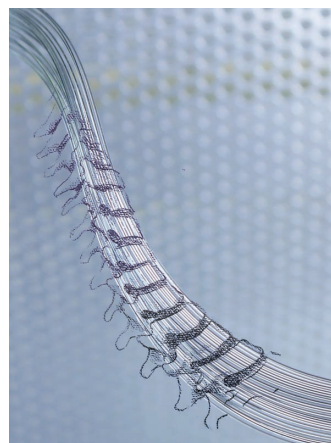
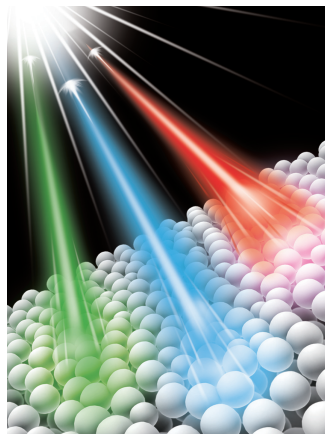


Microstructures

The influence of three-dimensional topographies on viability parameters of osteoblast-like cells is investigated via a systematic variation of structural parameters. On page 6573 J. K. Hohmann and G. von Freymann report which topographies significantly enhance proliferation and how structural parameters influence cell morphology and differentiation. Cover design by Judith K. Hohmann and Christoph Reinheimer.

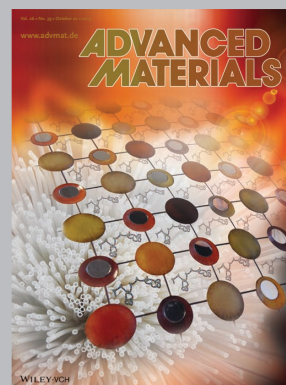
Nanospheres

ZnGa_2O_4 nanospheres with high uniformity are synthesized by a facile hydrothermal method with the assistance of organic additive trisodium citrate (Cit^{3-}). On page 6581 M. Shang, J. Lin, and team show how, under UV light and low-voltage electron beam excitation, ZnGa_2O_4 , $\text{ZnGa}_2\text{O}_4:\text{Mn}^{2+}$, and $\text{ZnGa}_2\text{O}_4:\text{Eu}^{3+}$ nanospheres emit bright blue, green, and red luminescence, respectively. A wide range of tunable color including white emission is obtained through changing the relative amount of the Mn^{2+} and Eu^{3+} -doped samples, indicating this material can be used in future lighting and display systems.



Flexible Fibers

On page 6594, polymer fibers are designed by P. Anikeeva and co-workers to mimic fibrous geometry of the nerves allow simultaneous optical stimulation and neural recording in the spinal cord. The cover picture illustrates the flexibility of the bifunctional neural probes and their ability to accommodate deformation due to the movement of vertebrae.



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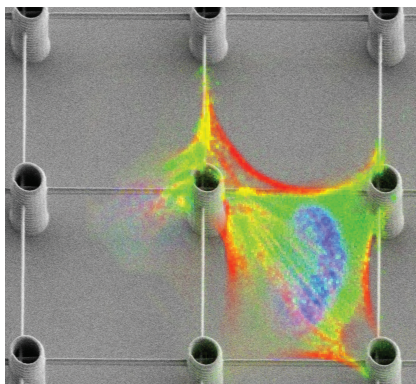
www.small-journal.com

FULL PAPERS

Microstructures

J. K. Hohmann,*
G. von Freymann 6573–6580

Influence of Direct Laser Written 3D Topographies on Proliferation and Differentiation of Osteoblast-Like Cells: Towards Improved Implant Surfaces

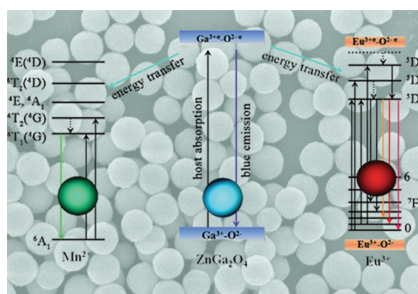


Proliferation and differentiation can be influenced via three-dimensional designer topographies. This systematic study shows how osteoblast-like cells grow on different well-defined structures, fabricated by direct laser writing. Proliferation is significantly increased (170%) on particular structures compared to unstructured surfaces (100%) with identical chemical composition. The results might lead to novel implants with decreased implant failure rates.

Nanospheres

Y. Zhang, Z. Wu, D. Geng, X. Kang,
M. Shang,* X. Li, H. Lian, Z. Cheng,
J. Lin* 6581–6593

Full Color Emission in ZnGa_2O_4 : Simultaneous Control of the Spherical Morphology, Luminescent, and Electric Properties via Hydrothermal Approach

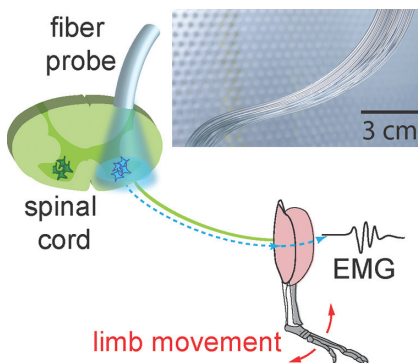


ZnGa_2O_4 : $\text{Mn}^{2+}/\text{Eu}^{3+}$ with uniform nanospheric morphology (diameter about 400 nm) are synthesized via a facile hydrothermal approach. The electronic properties, chemical bonding, and mechanisms of electron transitions in ZnGa_2O_4 and $\text{Mn}^{2+}/\text{Eu}^{3+}$ -doped ZnGa_2O_4 systems are studied based on the density functional theory (DFT) calculations from first principles.

Flexible Fibers

C. Lu, U. P. Frierp, R. A. Koppes,
A. Canales, V. Caggiano, J. Selvidge,
E. Bizzi, P. Anikeeva* 6594–6600

Polymer Fiber Probes Enable Optical Control of Spinal Cord and Muscle Function In Vivo

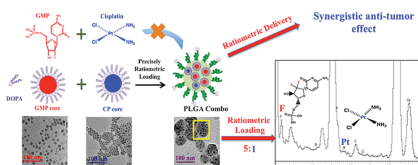


Flexible polymer fiber probes that integrate optical waveguides and conductive electrodes and maintain their functions under dynamic strain are developed. These probes allow simultaneous optogenetic stimulation and recording of neural activity in the spinal cord, which is accompanied by induced limb movements in vivo.

Combination Therapy

L. Miao, S. Guo, J. Zhang, W. Y. Kim,
L. Huang* 6601–6611

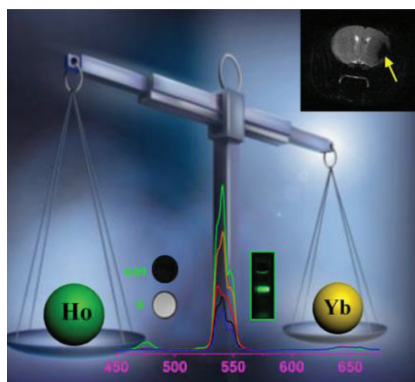
Nanoparticles with Precise Ratiometric Co-Loading and Co-Delivery of Gemcitabine Monophosphate and Cisplatin for Treatment of Bladder Cancer



A novel nano-platform with ratiometric loading and delivery of multiple hydrophilic drug moieties is demonstrated. Hydrophilic cisplatin and gemcitabine monophosphate are standardized to a similar hydrophobicity through loading into lipid-coated calcium phosphate and cisplatin cores, respectively. Precise ratio-controlled loading and delivery is achieved by incorporating these cores into PLGA NPs. These ratiometric combinations lead to the maximal synergistic anticancer effect.

FULL PAPERS

The first example of T_2 -weighted MR imaging of the sensitizer (Yb^{3+}) and activator (Ho^{3+}) in UCNPs is presented. These could also be simultaneously used for UCL and CT imaging, thus enabling the high performance multimodal MRI/UCL/CT imaging in single UCNPs. Impressively, the remarkable T_2 -MRI capability of the Ho^{3+} -doped UCNPs favors the accurate early diagnosis of brain tumors.

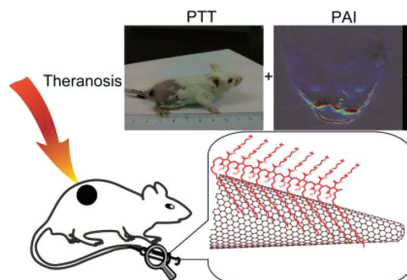


Brain Tumors

D. Ni, W. Bu,* S. Zhang, X. Zheng, M. Li, H. Xing, Q. Xiao, Y. Liu, Y. Hua, L. Zhou, W. Peng, K. Zhao, J. Shi*6613–6620

Single Ho^{3+} -Doped Upconversion Nanoparticles for High-Performance T_2 -Weighted Brain Tumor Diagnosis and MR/UCL/CT Multimodal Imaging

SWNHs/ C_{18} PMH-PEG with high stability and biocompatibility is prepared for photoacoustic imaging guided photothermal therapy. The boundary of the tumor in mice after intravenously injected with SWNHs/ C_{18} PMH-PEG is clearly visualized and the subsequent phototherapy is highly efficient under the guidance of photoacoustic imaging.

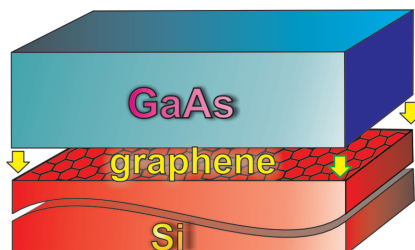


Theranostics

D. Chen, C. Wang, X. Nie, S. Li, R. Li, M. Guan, Z. Liu, C. Chen, C. Wang, C. Shu,* L. Wan*6621–6628

Photoacoustic Imaging Guided Near-Infrared Photothermal Therapy Using Highly Water-Dispersible Single-Walled Carbon Nanohorns as Theranostic Agents

Van der Waals growth of GaAs on silicon using graphene as a lattice mismatch/thermal expansion coefficient mismatch relieving vdW buffer layer is reported. The growth of GaAs thin films on graphene is a potential route towards heteroepitaxial integration of GaAs on silicon. An ultrasmooth morphology for GaAs films with a strong (111) oriented fiber-texture on graphene/Si using quasi van der Waals epitaxy is presented.

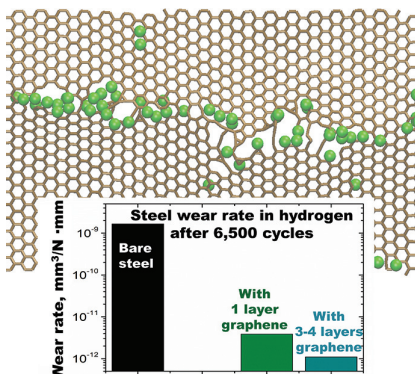


Heterogeneous Integration

Y. Alaskar, S. Arafin,* D. Wickramaratne, M. A. Zurbuchen, L. He, J. McKay, Q. Lin, M. S. Goorsky, R. K. Lake, K. L. Wang*6629–6638

Towards van der Waals Epitaxial Growth of GaAs on Si using a Graphene Buffer Layer

The mechanism of extraordinary wear resistance of just one atom thick graphene layer on steel is revealed. A single layer of graphene is able to reduce steel wear by 3–4 orders of magnitude. The wear-life of graphene significantly increases when tested in hydrogen environment. Hydrogen plays a crucial role in preventing graphene from wear-induced damage by passivating carbon dangling bonds.



Graphene

D. Berman, S. A. Deshmukh, S. K. R. S. Sankaranarayanan, A. Erdemir, A. V. Sumant*6640–6646

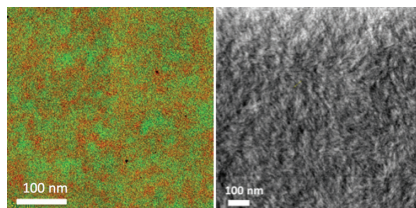
Extraordinary Macroscale Wear Resistance of One Atom Thick Graphene Layer

FULL PAPERS

Photovoltaics

M. Shao, J. K. Keum, R. Kumar, J. Chen,
J. F. Browning, S. Das, W. Chen, J. Hou,
C. Do, K. C. Littrell, A. Rondinone,
D. B. Geohegan, B. G. Sumpter,
K. Xiao* 6647–6657

Understanding How Processing Additives Tune the Nanoscale Morphology of High Efficiency Organic Photovoltaic Blends: From Casting Solution to Spin-Cast Thin Film

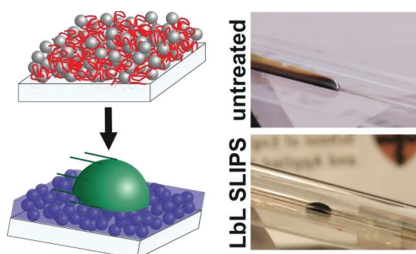


A comprehensive suite of characterization techniques and theoretical analyses are used to reveal both the lateral and vertical morphological effects of the processing additive diiodooctane, DIO, on the formation of bulk-heterojunctions and the resulting organic photovoltaic device parameters starting from a donor/acceptor polymer blend PBDDTT-C-T:PC₇₁BM in solution, to the spin-cast films.

Omniphobicity

S. Sunny, N. Vogel,* C. Howell, T. L. Vu,
J. Aizenberg* 6658–6667

Lubricant-Infused Nanoparticulate Coatings Assembled by Layer-by-Layer Deposition

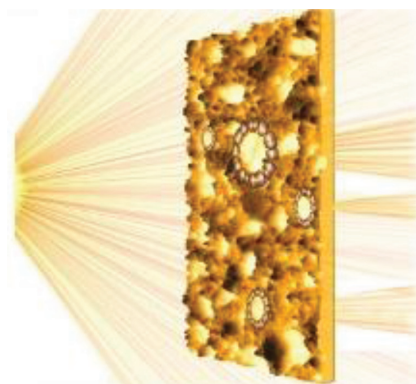


Lubricant-infused coatings provide efficient repellency of various liquids and prevent the adhesion of liquid-borne contaminants. Here, a simple layer-by-layer deposition process is used to create functional, transparent, mechanically robust and stable lubricant-infused coatings on a variety of different materials with arbitrary shapes.

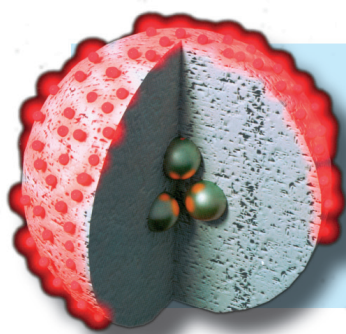
Solar Cells

S. Schubert,* L. Müller-Meskamp,
K. Leo 6668–6676

Unusually High Optical Transmission in Ca:Ag Blend Films: High-Performance Top Electrodes for Efficient Organic Solar Cells



Calcium:silver blend electrodes show extraordinarily high mean transmittance of 93.0% in the visible spectral range, low sheet resistance of 27.3 Ω/\square , and excellent flexibility, superior to commonly used indium tin oxide. The unique microstructure enables broadband transmittance enhancement due to plasmonic coupling. Top-illuminated OPV cells using such metal blends as top electrode achieve an outstanding power conversion efficiency of 7.2%.



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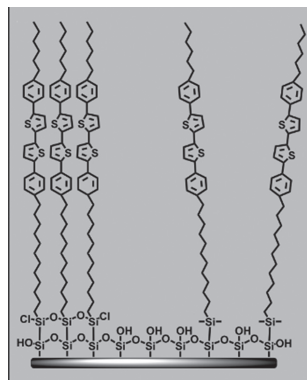
FULL PAPERS

Organic Electronics

A. V. S. Parry, K. Lu, D. J. Tate,
B. Urasinska-Wojcik, D. Caras-Quintero,
L. A. Majewski, M. L. Turner*...6677–6683

Trichlorosilanes as Anchoring Groups for Phenylene-Thiophene Molecular Monolayer Field Effect Transistors

A self assembled monolayer field effect transistor is presented. A p-type mesogen is used as the semiconducting core for a trichlorosilane based self-assembled monolayer used in a field effect transistor. Monolayers are formed in less than 10 h and devices are reported with a mobility as high as $1.7 \times 10^{-2} \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$.

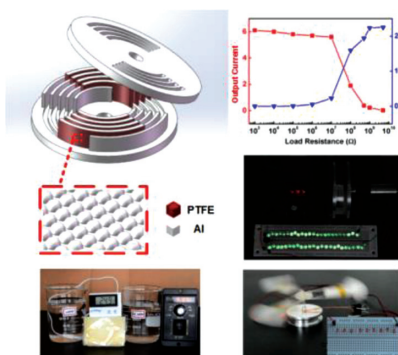


Nanogenerators

W. Tang, C. Zhang, C. B. Han,
Z. L. Wang*6684–6690

Enhancing Output Power of Cylindrical Triboelectric Nanogenerators by Segmentation Design and Multilayer Integration

The triboelectric nanogenerator (TENG) is a newly invented technology that is effective for harvesting ambient mechanical energy. By introducing segmentation and multi-layer integration into the cylindrical TENG, the generator's output is enhanced significantly. It is demonstrated that the segmentation design and the fractal geometry are a perfect self-power-management technique and an effective surface-maximizing way to enhance the TENG's performance.

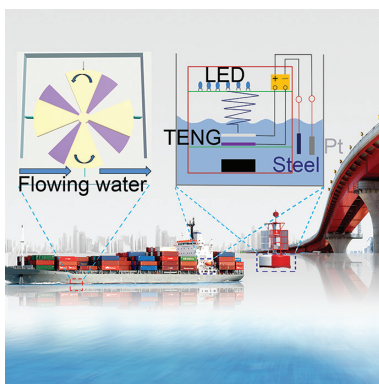


Nanogenerators

W. Guo, X. Li, M. Chen, L. Xu, L. Dong,
X. Cao, W. Tang, J. Zhu, C. Lin,* C. Pan,*
Z. L. Wang*6691–6699

Electrochemical Cathodic Protection Powered by Triboelectric Nanogenerator

Triboelectric nanogenerator (TENG) with different operating modes is developed to achieve a special cathodic protection effect for steels, the cathodic potentials of steels can be adjusted by simply changing the external loads of the TENG, which is sufficient to meet the minimum cathodic protection potentials for most of the metals and alloys. An application of marine corrosion prevention is performed by mounting the TENG onto a buoy.

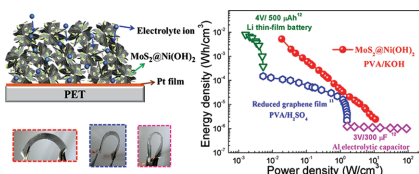


Flexible Electronics

C. Hao, F. Wen,* J. Xiang, L. Wang,
H. Hou, Z. Su, W. Hu,
Z. Liu*6700–6707

Controlled Incorporation of Ni(OH)₂ Nanoplates Into Flowerlike MoS₂ Nanosheets for Flexible All-Solid-State Supercapacitors

A self-supporting three-dimensional hierarchical nanostructured MoS₂@Ni(OH)₂ flexible all-solid-state supercapacitor can operate at high rates up to 1000 V/s, exhibiting mechanical flexibility during extreme bending, and excellent long-life cycling stability, retaining 94.2% of the initial capacitance after 9000 cycles. MoS₂@Ni(OH)₂ nanocomposites are a promising electrode material for flexible long-life cycling all-solid-state supercapacitors.

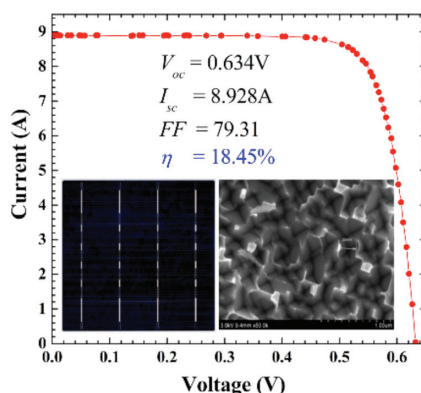


FULL PAPERS

Solar Cells

X. Ye, S. Zou, K. Chen, J. Li, J. Huang,
F. Cao, X. Wang, L. Zhang, X.-F. Wang,
M. Shen, X. Su* 6708–6716

**18.45%-Efficient Multi-Crystalline
Silicon Solar Cells with Novel Nanoscale
Pseudo-Pyramid Texture**

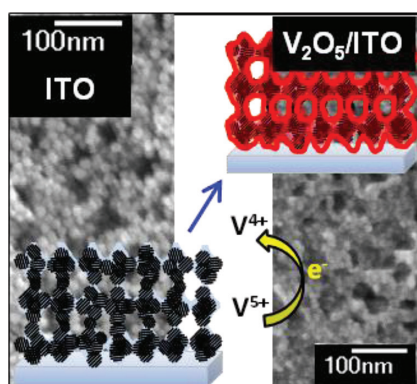


18.45% efficient multi-crystalline silicon solar cells with nanoscale pseudo-pyramidal texture are fabricated by using a metal-catalyzed chemical etching plus a post alkaline etching. The improved efficiency is mainly ascribed to its enhanced light absorption and acceptable passivation quality, that is, the short-circuit current density has an increase of $\approx 300 \text{ mA cm}^{-2}$, while the open-circuit voltage has only a slight decrease of $\approx 1 \text{ mV}$.

Energy Storage

I. E. Rauda, V. Augustyn,
L. C. Saldarriaga-Lopez, X. Chen,
L. T. Schelhas, G. W. Rubloff*, B. Dunn*,
S. H. Tolbert* 6717–6728

**Nanostructured Pseudocapacitors Based
on Atomic Layer Deposition of V_2O_5
onto Conductive Nanocrystal-based
Mesoporous ITO Scaffolds**



Nanostructured pseudocapacitors are created by coating a conductive scaffold, made through solution-phase templating of ITO nanocrystals, with a conformal layer of vanadium oxide. The materials combine intrinsic electrical conductivity, porosity for solvent diffusion, and short solid-state Li^+ diffusion distance. By tuning the vanadia thickness, redox reactions are dominantly pseudocapacitive for vanadia layers up to 7 nm thickness.