

ADVANCED FUNCTIONAL MATERIALS

www.afm-journal.de

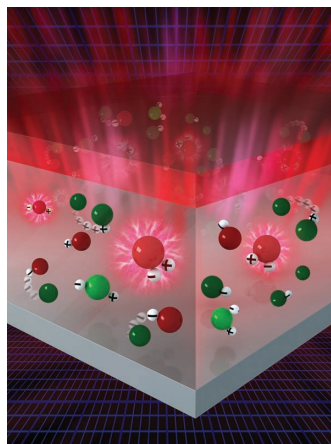
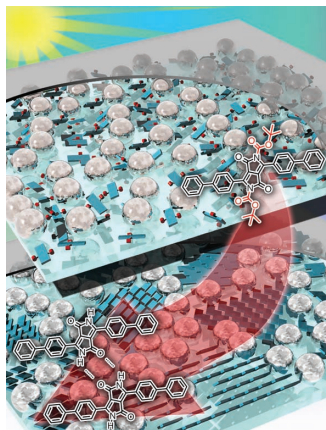


Proteins

Squid ring teeth complex extracted from *Loligo vulgaris* shows reversible solid to melt phase transition on page 7401. M. C. Demirel and team show how the direct extraction or recombinant expression of protein based thermoplastics opens up new avenues for materials fabrication and synthesis, which will eventually be competitive with the high-end synthetic oil based plastics.

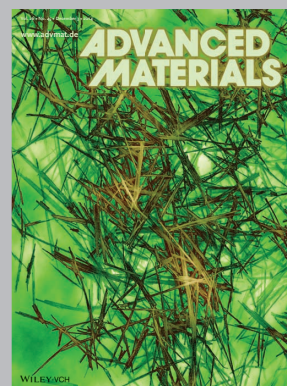
Photovoltaics

On page 7410, L. Beverina, S. Brovelli, and co-workers demonstrate a new paradigm for fine tuning the phase segregation in small-molecule solar cells based on the post-deposition exploitation of latent hydrogen bonding. Thermally activating latent conjugated pigments fine-tunes and stabilizes the nanoscale film connectivity, thereby simultaneously optimizing charge generation and transport processes, resulting in over 20-fold increase of the photovoltaic efficiency.



Electrophosphorescence

An all-phosphor host-guest doping system is presented by Y. Liu, Y. Wang, M. R. Bryce, and colleagues on page 7420. It is based on two novel Ir complexes possessing bipolar transporting ability and realizes ultra-high efficiency orange-red phosphorescent organic light-emitting devices, which exhibit constant peak power efficiency of $>75 \text{ lm W}^{-1}$ and external quantum efficiency of $>26\%$ as well as extremely low efficiency roll-off within a certain range of 8 and 15 wt%.



Advanced Materials has been bringing you the best in materials research for over twenty-five years.

With its increased ISI Impact Factor of 15.409, *Advanced Materials* is one of the most influential journals in the field. Publishing every week, *Advanced Materials* now brings you even more of the latest results at the cutting edge of materials science.

www.advmat.de



Small is the very best interdisciplinary forum for all experimental and theoretical aspects of fundamental and applied research at the micro and nano length scales.

With an ISI impact Factor of 7.514 and publishing every two weeks in 2014 with papers online in advance of print, *Small* is your first-choice venue for top-quality communications, detailed full papers, cutting-edge concepts, and in-depth reviews of all things micro and nano.

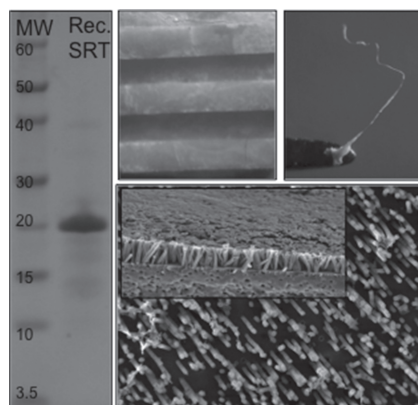
www.small-journal.com

FULL PAPERS

Proteins

A. Pena-Francesch, S. Florez, H. Jung,
A. Sebastian, I. Albert, W. Curtis,
M. C. Demirel* 7401–7409

Materials Fabrication from Native and Recombinant Thermoplastic Squid Proteins

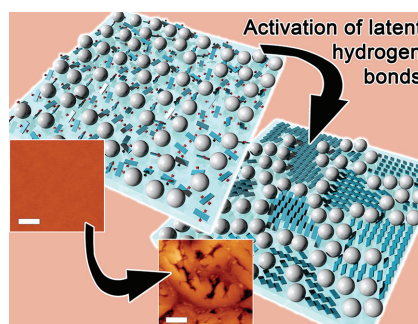


Protein sequences are identified in a squid ring teeth complex extracted from *Loligo vulgaris* and recombinant expression for its use in the fabrication of thermoplastic materials is demonstrated for the first time. Earlier attempts to create recombinant thermoplastic SRT protein failed due to the choice of larger molecular weight proteins. Reversible solid is demonstrated to melt phase transition of the recombinant protein, which is thermally shaped into any 3D geometries.

Photovoltaics

F. Bruni, M. Sassi, M. Campione,
U. Giovanella, R. Ruffo, S. Luzzati,
F. Meinardi, L. Beverina,*
S. Brovelli* 7410–7419

Post-Deposition Activation of Latent Hydrogen-Bonding: A New Paradigm for Enhancing the Performances of Bulk Heterojunction Solar Cells

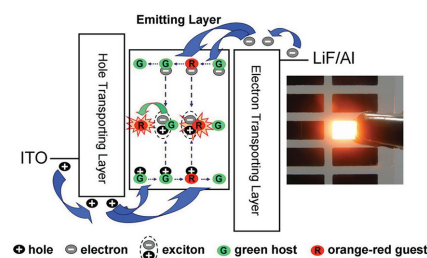


A new paradigm for the fine-tuning the phase segregation in SM-BHJs, based on the post-deposition exploitation of latent hydrogen bonds in binary molecular blends, is demonstrated. This approach allows fine-tuning of the nanoscale film connectivity and to simultaneously optimize charge generation and extraction via ordered phase-separated domains. As a result, the PV efficiency undergoes a 20-fold increase with respect to control devices.

Electrophosphorescence

G. Li, D. Zhu, T. Peng, Y. Liu,* Y. Wang,*
M. R. Bryce* 7420–7426

Very High Efficiency Orange-Red Light-Emitting Devices with Low Roll-Off at High Luminance Based on an Ideal Host–Guest System Consisting of Two Novel Phosphorescent Iridium Complexes with Bipolar Transport

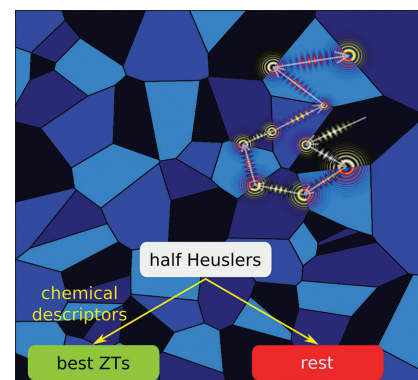


An all-phosphor host–guest doping system based on two novel Ir complexes possessing bipolar transporting ability realizes very-high efficiency orange-red phosphorescent organic light-emitting devices, which exhibit constant peak electroluminescent efficiency of $>75 \text{ lm W}^{-1}$ for power efficiency and 26% for external quantum efficiency as well as extremely low efficiency roll-off within a range of 8 and 15 wt%.

Thermoelectrics

J. Carrete, N. Mingo,* S. Wang,
S. Curtarolo* 7427–7432

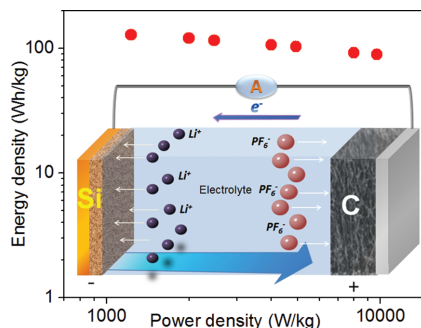
Nanograined Half-Heusler Semiconductors as Advanced Thermoelectrics: An Ab Initio High-Throughput Statistical Study



First-principles calculations are used to model the thermoelectric properties of 75 nanograined compounds obtained after filtering through the 79 057 half-Heusler entries available in the AFLOWLIB.org repository utilizing electronic and thermodynamic criteria. Many of the figures of merit obtained are markedly above those attainable with nanograined IV and III-V semiconductors, and competitive with the state of the art.

FULL PAPERS

A hybrid supercapacitor is constructed with a high-rate Si-based anode and a porous carbon cathode. The hybrid supercapacitor exhibits a high energy density of 128 Wh/kg at 1229 W/kg. Even when power density increases to the level of a conventional supercapacitor (9704 W/kg), 89 Wh/kg can be obtained. Long cycling life and low self-discharge rate are also achieved.

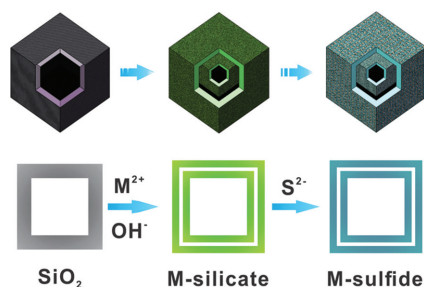


Energy Storage

R. Yi, S. Chen, J. Song, M. L. Gordin, A. Manivannan, D. Wang*7433–7439

High-Performance Hybrid Supercapacitor Enabled by a High-Rate Si-based Anode

Box in box: A template-engaged method is successfully developed to synthesize hierarchical metal sulfide (NiS, CuS, MnS) box-in-box hollow structures with double-shells. As an example, it is demonstrated that the NiS box-in-box hollow structure exhibits excellent pseudocapacitive performance with remarkable rate performance and cycling stability.

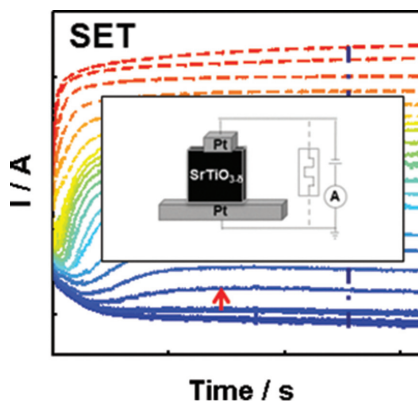


Supercapacitors

X.-Y. Yu, L. Yu, L. F. Shen, X. H. Song, H. Y. Chen, X. W. Lou*7440–7446

General Formation of MS (M = Ni, Cu, Mn) Box-in-Box Hollow Structures with Enhanced Pseudocapacitive Properties

The strategy for studying material-dependent diffusion characteristics for mixed conducting memristors is extended by applying chronoamperometry and bias-dependent resistive measurements. The memristor-based Cottrell analysis and equation is proposed to derive oxygen diffusion coefficients of $3 \times 10^{-15} \text{ m}^2 \text{ s}^{-1}$ for bias increase up to 3.8 V for $\text{SrTiO}_{3-\delta}$ memristors at room temperature.

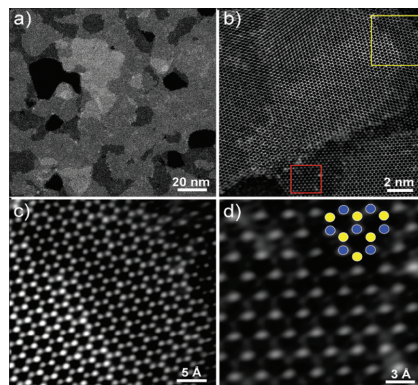


Memristors

F. Messerschmitt, M. Kubicek, S. Schweiger, J. L. M. Rupp* ..7448–7460

Memristor Kinetics and Diffusion Characteristics for Mixed Anionic-Electronic $\text{SrTiO}_{3-\delta}$ Bits: The Memristor-Based Cottrell Analysis Connecting Material to Device Performance

Wafer scale synthesis of atomically thin MoS_2 layers via thermolysis of spin coated films is presented. High resolution characterization of atomically thin layers is performed by HAADF-STEM image analysis. This approach could be applied to a variety of substrates and provides a promising route towards wafer scale production of other TMD and doped materials for applications in electronics and optoelectronics.



Thin Films

A. S. George, Z. Mutlu, R. Ionescu, R. J. Wu, J. S. Jeong, H. H. Bay, Y. Chai, K. A. Mkhoyan, M. Ozkan, C. S. Ozkan*7461–7466

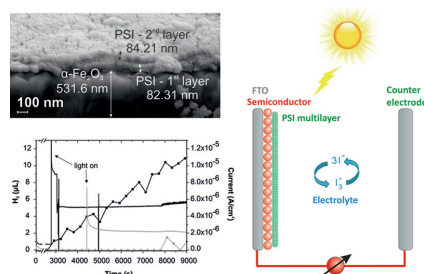
Wafer Scale Synthesis and High Resolution Structural Characterization of Atomically Thin MoS_2 Layers

FULL PAPERS

Biophotovoltaics

K. Ocakoglu,* T. Krupnik,
B. van den Bosch, E. Harputlu,
M. P. Gullo, J. D. J. Olmos,
S. Yildirimcan, R. K. Gupta,
F. Yakuphanoglu, A. Barbieri,
J. N. Reek, J. Kargul* 7467–7477

Photosystem I-based Biophotovoltaics on Nanostructured Hematite

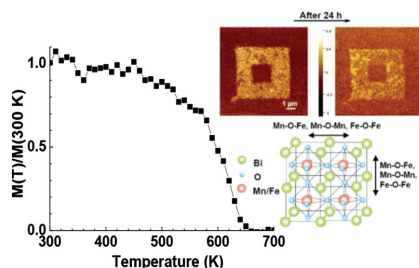


A fully integrated, stable, and functional photosystem I-based biohybrid dye-sensitized solar cell is constructed with an improved solar-to-electric quantum efficiency over previously reported biohybrid devices. A highly robust oriented *Cyanidioschyzon merolae* PSI-LHCI complex is used as a natural photosensitizer of the nanostructured hematite substrate for the sustained photodriven H_2 production.

Multiferroics

E.-M. Choi,* T. Fix, A. Kursumovic,
C. J. Kinane, D. Arena, S.-L. Sahonta,
Z. Bi, J. Xiong, L. Yan, J.-S. Lee, H. Wang,
S. Langridge, Y.-M. Kim, A. Y. Borisevich,
I. MacLaren, Q. M. Ramasse,
M. G. Blamire, Q. X. Jia,
J. L. MacManus-Driscoll 7478–7487

Room Temperature Ferrimagnetism and Ferroelectricity in Strained, Thin Films of $BiFe_{0.5}Mn_{0.5}O_3$

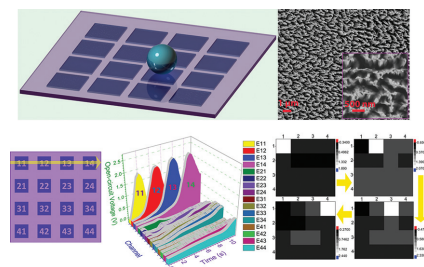


A new window for designing multiferroic materials through epitaxial strain control: For the first time, coexistent ferrimagnetism and ferroelectricity is demonstrated at RT in $BiFe_{0.5}Mn_{0.5}O_3$ (BFMO) by strain engineering. The most highly strained and crystalline films have a ferrimagnetic transition temperature of ≈ 600 K, which is 500 K higher than bulk BMO and a piezoresponse amplitude of 45 pm/V.

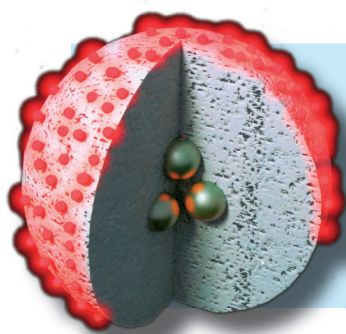
Motion Sensors

F. Yi, L. Lin, S. Niu, J. Yang, W. Wu,
S. Wang, Q. Liao, Y. Zhang,*
Z. L. Wang* 7488–7494

Self-Powered Trajectory, Velocity, and Acceleration Tracking of a Moving Object/Body using a Triboelectric Sensor



A self-powered, single-electrode-based triboelectric sensor is reported to accurately detect the movement of an object/body in two dimensions. Based on the coupling of triboelectric effect and electrostatic induction, the motion information about the object, such as trajectory, velocity, and acceleration, is derived in conformity with the preset values.



How to contact us:

Editorial Office:

Phone: (+49) 6201-606-286/531
Fax: (+49) 6201-606-500
Email: afm@wiley-vch.de

Reprints:

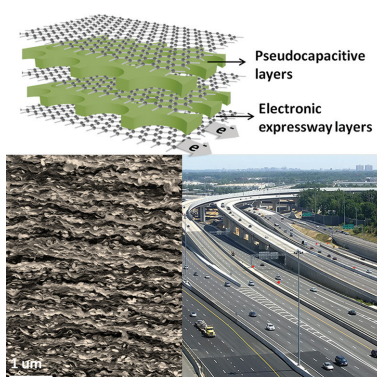
cherth@wiley-vch.de

Copyright Permission:

Fax: (+49) 6201-606-332
Email: rights@wiley-vch.de

FULL PAPERS

The fabrication of a flexible solid-state asymmetric supercapacitor, based on bendable film electrodes with 3D expressway-like architecture of graphenes and “hard nano-spacer” via an extended filtration assisted method, is reported. The 3D expressway-like electrode exhibits superior supercapacitive performance including high gravimetric capacitance ($\approx 573 \text{ F g}^{-1}$), high volumetric capacitance ($\approx 655 \text{ F cm}^{-3}$), excellent rate capability, and superior cycling stability.

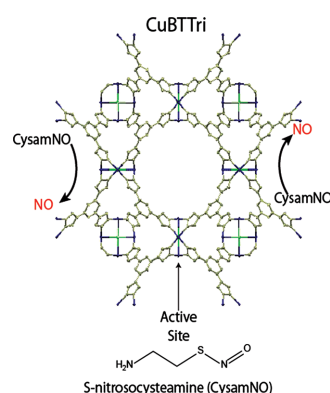


Flexible Electronics

M. Li, Z. Tang, M. Leng,
J. Xue* 7495–7502

Flexible Solid-State Supercapacitor Based on Graphene-based Hybrid Films

The use of a physiologically stable metal organic framework for the catalytic generation of nitric oxide represents a new frontier in materials designed as biotherapeutics. The incorporation into polymeric materials subsequently results in the development of biomaterials geared towards possessing anti-fouling properties by the surface elution of the bioactive agent nitric oxide.

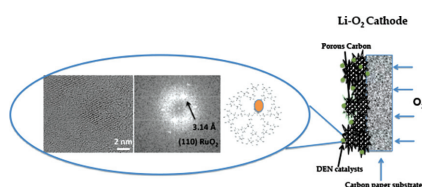


Biotherapeutics

J. L. Harding, J. M. Metz,
M. M. Reynolds* 7503–7509

A Tunable, Stable, and Bioactive MOF Catalyst for Generating a Localized Therapeutic from Endogenous Sources

Dendrimer-encapsulated ruthenium nanoparticles are readily oxidized to RuO_2 when exposed to ambient conditions. These nanoparticles are used as catalysts in Li-O_2 batteries, which exhibited improved cycling thus suggesting that porous dendrimer-encapsulated nanoparticles can be used to achieve superior performance in energy storage systems.

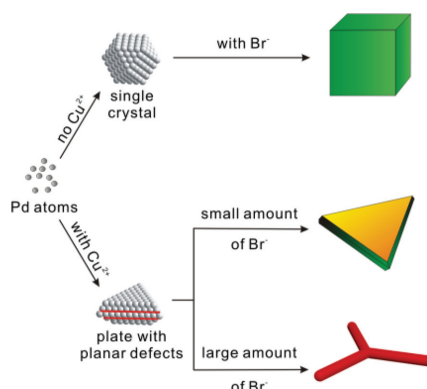


Dendrimers

P. Bhattacharya,* E. N. Nasybulin,
M. H. Engelhard, L. Kovarik,
M. E. Bowden, X. S. Li, D. J. Gaspar,
W. Xu, J.-G. Zhang* 7510–7519

Dendrimer-Encapsulated Ruthenium Oxide Nanoparticles as Catalysts in Lithium-Oxygen Batteries

Pd–Cu bimetallic tripods are prepared by adding CuCl_2 and KBr into an aqueous synthesis that involves the reduction of a salt precursor by ascorbic acid. When compared with commercial Pd black, the Pd–Cu tripods exhibit substantially enhanced (almost eightfold per unit mass of Pd) catalytic activity toward the electro-oxidation of formic acid.



Bimetallic Nanocrystals

L. Zhang, S.-I. Choi, J. Tao, H.-C. Peng,
S. Xie, Y. Zhu, Z. Xie,
Y. Xia* 7520–7529

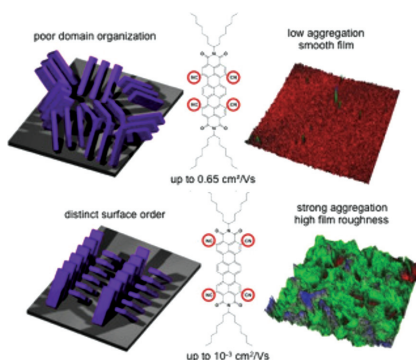
Pd–Cu Bimetallic Tripods: A Mechanistic Understanding of the Synthesis and Their Enhanced Electrocatalytic Activity for Formic Acid Oxidation

FULL PAPERS

Transistors

G. Battagliarin, S. R. Puniredd,
S. Stappert, W. Zajackowski,
S. Wang, C. Li, W. Pisula,*
K. Müllen* 7530–7537

Ortho- vs Bay-Functionalization: A Comparative Study on Tetracyano-Terrylenediimides



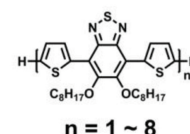
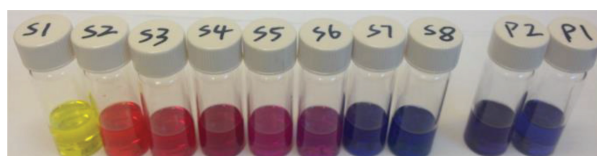
Ortho- or bay-tetracyanation? A comparative study on terrylenediimide reveals that the two functionalizations have similar impact on the optoelectronic properties, but remarkably different effects on self-assembling from solution, with striking consequences on the n-type behavior in field-effect transistors. The pronounced electron mobilities here reported for the bay-tetracyano derivative demonstrate the high potential of terrylenediimide as scaffold for n-type semiconductors.

Organic Photovoltaics

C. Zhou, Y. Liang, F. Liu, C. Sun,
X. Huang, Z. Xie, F. Huang,* J. Roncali,*
T. P. Russell,* Y. Cao 7538–7547

Chain Length Dependence of the Photo- voltaic Properties of Monodisperse Donor–Acceptor Oligomers as Model Compounds of Polydisperse Low Band Gap Polymers

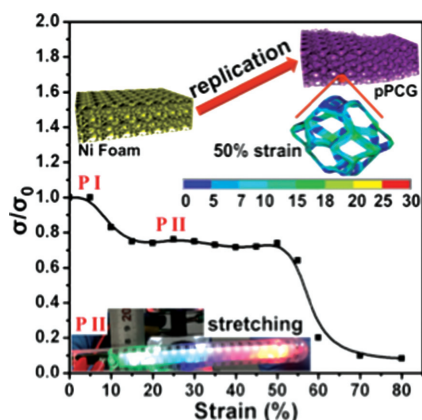
A series of donor–acceptor monodisperse oligomers (S1–S8) and two analogous polydisperse polymers (P1, P2) are synthesized successfully. These materials serve as a model system to understand the relationship between conjugation length and the photophysical, morphological, and photovoltaic properties in donor–acceptor polymer solar cell materials, and provide a bridge between small molecules and the polymers



Stretchable Materials

M. T. Chen, L. Zhang,* S. S. Duan,
S. L. Jing, H. Jiang,
C. Z. Li* 7548–7556

Highly Stretchable Conductors Integrated with a Conductive Carbon Nanotube/Graphene Network and 3D Porous Poly(dimethylsiloxane)



A highly stretchable conductor is manufactured by integrating porous poly(dimethylsiloxane) (p-PDMS) with a CNT/graphene network (pPCG). Mechanical simulation of p-PDMS demonstrates that large strains are accommodated through strut rotations and bending. After a slight decrease, the high conductivity (27 S m^{-1} with 2 wt% CNTs/graphene) remained constant, even as the strain was increased to 50%.