

# ADVANCED FUNCTIONAL MATERIALS

[www.afm-journal.de](http://www.afm-journal.de)

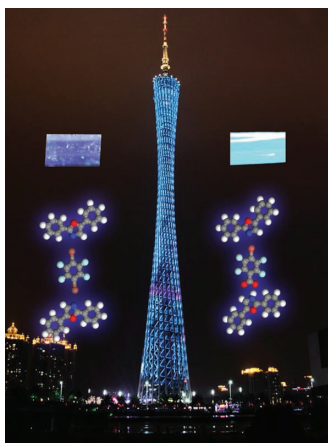
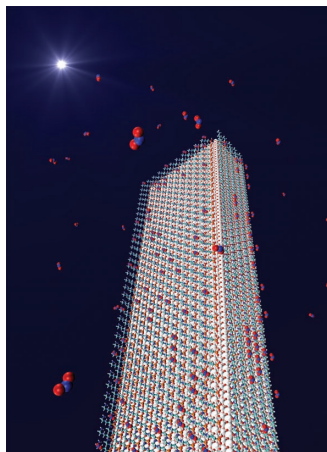


## Nanowire Arrays

Well-aligned hierarchical nanoarrays containing a ZnO core and layered double hydroxide (LDH) nanoplatelet shell are synthesized by M. Wei and co-workers via a facile electrosynthesis method. The resulting ZnO@CoNi-LDH core-shell nanoarray material exhibits promising behavior in photoelectrochemical (PEC) water splitting, giving rise to a largely enhanced photocurrent density as well as stability. On page 580, a facile and cost-effective strategy is provided for the fabrication of hierarchical nanoarrays which can be potentially used in energy storage and conversion.

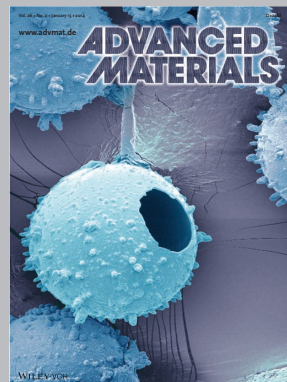
## Sensors

An ultra-selective NO<sub>2</sub> sensor is designed and realized by J. D. Prades, H. Shen, and co-workers based on self-assembled monolayer (SAM)-modified semiconductor nanowires (NWs). On page 595, consistent experimental sensing evaluations on different gases and density functional theory (DFT) simulations on the sensing mechanism of the complex NW-SAM-gas systems are presented. The resulting insight into the charge transfer mechanism depicts a theoretical route to develop highly selective hybrid gas sensors.



## Supramolecular Materials

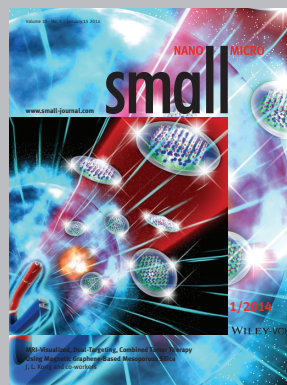
Based on a supramolecular assembly strategy, Yan and co-workers obtain two-component molecular solid-state materials of diphenyloxazole (DPO) through a solution-growth process. On page 587, the DPO-based high-quality single crystals display tunable luminescence properties (such as emissive wavelength, color, and fluorescence lifetime) as well as multicolor polarized emission in the UV/blue/green region. This is similar to, in a macroscopic scenario, the variable light emitted from Canton tower (the highest tower in China, shown here) at the side of the Zhujiang river.



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

With its increased ISI Impact Factor of 14.829, *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](http://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 7.823 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.

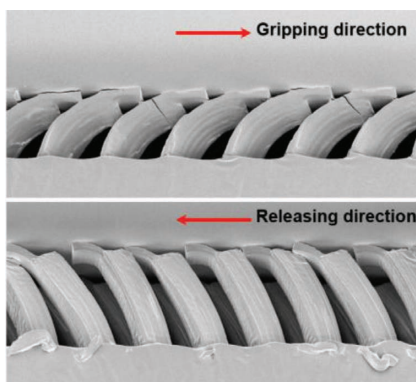
[www.small-journal.com](http://www.small-journal.com)

## FULL PAPERS

## Adhesives

K. Jin, J. C. Cremaldi, J. S. Erickson,  
Y. Tian, J. N. Israelachvili,  
N. S. Pesika\* ..... 574–579

### Biomimetic Bidirectional Switchable Adhesive Inspired by the Gecko

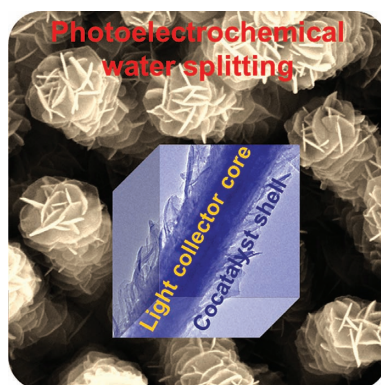


A switchable gecko-inspired adhesive that shows anisotropic adhesion and friction properties is presented. With proper actuation, the polymer-based dry adhesive provides strong adhesion and friction forces for attachment (or gripping), or weak forces for detachment (or releasing). The reusability of the dry adhesive is also demonstrated over multiple attachment/detachment cycles.

## Nanowire Arrays

M. F. Shao, F. Y. Ning, M. Wei,\*  
D. G. Evans, X. Duan ..... 580–586

### Hierarchical Nanowire Arrays Based on ZnO Core–Layered Double Hydroxide Shell for Largely Enhanced Photoelectrochemical Water Splitting

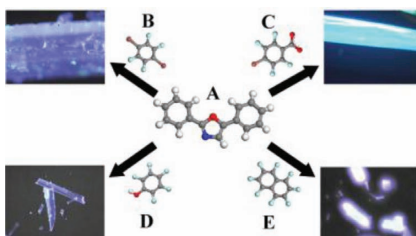


Hierarchical nanowire arrays based on a semiconductor core–layered double hydroxide shell are synthesized via a facile and cost-effective electrosynthesis method. The resulting core–shell ZnO@LDH NW array exhibits largely enhanced efficiency in photoelectrochemical water-splitting, including a large photocurrent and high stability, as a result of the significantly improved photogenerated carrier transfer and increased reaction kinetics of water splitting.

## Supramolecular Materials

D. Yan,\* H. Yang, Q. Meng, H. Lin,  
M. Wei ..... 587–594

### Two-Component Molecular Materials of 2,5-Diphenyloxazole Exhibiting Tunable Ultraviolet/Blue Polarized Emission, Pump-enhanced Luminescence, and Mechanochromic Response

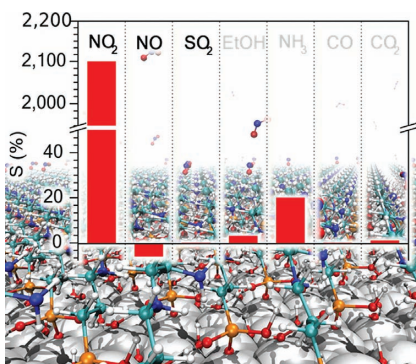


By the formation of two-component molecular solids, 2,5-diphenyloxazole (DPO)-based crystalline materials exhibit tunable polarized emission, pump-enhanced luminescence, and mechanochromic response in the UV/blue region, which is absent for the pristine DPO sample.

## Sensors

M. W. G. Hoffmann, J. D. Prades,\*  
L. Mayrhofer, F. Hernandez-Ramirez,  
T. T. Järvi, M. Moseler, A. Waag,  
H. Shen\* ..... 595–602

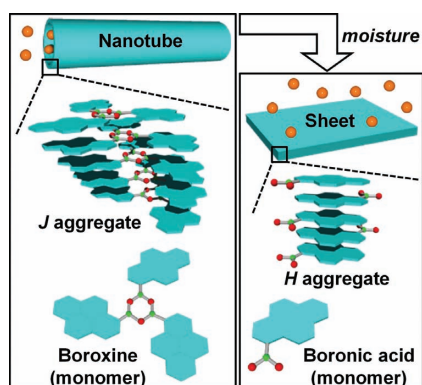
### Highly Selective SAM–Nanowire Hybrid NO<sub>2</sub> Sensor: Insight into Charge Transfer Dynamics and Alignment of Frontier Molecular Orbitals



The tailored design of highly selective and sensitive gas sensors is the central issue in gas sensor technology. Density functional theory identifies the requirements for an efficient interaction between gas species and modified nanowires, enabling ultraselective detection. A prototype system with NO<sub>2</sub> as the target gas shows extraordinary selectivity and sensitivity experimentally.

## FULL PAPERS

**Self-assembly of boroxines in toluene** produce various nanostructures, including nanotubes, depending on the boroxines' aromatic substituents. Humidification-induced morphological transformations from nanotubes to sheets or helical coils are observed, accompanied by the hydrolysis of the boroxine components and a molecular-packing rearrangement from *J*- to *H*-aggregates. These morphological changes enable the precisely controlled release of guest molecules encapsulated in the nanotubes' hollow cylinders.

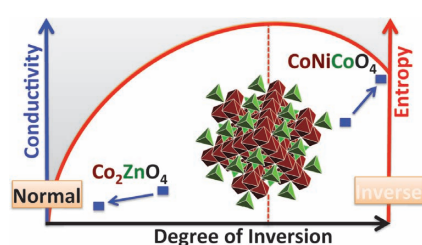


## Controlled Release

K. Ishikawa, N. Kameta,\* M. Masuda, M. Asakawa, T. Shimizu .....603–609

### Boroxine Nanotubes: Moisture-Sensitive Morphological Transformation and Guest Release

**A combination of experiment and theory quantifies the dependence of the conductivity in  $\text{Co}_2\text{ZnO}_4$  and  $\text{Co}_2\text{NiO}_4$  on the cation disorder.** A self-doping mechanism is identified as the origin of conductivity and a thermodynamic model is used to describe the non-equilibrium cation disorder in terms of an effective temperature. The conductivity in spinels can be controlled by manipulating the cation disorder.

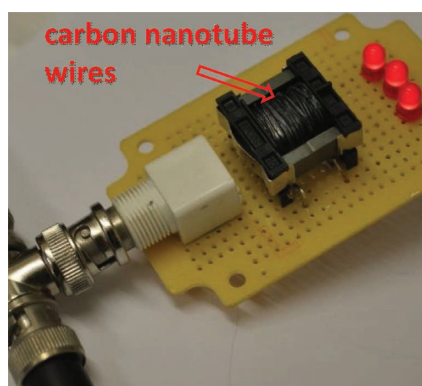


## Spinels

P. F. Ndione,\* Y. Shi, V. Stevanovic, S. Lany, A. Zakutayev, P. A. Parilla, J. D. Perkins, J. J. Berry, D. S. Ginley, M. F. Toney\* .....610–618

### Control of the Electrical Properties in Spinel Oxides by Manipulating the Cation Disorder

**It is demonstrated for the first time that macroscopic electrical wires made purely of carbon nanotubes (CNT)** may successfully replace conventional copper wires in one of the most widely applied electrical machines, that is, an electrical transformer. It is shown that the transformer with CNT winding allows the conversion of electrical signals in wide range of frequencies.

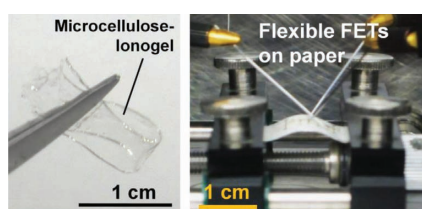


## Carbon Nanotubes

L. Kurzepa, A. Lekawa-Raus, J. Patmore, K. Koziol\* .....619–624

### Replacing Copper Wires with Carbon Nanotube Wires in Electrical Transformers

**Highly flexible and biofriendly ionogels are produced by gelation of microcellulose thin films** with 1-ethyl-3-methylimidazolium methylphosphonate ionic liquids. The obtained ionogels can be laminated onto any substrate such as paper and act as high capacitance dielectrics for electrolyte-gated inorganic (ZnO) and organic (P3HT) field-effect transistors. They operate at very low voltages (<2 V) and enable the fabrication of flexible circuits on multilayer-coated paper.



## Flexible Electronics

S. Thiemann, S. J. Sachnov, F. Pettersson, R. Bollström, R. Österbacka, P. Wasserscheid, J. Zaumseil\* .....625–634

### Cellulose-Based Ionogels for Paper Electronics

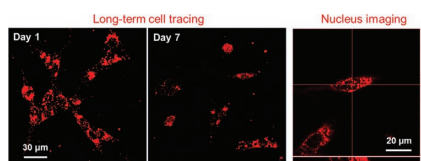


## FULL PAPERS

## Fluorescence Imaging

W. Qin, K. Li, G. Feng, M. Li, Z. Yang,  
B. Liu,\* B. Z. Tang\* .....635–643

**Bright and Photostable Organic  
Fluorescent Dots with Aggregation-  
Induced Emission Characteristics for  
Noninvasive Long-Term Cell Imaging**

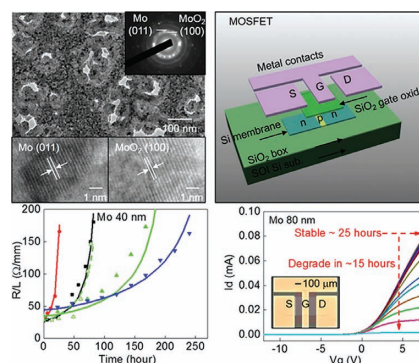


**Encapsulation of orange-red fluorescent luminogens with aggregation-induced emission (AIE) characteristics in biocompatible matrix yields AIE dots with strong emission, large Stokes shift, good biocompatibility, and high photostability. Application of the AIE dots for in vitro cell tracing and nucleus imaging has been demonstrated using MCF-7 breast cancer cells as an example.**

## Transient Electronics

L. Yin, H. Cheng, S. Mao, R. Haasch,  
Y. Liu, X. Xie, S.-W. Hwang, H. Jain,  
S.-K. Kang, Y. Su, R. Li, Y. Huang,  
J. A. Rogers\* .....645–658

**Dissolvable Metals for Transient  
Electronics**

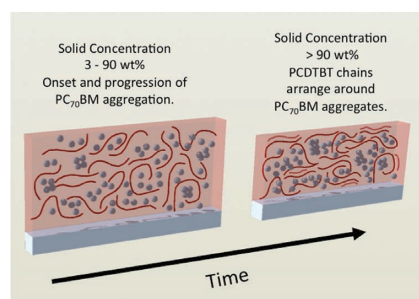


**Effects of reactive dissolution on electrical conduction, morphological change, and chemical transformation of biodegradable metal thin films (Mg, Zn, W, Mo, and Fe) are studied for application of these metals in water-soluble transient electronic devices. Feasibility of using these dissolvable metals as contacts for n-channel silicon metal oxide field effect transistors (MOSFETs) is also demonstrated.**

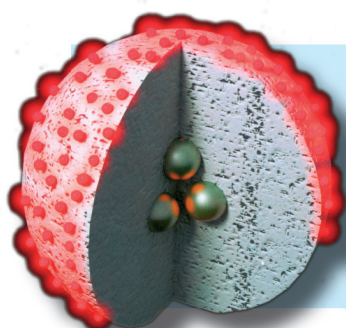
## Polymers

A. J. Pearson,\* T. Wang, A. D. F. Dunbar,  
H. Yi, D. C. Watters, D. M. Coles,  
P. A. Staniec, A. Iraqi, R. A. L. Jones,  
D. G. Lidzey\* .....659–667

**Morphology Development in  
Amorphous Polymer:Fullerene  
Photovoltaic Blend Films During  
Solution Casting**



**Thin-film formation in solution-cast PCDTBT:PC<sub>70</sub>BM 1:4 wt% blend films is characterised using a combination of spectroscopic ellipsometry and grazing-incidence wide angle X-ray scattering. A multi-step process of structure evolution is observed which includes the coalescence of PC<sub>70</sub>BM molecules and an apparent delay in weak ordering within the PCDTBT-rich phases of the film.**



## How to contact us:

## Editorial Office:

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

## Reprints:

[cherth@wiley-vch.de](mailto:cherth@wiley-vch.de)

## Copyright Permission:

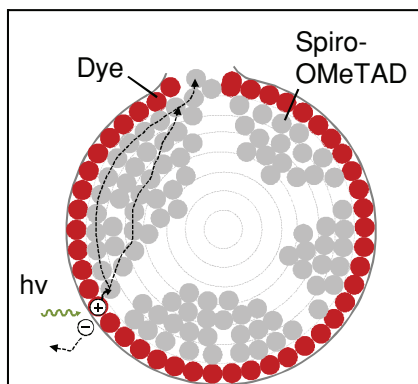
Fax: (+49) 6201-606-332  
Email: [rights@wiley-vch.de](mailto:rights@wiley-vch.de)

## FULL PAPERS

### Solar Cells

C. T. Weisspfennig, D. J. Hollman, C. Menelaou, S. D. Stranks, H. J. Joyce, M. B. Johnston, H. J. Snaith, L. M. Herz\* .....668–677

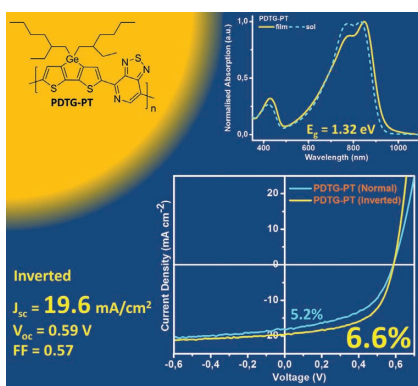
**Dependence of Dye Regeneration and Charge Collection on the Pore-Filling Fraction in Solid-State Dye-Sensitized Solar Cells**



### Solar Cells

C. P. Yau, Z. Fei,\* R. S. Ashraf, M. Shahid, S. E. W. P. Pattanasattayavong, T. D. Anthopoulos, V. G. Gregoriou, C. L. Chochos,\* M. Heeney\* .....678–687

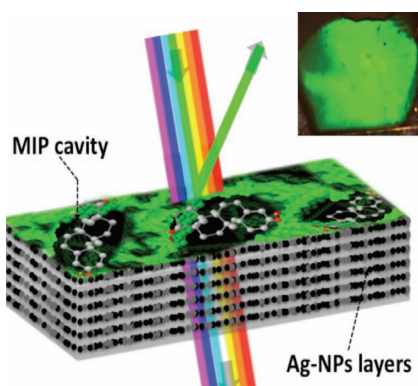
**Influence of the Electron Deficient Co-Monomer on the Optoelectronic Properties and Photovoltaic Performance of Dithienogermole-based Co-Polymers**



### Holograms

Y. Fuchs, S. Kunath, O. Soppera, K. Haupt,\* A. G. Mayes\* .....688–694

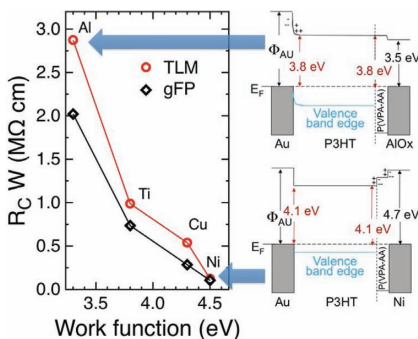
**Molecularly Imprinted Silver-Halide Reflection Holograms for Label-Free Opto-Chemical Sensing**



### Organic Transistors

S. Fabiano,\* S. Braun, M. Fahlman, X. Crispin, M. Berggren .....695–700

**Effect of Gate Electrode Work-Function on Source Charge Injection in Electrolyte-Gated Organic Field-Effect Transistors**



**Solid-state dye-sensitized solar cells capable of complete hole transfer** with pore-filling fractions as low as  $\approx 30\%$  are demonstrated. Improvements of device efficiencies beyond  $\approx 30\%$  are explained by a stepwise increase in charge-collection efficiency in agreement with percolation theory. Furthermore, it is predicted that, for a 20 nm pore size, the photocurrent reaches a maximum at  $\approx 83\%$  pore-filling fraction.

The **optoelectronic properties and photovoltaic device performance** for a series of low band gap donor–acceptor polymers based upon dithienogermole are reported. One very low band gap polymer, PDTG-PT, ( $E_g^{\text{opt}} = 1.32$  eV) is shown to exhibit a promising device efficiency of 6.6% when utilized in inverted photovoltaic devices, making it a promising candidate for incorporation in tandem solar cell devices.

**Reflection holograms are fabricated in a molecularly imprinted polymer (MIP) film** by periodic photoreduction of silver-halides using a standing wave originating from two interfering laser beams. The MIP-based holographic film is used as a label-free opto-chemical sensor for the specific detection of testosterone.

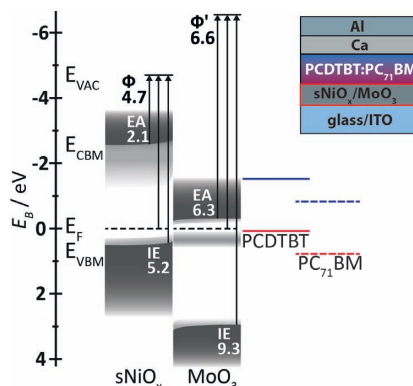
A **dependence of charge injection on the gate electrode work function is demonstrated** by systematically investigating the contact resistance in electrolyte-gated OFETs. This analysis reveals contact-limitations at the metal-semiconductor interface and shows that contact resistance increases as low work function metals are used as gate electrodes.

# FULL PAPERS

## Photovoltaic Devices

P. Schulz,\* S. R. Cowan, Z.-L. Guan,  
A. Garcia, D. C. Olson,  
A. Kahn .....701–706

### NiO<sub>x</sub>/MoO<sub>3</sub> Bi-Layers as Efficient Hole Extraction Contacts in Organic Solar Cells



**Nickel oxide/molybdenum oxide bi-layers enhance hole collection in organic photovoltaic devices.** Device improvement in PCDTBT:PC71BM based solar cells is attributed to the electronic structure of the oxide interlayer. The electron blocking capability of NiO<sub>x</sub> is combined with the high work function of MoO<sub>3</sub>, which enables efficient coupling of the electrode to the hole transport level in the polymer.

## Inverse Opals

T. Ling, S. A. Kulinich, Z.-L. Zhu,  
S.-Z. Qiao, X.-W. Du\* .....707–715

### Highly Conductive CdS Inverse Opals for Photochemical Solar Cells

**Highly conductive CdS inverse opal structures** are prepared using ultrafine CdS nanocrystals as building blocks to construct an inverse-opal skeleton, and filling gaps between the nanocrystals by electrodepositing additional CdS. Subsequent annealing treatments transform the fine constituent nanocrystals into larger ones, thus considerably enhancing the electrical conductivity of CdS inverse opal structures.

