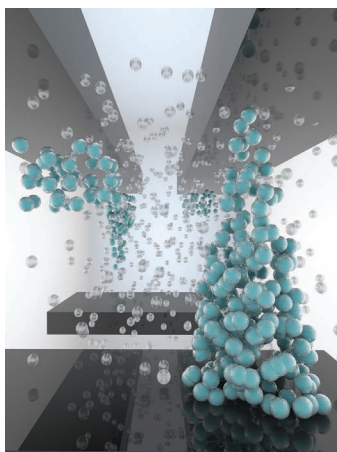


# ADVANCED FUNCTIONAL MATERIALS

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

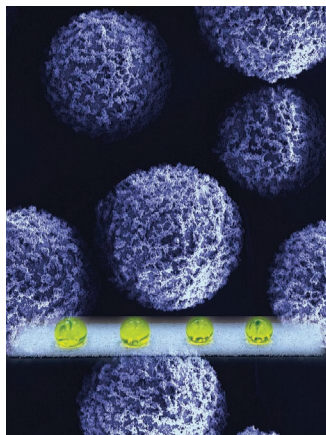
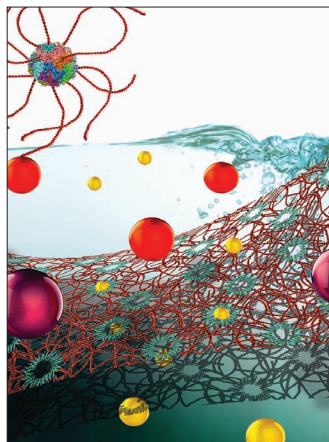


## Memristors

Controlled oxygen deficiencies are realized in amorphous  $\text{SrTiO}_3$  thin films. On page 6741 H. Nili, S. Sriram, and colleagues utilize these deficiencies to achieve CMOS-compatible, high performance resistive switching in the room temperature processed thin films. The cover image depicts a cross-bar arrangement with elements at different switching states. Image courtesy of Ella Marushchenko (Scientific Illustrations).

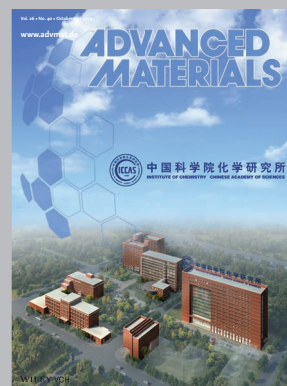
## Biomimetics

Multifunctional superhydrophobic polymeric microcapsules with lotus-leaf-like hierarchical surface structure and moisture-sensitive core are prepared by J. Yang and team on page 6751 by a facile and versatile strategy. The microcapsules exhibit superior shell tightness against solvents and heat, and possess widely tunable, repetitiously self-restorable, and solvent-proof superhydrophobicity. By incorporating these microcapsules in coating matrix, a biomimetic smart coating is developed, seamlessly combining self-healing and self-cleaning functionalities for anticorrosion and antifouling applications.



## Self-Assembled Membranes

A new design concept is developed on page 6762 by A. Böker and co-workers for preparing ultra-thin membranes based on the self-assembly of polymer-decorated protein nanoparticles which is highly flexible and robust for testing in a macroscopic membrane setup. This approach opens the gate for the development of sophisticated membranes in which protein are used as selective and “smart” pores.



*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](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 7.514 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.

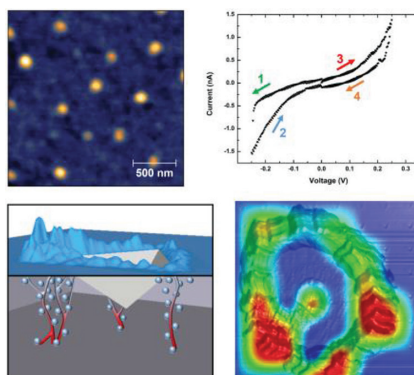
[www.small-journal.com](http://www.small-journal.com)

# FULL PAPERS

## Memristors

H. Nili,\* S. Walia, S. Balendhran,  
D. B. Strukov, M. Bhaskaran,  
S. Sriram\* ..... 6741–6750

### Nanoscale Resistive Switching in Amorphous Perovskite Oxide ( $a$ -SrTiO<sub>3</sub>) Memristors



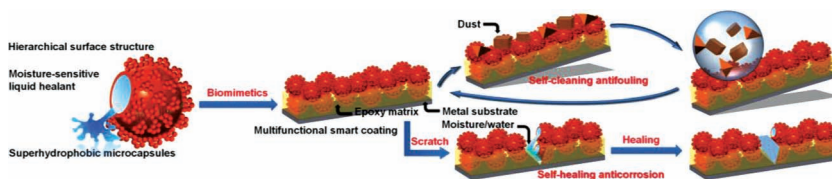
**High performance CMOS/CMOL compatible memristive arrays** based on amorphous SrTiO<sub>3</sub> thin films with engineered oxygen deficiencies are presented. Isolated nano-switches are found to be responsible for the excellent switching performance of  $a$ -STO memory cells. Nanoscale electromechanical investigations highlight the assistive role of mechanical stress in nanoionics based conduction and resistive switching in  $a$ -STO devices and confirm their ultimate scalability.

## Biomimetics

G. Wu, J. An, X.-Z. Tang, Y. Xiang,  
J. Yang\* ..... 6751–6761

### A Versatile Approach towards Multifunctional Robust Microcapsules with Tunable, Restorable, and Solvent-Proof Superhydrophobicity for Self-Healing and Self-Cleaning Coatings

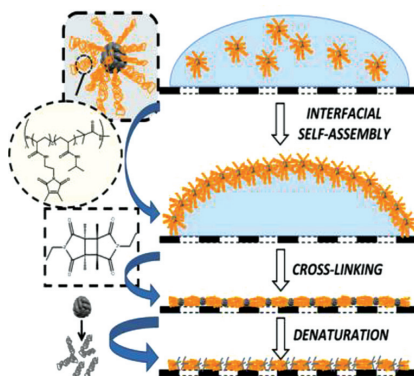
**A variety of chemical-filled multifunctional robust microcapsules** exhibiting superior shell tightness against solvents and heat, and possessing widely tunable, multiple self-restorable, and solvent-proof superhydrophobicity are prepared by an easily modifiable and highly versatile method. The biomimetic multifunctional smart coatings for self-healing anticorrosion and self-cleaning antifouling applications are easily fabricated by directly dispersing the microcapsules into and onto a polymer resin.



## Self-Assembled Membranes

P. van Rijn, M. Tutus, C. Kathrein,  
N. C. Mougín, H. Park, C. Hein,  
M. P. Schürings, A. Böker\* ... 6762–6770

### Ultra-Thin Self-Assembled Protein-Polymer Membranes: A New Pore Forming Strategy

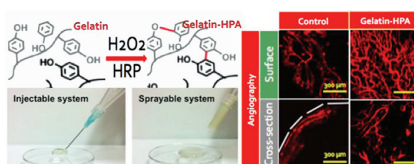


**Self-assembled membranes** offer a promising alternative for conventional membrane fabrication, especially in the field of ultrafiltration. Here a new pore-making strategy is introduced involving stimuli responsive protein-polymer conjugates self-assembled across a large surface area using drying-mediated interfacial self-assembly. The membrane is flexible and assembled on porous supports. This approach diversifies membrane technology generating a platform for “smart” self-assembled membranes.

## Injectable Biomaterials

S. H. Lee, Y. Lee, Y. W. Chun,  
S. W. Crowder, P. P. Young, K. D. Park,  
H.-J. Sung\* ..... 6771–6781

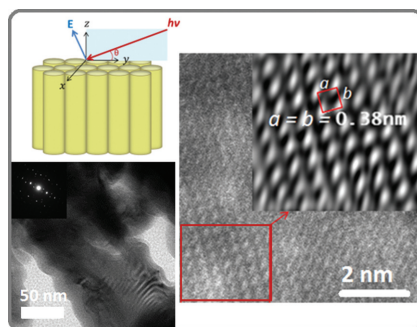
### In Situ Crosslinkable Gelatin Hydrogels for Vascuogenic Induction and Delivery of Mesenchymal Stem Cells



**Injectable and in situ crosslinkable gelatin hydrogel** is developed by conjugating hydroxyphenyl propionic acid to gelatin and used as a delivery platform for mesenchymal stem cells to reveal superior vasculo/angiogenic effects both in vitro and in vivo in a soluble factor-free manner. Its superior bioactivity and ease of production, handling, and application makes it a promising biomaterial for treating vascular diseases.

# FULL PAPERS

**Doping mechanism and the induced structural changes/defects** in the bulk and surface of in situ synthesized strontium-doped titania (Sr-doped  $\text{TiO}_2$ ) nanotube arrays are systematically studied. Here, surface and bulk characterization of the doped nanotubes, which enables reliable identification of success or failure, uniformity, and the mechanism of divalent doping along the nanotube axis and in the radial direction, is reported.

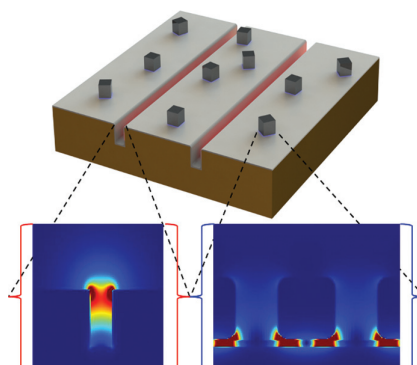


## Nanotubes

H. A. Hamedani,\* N. K. Allam,  
M. A. El-Sayed, M. A. Khaleel,  
H. Garmestani,  
F. M. Alamgir .....6783–6796

**An Experimental Insight into the Structural and Electronic Characteristics of Strontium-Doped Titanium Dioxide Nanotube Arrays**

**An efficient broadband absorber in the visible wavelength range** is constructed from the individual plasmonic resonances of gold nanogratings and silver nanocubes separated from one another by a dielectric spacer. An average 84% absorption in the 450–850 nm wavelength range is ultimately achieved for this unique design.

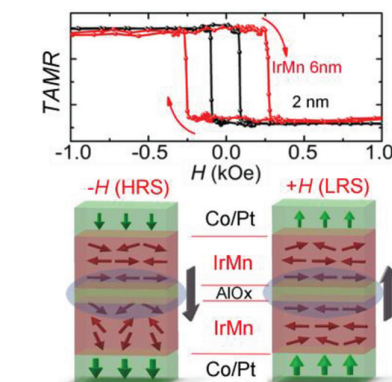


## Nanostructures

J. Geldmeier, T. König, M. A. Mahmoud,  
M. A. El-Sayed, V. V. Tsukruk\* ... 6797–6805

**Tailoring the Plasmonic Modes of a Grating-Nanocube Assembly to Achieve Broadband Absorption in the Visible Spectrum**

**Anti-ferromagnet controlled tunneling magnetoresistance** is obtained at room-temperature in a novel perpendicular IrMn/AlOx/IrMn junction, where the magnetoresistance is governed by the relative arrangement of the IrMn moments. In addition to the fundamental significance of the interactions between two anti-ferromagnetic layers, it is promising to achieve high-density anti-ferromagnet spintronics that are far from ferromagnetic stray fields and magnetic field perturbations.

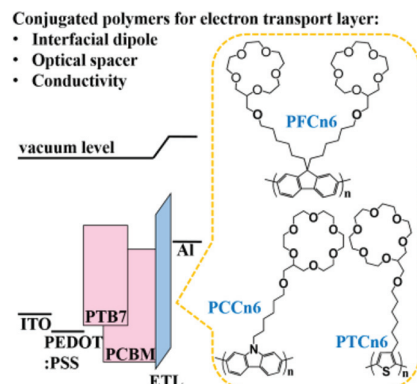


## Spintronics

Y. Y. Wang, C. Song,\* G. Y. Wang,  
J. H. Miao, F. Zeng, F. Pan\*...6806–6810

**Anti-Ferromagnet Controlled Tunneling Magnetoresistance**

**Alcohol-soluble conjugated polymers** are designed for use as the electron transport layer in polymer solar cells to improve the power conversion efficiency. The use of a suitable conjugated main chain increases the open-circuit voltage via the interfacial dipole and enhances the short-circuit current density of active the layer by rearranging the optical electric field within the device. Additionally, a deeper highest occupied molecular orbital level, compared to the light-absorbing active polymer, serves to block holes and suppress leakage current.



## Solar Cells

Y.-L. Li, Y.-S. Cheng, P.-N. Yeh,  
S.-H. Liao, S.-A. Chen\* .....6811–6817

**Structure Tuning of Crown Ether Grafted Conjugated Polymers as the Electron Transport Layer in Bulk-Heterojunction Polymer Solar Cells for High Performance**

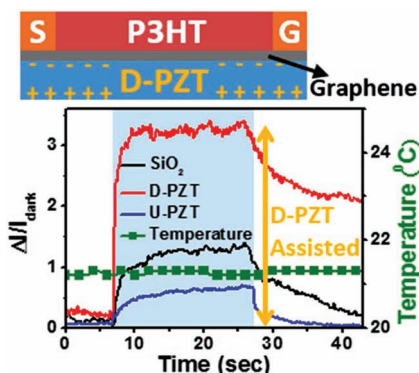


## FULL PAPERS

## Sensors

W.-C. Tan, W.-H. Shih,\*  
Y. F. Chen\* ..... 6818–6825

### A Highly Sensitive Graphene–Organic Hybrid Photodetector with a Piezoelectric Substrate

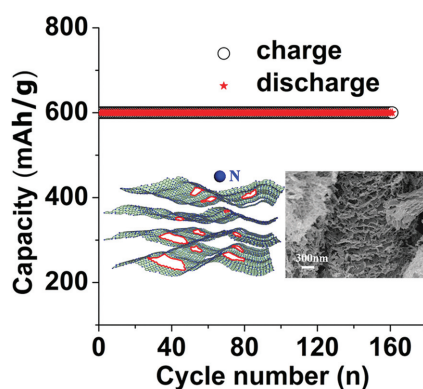


The application of a piezoelectric substrate (PZT) to enhance (down polarized, D-PZT) or decrease (up polarized, U-PZT) the graphene-organic semiconductor (P3HT) hybrid photodetector compared to that of a silica substrate is reported. The permanent polarization in PZT generates an electric field promoting or decreasing charge transfer behavior of the device.

## Energy Storage

Z. Zhang, J. Bao, C. He, Y. Chen,  
J. Wei, Z. Zhou\* ..... 6826–6833

### Hierarchical Carbon–Nitrogen Architectures with Both Mesopores and Macrochannels as Excellent Cathodes for Rechargeable Li–O<sub>2</sub> Batteries

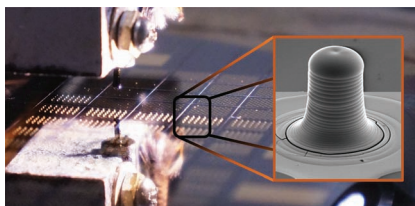


Hierarchical carbon–nitrogen architectures are prepared for Li–O<sub>2</sub> battery cathodes. The predominant cyclability originates from the coexistence of mesopores and macrochannels, which facilitates both diffusion of Li<sup>+</sup> and O<sub>2</sub> and accumulation of discharge products. Pyridinic N, which is dominant in this material, warrants the adsorption of O<sub>2</sub> and activates it, thus catalyzing the electrochemical process according to first-principles computations.

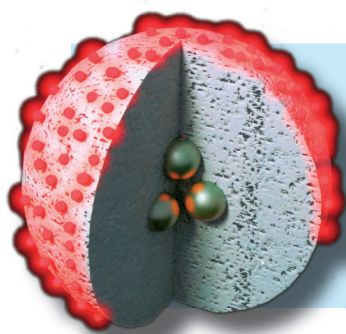
## Electronic Inks

J. A. Sadie, V. Subramanian\* ... 6834–6842

### Three-Dimensional Inkjet-Printed Interconnects using Functional Metallic Nanoparticle Inks



Inkjet-printed 3D nanoparticle pillars are investigated as a novel alternative to semiconductor packaging interconnects. The first detailed study of sintering in such large nanoparticle-based structures reveals electrical, elastic, and shear properties that outperform conventional materials undergoing similar heat treatments. The results indicate much promise for nanoparticle-based materials in advanced electronic packages and provide critical insights for further materials optimization.



## 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:

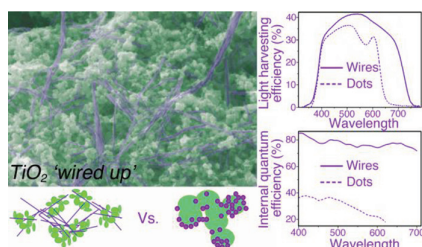
[cherth@wiley-vch.de](mailto:cherth@wiley-vch.de)

## Copyright Permission:

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

## FULL PAPERS

**A new strategy for nanocrystal-sensitized solar cell fabrication** that is independent of the sensitizer geometry is demonstrated. Solar cells are fabricated from CdSe quantum dots or nanowires and show that nanowires afford consistently higher power-conversion efficiencies for equivalent nanocrystal masses and otherwise identical devices. It is revealed that nanowires are characterized by both enhanced light harvesting and internal quantum efficiencies more than double their quantum dot counterparts.

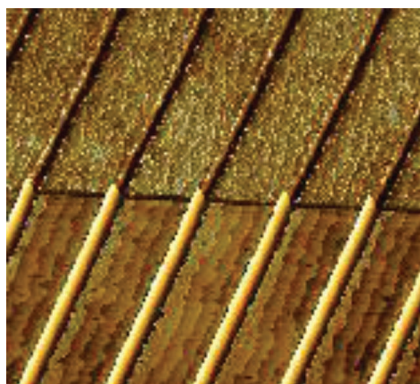


## Solar Cells

K. P. Acharya, Z. Ji, T. G. Holesinger, J. A. Crisp, S. A. Ivanov, D. J. Williams, J. L. Casson, M. Sykora,\* J. A. Hollingsworth\* .....6843–6852

### Layer-by-Layer Fabrication of Nanowire Sensitized Solar Cells: Geometry-Independent Integration

**Nano transfer molding and micro molding in capillaries** are used to make stencil masks of ZnO on single crystalline SrTiO<sub>3</sub> substrates. Isolated epitaxial structures of two functional perovskite oxides are formed after pulsed laser deposition and dissolution of ZnO. Bottom-up fabricated patterns similar to those presented here were not shown before, illustrating the versatility of the soft lithographic approaches.

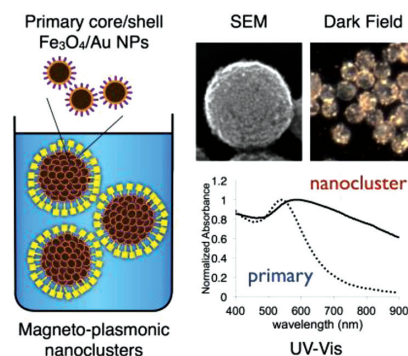


## Epitaxial Patterning

M. Nijland, A. George, S. Thomas, E. P. Houwman, J. Xia, D. H. A. Blank, G. Rijnders, G. Koster, J. E. ten Elshof\* .....6853–6861

### Patterning of Epitaxial Perovskites from Micro and Nano Molded Stencil Masks

**A new generation of hybrid magneto-plasmonic nanoparticles** is developed by utilizing an oil-in-water microemulsion method. The nanoparticles combine a high density of magnetic and plasmonic functionalities together with biocompatibility and molecular targeting capability that provide a promising tool for sensitive and selective cancer detection and other biomedical applications.

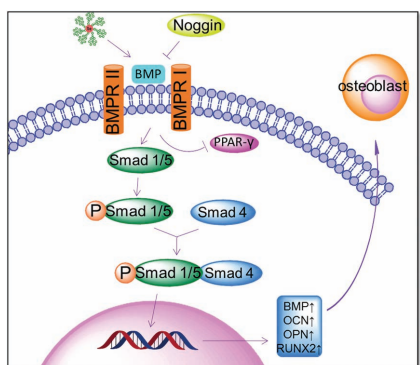


## Hybrid Nanomaterials

C.-H. Wu, J. Cook, S. Emelianov, K. Sokolov\* .....6862–6871

### Multimodal Magneto-Plasmonic Nanoclusters for Biomedical Applications

**Ru@Se, a good biocompatible nanoparticle**, can be uptaken by human umbilical cord mesenchymal stem cells and can enhance the osteogenic differentiation of HUMSCs through the Smad-dependent BMP signaling pathway. The activation of BMP pathway induces the Smad1/5 protein phosphorylation. p-Smad1/5 combines with Smad 4 and translocates into the nucleus to promote the expression of the osteogenesis specific genes, such as BMP, OCN, OPN, thus driving HUCMSCs to differentiate into osteoblasts.



## Stem Cells

C. Zheng, J. Wang, Y. Liu, Q. Yu, Y. Liu, N. Deng,\* J. Liu\* .....6872–6883

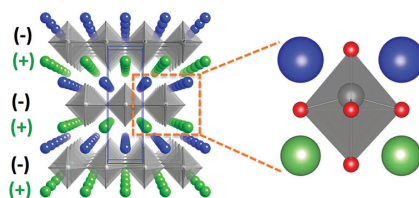
### Functional Selenium Nanoparticles Enhanced Stem Cell Osteoblastic Differentiation through BMP Signaling Pathways

## FULL PAPER

## Metal Oxides

B. B. Nelson-Cheeseman, H. Zhou,  
P. V. Balachandran, G. Fabbri,  
J. Hoffman, D. Haskel, J. M. Rondinelli,  
A. Bhattacharya\* ..... 6884–6891

**Polar Cation Ordering: A Route to  
Introducing >10% Bond Strain Into  
Layered Oxide Films**



The cations of a well-known layered oxide,  $\text{LaSrNiO}_4$ , are re-arranged in a “polar” structure using molecular beam epitaxy. X-ray probes reveal that the resulting electrostatic dipoles act on the Ni–O bonds, creating large distortions and changes to hybridization. This “electrostatic bond strain” approach has potential to tailor electronic properties in layered oxides by altering the local bonding without epitaxy or doping.