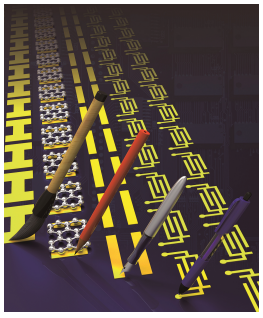
ADVANCED FUNCTIONAL MATERIALS

www.afm-journal.de

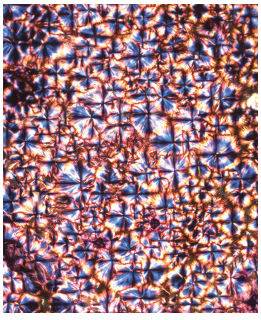


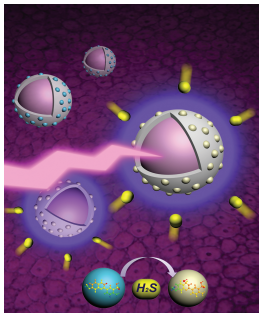
Pen-Based Writing

Due to the emerging demand for methods of fabricating electronics in a cost-effective, easily accessible way that allows for rapid prototyping way, novel techniques to design and manufacture electronics are required. On page 165, F. Li, F. Xu, and co-workers review the recent innovations allowing ubiquitously available pens to be employed to directly write electronics, as inspired by the daily act of hand writing.

Disease Diagnostics

With worldwide epidemic outbreaks occurring on a regular basis, there is urgent need to improve and establish new strategies toward rapid, simple, and affordable detection of target analytes. Birefringence generated from versatile lipid based liquid crystal cubic phase leads to a unique optical signal that can be used to detect analytes of medical interest, including bacteria, viruses, and parasites, as shown by R. Mezzenga and co-workers on page 181.



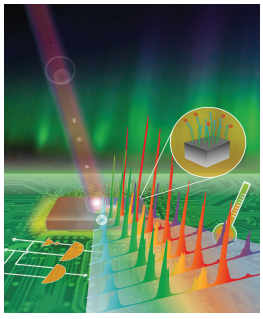


Sensors

Hydrogen sulfide is regarded as one of the most significant gas signaling molecules for a variety of physiological and pathological processes. On page 191, L. Yuan, Y.-T. Chang, and co-workers design a H_2S sensing nanoplatform based on dye assembled upconversion nanoparticles. These powerful sensors demonstrate highly selective and rapid responses to H_2S in vitro and in cells, for a variety of applications in environmental and bioimaging fields

Luminescent Thermometers

The thermal gradients generated at submicrometer scale are the limiting factor of device integration in micro- and nanoelectronics. Silicon functionalized surfaces combine the benefits of electronic circuits with those of molecular probes. On page 200, L. D. Carlos, A. Millán, and co-workers describe the first self-assembled Tb^{3+}/Eu^{3+}-doped-polymer-based monolayer that acts as a ratiometric thermometer, displaying bi-stability that can be used as an optically active molecular demultiplexer.



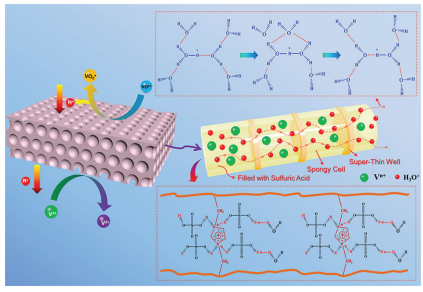
FEATURE ARTICLE

FULL PAPERS

CONTENTS

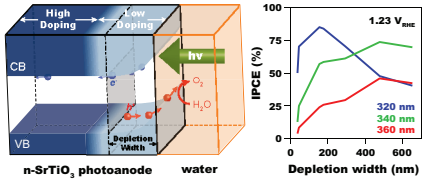
FULL PAPERS

Batteries



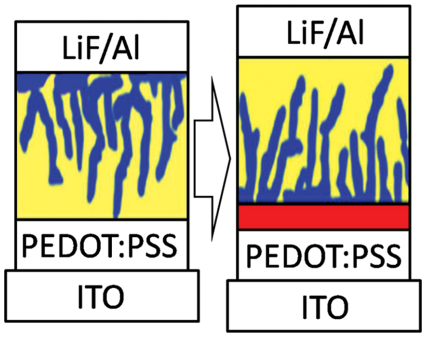
A charged sponge-like membrane with a pore-wall covered imidazolium-based crosslinked structure is designed and fabricated. The prepared membranes exhibit excellent selectivity and stability for vanadium flow battery application.

Water Splitting

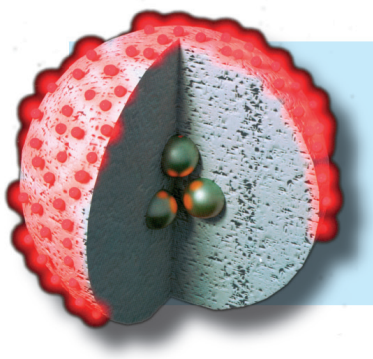


Water photolysis over semiconducting metal oxide is studied at the limit of very wide depletion region for *n*-$SrTiO_3$ photoanodes. Through a graded doping architecture, the depletion region is widened to an unprecedented depth of 500+ nm, which optimizes the trade-off between photon collection and minority carrier delivery, leading to an incident photon-to-current efficiency over 70% for its weak indirect band gap absorption.

Polymer Solar Cells



A cross-linkable donor polymer is developed and used as the underlying layer to improve the vertical composition distribution of donor:acceptor in the active layer of polymer solar cells (PSCs). With the improvement, the regular PSC device based on PTB7:$PC_{71}BM$ active layer exhibits power conversion efficiency increase from 7.41% to 8.55%.



How to contact us:

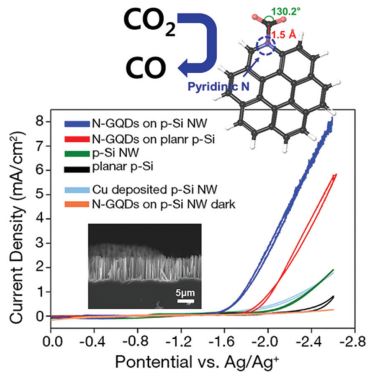
Editorial Office:
Phone: (+49) 6201-606-286/531
Fax: (+49) 6201-606-500
Email: afm@wiley-vch.de

Reprints:
cherth@wiley-vch.de

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

FULL PAPERS

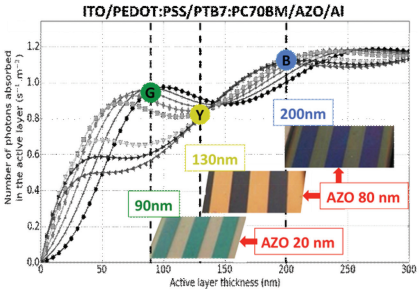
Highly selective CO_2 to CO photoconversion catalyzed by N-doped graphene quantum sheets (N-GQSs) on a p-type Si nanowire is demonstrated. The photocatalytic system produces CO with the chemical selectivity of more than 95%, which is comparable with that of the noble metals such as Au and Re. The developed system provides a new means for utilizing CO_2 as a usable chemical feedstock.



Quantum Sheets

Graphene Quantum Sheet Catalyzed Silicon Photocathode for Selective CO_2 Conversion to CO

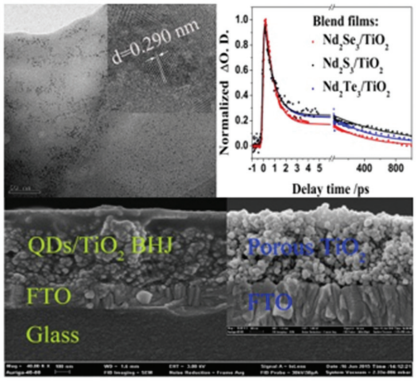
A facile Al-doped ZnO nanocrystal synthesis for solution-processed electron extraction layer and playing as well as optical spacer in regular polymer solar cells is presented. A high power conversion efficiency together with fine-tuning of the reflected cell color is obtained. Thick layers of this annealing-free conductive film (up to 80 nm) together with thick layers of active blends (up to 200 nm) strongly improve the compatibility of polymer solar cells with large-scale robust solution processing.



Organic Solar Cells

Ligand-Free Synthesis of Aluminum-Doped Zinc Oxide Nanocrystals and their Use as Optical Spacers in Color-Tuned Highly Efficient Organic Solar Cells

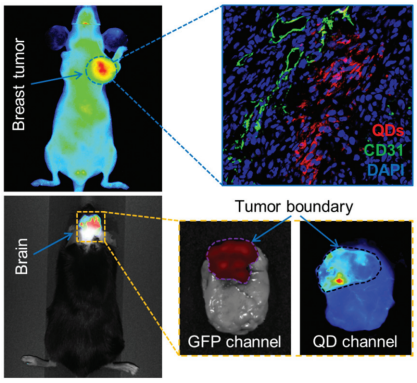
Lead/cadmium-free and optimized neodymium chalcogenide quantum dots (QDs) have been synthesized by varying the ratio of neodymium to chalcogenide and their promising applications to solar cells have been demonstrated in terms of optical properties, energy level alignment, and charge transfer dynamics, etc. Nd_2Se_3 QDs exhibit a faster charge transfer rate and a conversion efficiency of 3.19% has been achieved.



Quantum Dots

$Nd_2(S, Se, Te)_3$ Colloidal Quantum Dots: Synthesis, Energy Level Alignment, Charge Transfer Dynamics, and Their Applications to Solar Cells

Highly luminescent cadmium-free $CuInSe_2/ZnS$ core/shell quantum dots are demonstrated as a tumor-targeted imaging probe. This probe exhibits excellent photostability, long circulation time, and minimal toxicity. Intense intratumoral signals are detected using three luminescence imaging modalities: near-infrared, time-gated, and two-photon. The probe clearly denotes tumor boundaries and diffusely infiltrating tumor cells in a glioblastoma mouse model.

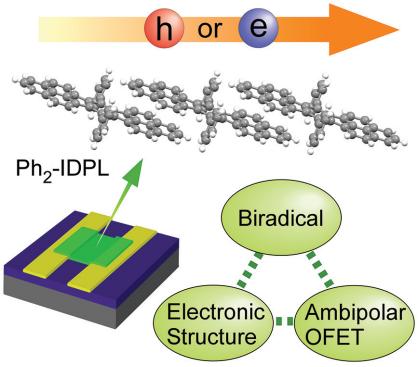


Tumor Imaging

Tumor-Targeted Multimodal Optical Imaging with Versatile Cadmium-Free Quantum Dots

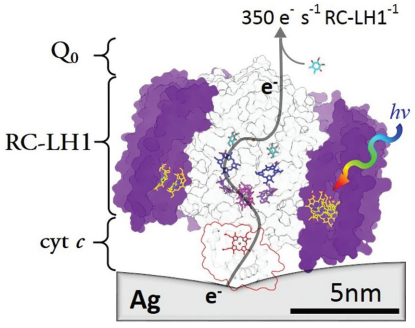
FULL PAPERS

Organic Electronics



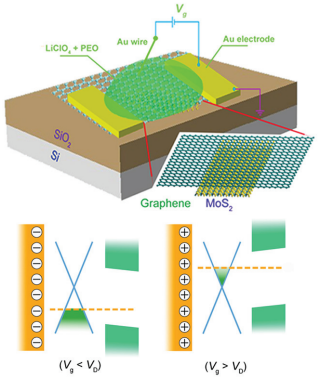
A singlet biradical nature enables high mobility comparable to that of amorphous Si in organic field-effect transistors (OFETs). This paper focuses on the electronic structure and electrical properties of OFETs of a delocalized singlet biradical hydrocarbon, the diphenyl derivative of *s*-indacenodiphenalene (Ph_2-IDPL). Ph_2-IDPL holds significant promise as a new semiconducting material for high-performance organic devices.

Bioelectronics



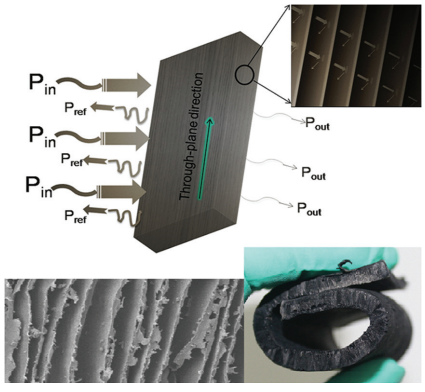
A novel biohybrid photocathode consisting of photosynthetic complexes is revealed on a nanostructured silver electrode. This photocathode nets record photocurrents up to 416 μA cm^{-2} in part thanks to a 2.5-fold plasmon-enhanced light harvesting efficiency.

Excitons



Using monolayer MoS_2/graphene heterostructures to construct electric double-layer devices with an ion-gels dielectric, the possibility of tuning the photoluminescence properties through electrochemical gating is realized. This tunability can be achieved by either modulating the carrier densities of the counterparts or the band alignment at the interface, and the dominant factor determining the PL tuning can be determined.

Carbon Nanotubes



Lightweight, flexible and anisotropic porous composites are assembled by a simple freeze-drying method. The composites contain wide range of mass ratios of multiwalled carbon nanotube in waterborne polyurethane matrix, and show giant electromagnetic interference shielding effectiveness, with the relevant specific shielding effectiveness greater than other shielding materials ever reported.