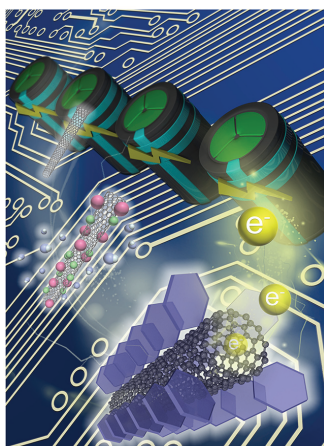


ADVANCED FUNCTIONAL MATERIALS

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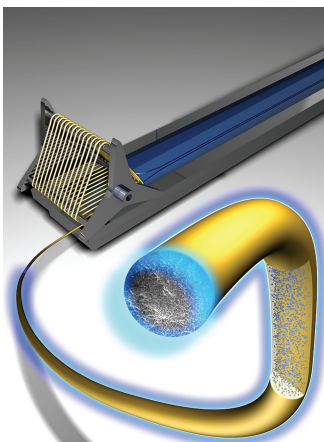


Flexible Electronics

A well-designed hierarchical nanostructure composed of NiMn-layered double hydroxide (NiMn-LDH) microcrystals grafted on a carbon nanotube (CNT) backbone is constructed by M. Wei and co-workers using an in situ growth route, which shows superior supercapacitive performance. On page 2938, an all-solid-state asymmetric supercapacitor (SC) with good flexibility is fabricated using the NiMn-LDH/CNT film and reduced graphene oxide (RGO)/CNT film as the positive and negative electrodes, respectively.

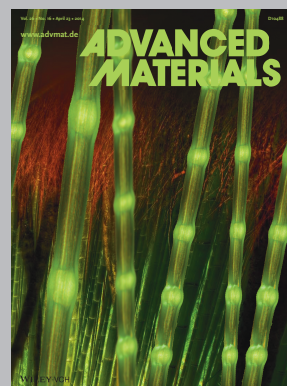
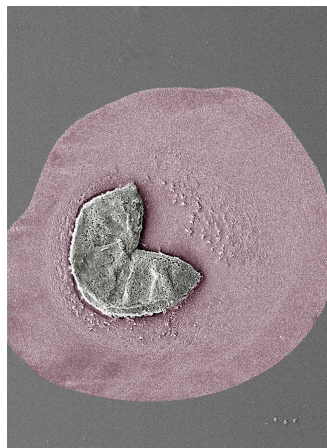
Carbon Black

On page 2947, N. R. Sottos and co-workers report the preparation of robust microcapsules that contain high concentration carbon black suspensions. Prior to encapsulation, carbon black particles are surface functionalized with octadecyl chains to create stable particle suspensions, which is critical for the release of carbon black. When ruptured, these microcapsules exhibit significant particle release, enabling full conductivity restoration of damaged battery electrodes.



Sensors

The optimization of processing conditions and material chemistries has enabled the uniform integration of PEDOT:PSS within a polyurethane matrix to fabricate elastomeric fibers with high electrical conductivity, using a simple fibre wet-spinning process. J. M. Razal, G. G. Wallace, and co-workers report the fabrication of these fibres on page 2957, and demonstrate strain sensing in a wide range of cyclic stretching.



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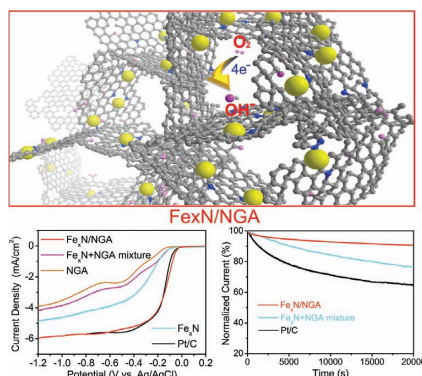
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FULL PAPERS

Doped Graphene

H. Yin, C. Zhang, F. Liu,
Y. Hou* 2930–2937

Hybrid of Iron Nitride and Nitrogen-Doped Graphene Aerogel as Synergistic Catalyst for Oxygen Reduction Reaction

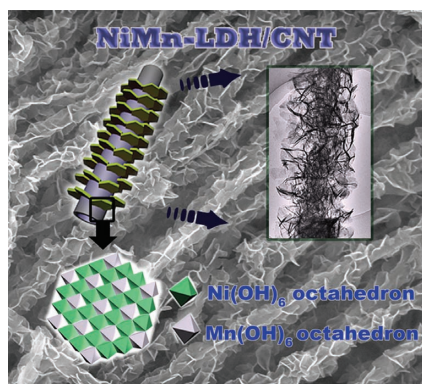


A novel macroporous iron nitride/nitrogen doped-graphene aerogel hybrid is reported as a highly active, stable, and low-cost catalyst for oxygen reduction reaction. The strong interactions between Fe_xN nanoparticles and graphene substrates boost its performance. It is also found that surface area, porosity, density of Fe–N–C sties, and particle sizes affect electrocatalytic activity.

Flexible Electronics

J. Zhao, J. Chen, S. Xu, M. Shao,
Q. Zhang, F. Wei, J. Ma, M. Wei,*
D. G. Evans, X. Duan 2938–2946

Hierarchical NiMn Layered Double Hydroxide/Carbon Nanotubes Architecture with Superb Energy Density for Flexible Supercapacitors

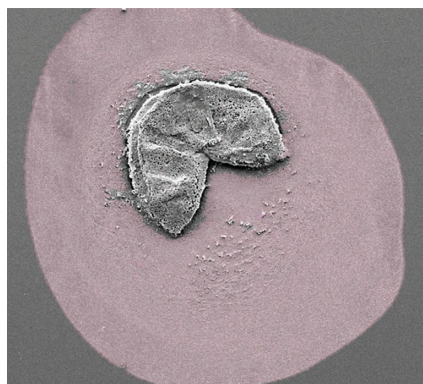


A smart hierarchical nanostructure composed of NiMn-LDH shell and carbon nanotube backbone core is designed and fabricated using a facile in situ synthetic route. By virtue of the desirable features of each component and the well-defined 3D configuration, the resulting NiMn-LDH/CNT composite electrode displays excellent pseudocapacitive behavior in asymmetric flexible supercapacitors.

Carbon Black

S. Kang, A. R. Jones, J. S. Moore,
S. R. White, N. R. Sottos* 2947–2956

Microencapsulated Carbon Black Suspensions for Restoration of Electrical Conductivity

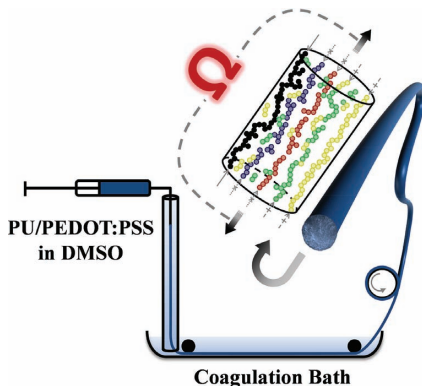


Robust microcapsules of carbon black suspensions high in solids loading (up to 0.2 g/mL) are prepared for electrical conductivity restoration. Octadecyl chains are covalently attached to carbon black surfaces to improve dispersability and suspension stability in *o*-dichlorobenzene. The microcapsules exhibit significant particle release upon crushing, resulting in full conductivity restoration of damaged silicon anodes.

Sensors

M. Z. Seyedin, J. M. Razal,* P. C. Innis,
G. G. Wallace* 2957–2966

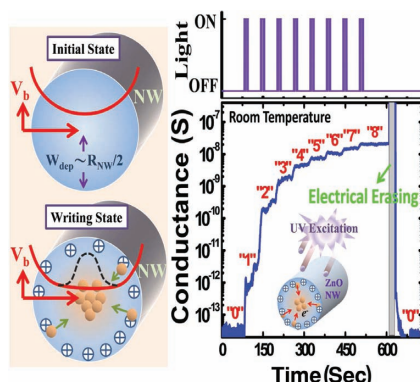
Strain-Responsive Polyurethane/PEDOT:PSS Elastomeric Composite Fibers with High Electrical Conductivity



Conducting elastomeric fibers based on a composite of polyurethane (PU) and PEDOT:PSS, produced by a wet-spinning method, have high electrical conductivity and stretchability. These fibers can sense large strains by changes in resistance. The PU/PEDOT:PSS fiber is optimized to achieve the best strain sensing. PU/PEDOT:PSS fibers can be produced on a large scale and integrated into conventional textiles by weaving or knitting.

FULL PAPERS

A multibit programmable optoelectronic nanowire (NW) memory operates with an ultralow optical writing energy (ca. 330 photons bit⁻¹) at room temperature. In this system, photoionized charged defects behave as surface trapped charges to achieve the electrical memory effect. The extremely high dynamic photoconductive gain (ca. 10¹⁰) makes it possible to write multibit optical data bit-by-bit into the NW.

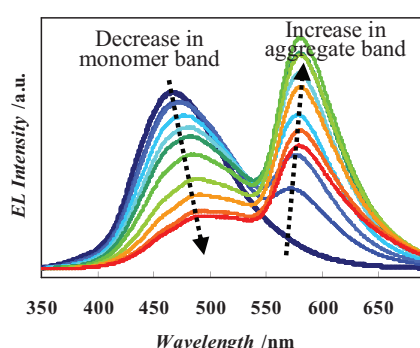


Memory

M.-P. Lu,* M.-Y. Lu,
L.-J. Chen2967–2974

Multibit Programmable Optoelectronic Nanowire Memory with Sub-femtojoule Optical Writing Energy

Exciton-polaron-induced aggregation occurs in a variety of wide-bandgap materials commonly used as host materials in phosphorescent organic light-emitting devices (PhOLEDs). Such an aggregation process is determined to play a major role in limiting the electroluminescence stability of PhOLEDs. The extent of aggregation correlates with the material's bandgap rather than with the glass-transition temperature.

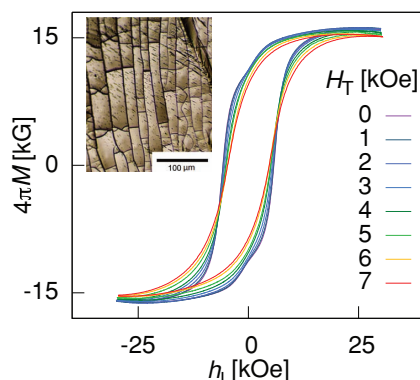


Wide-Bandgap Materials

Q. Wang, B. Sun, H. Aziz*2975–2985

Exciton–Polaron-Induced Aggregation of Wide-Bandgap Materials and its Implication on the Electroluminescence Stability of Phosphorescent Organic Light-Emitting Devices

Application of a transverse magnetic field can reversibly tune the magnetic hardness of a disordered uniaxial, high anisotropy rare earth magnet at room temperature. Random field effects control the effective strength of the material's intrinsic disorder, providing a convenient control knob for rapidly and isothermally switching between different computationally relevant magnetic characteristics.

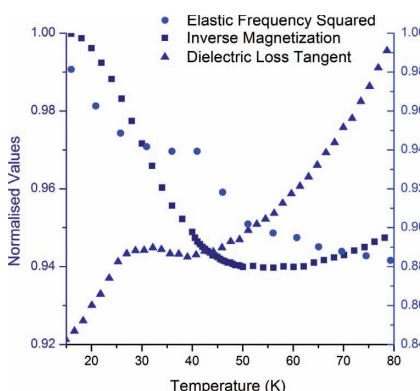


Ferromagnetism

S. L. Tomarken, D. M. Silevitch,
G. Aeppli, B. A. W. Brinkman, J. Xu,
K. A. Dahmen,
T. F. Rosenbaum*2986–2992

Reversible Disorder in a Room Temperature Ferromagnet

The correlations between electrical, magnetic, and elastic phenomena in the room temperature multiferroic Pb(Fe_{0.5}Ta_{0.5})_{0.4}(Zr_{0.53}Ti_{0.47})_{0.6}O₃ are examined. A striking correlation between these different kinds of order is found, particularly at a previously unreported transition between 35 and 50 K. This coupled behavior may help to explain the as-yet uniquely strong magneto-electric effects observed in this material.



Multiferroics

J. Schiemer,* M. A. Carpenter,
D. M. Evans, J. M. Gregg, A. Schilling,
M. Arredondo, M. Alexe, D. Sanchez,
N. Ortega, R. S. Katiyar, M. Echizen,
E. Colliver, S. Dutton,
J. F. Scott2993–3002

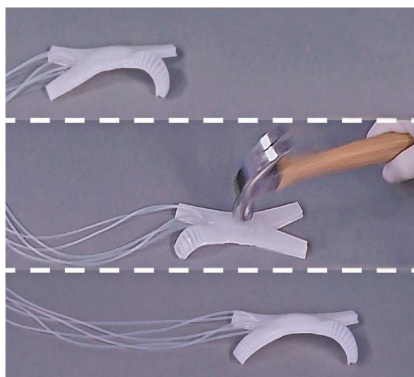
Studies of the Room-Temperature Multiferroic Pb(Fe_{0.5}Ta_{0.5})_{0.4}(Zr_{0.53}Ti_{0.47})_{0.6}O₃: Resonant Ultrasound Spectroscopy, Dielectric, and Magnetic Phenomena

FULL PAPERS

Soft Robotics

R. V. Martinez, A. C. Glavan,
C. Keplinger, A. I. Oyetibo,
G. M. Whitesides* 3003–3010

Soft Actuators and Robots that Are Resistant to Mechanical Damage

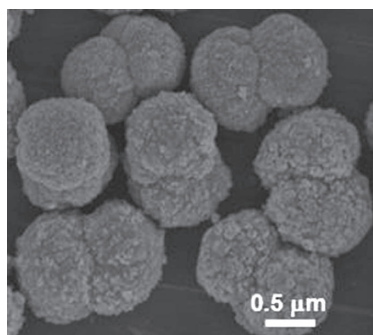


Soft pneumatic actuators and robots based on composites consisting of elastomers and embedded flexible reinforcing sheets are significantly more resistant to blunt impacts, tensile forces, and severe bending than hard robotic systems of similar size and weight. The range of physical damage that soft robots and actuators can withstand without suffering changes in mechanical performance is quantified.

Anodes

J. Bai, X. G. Li, G. Z. Liu, Y. T. Qian,
S. L. Xiong* 3012–3020

Unusual Formation of ZnCo_2O_4 3D Hierarchical Twin Microspheres as a High-Rate and Ultralong-Life Lithium-Ion Battery Anode Material

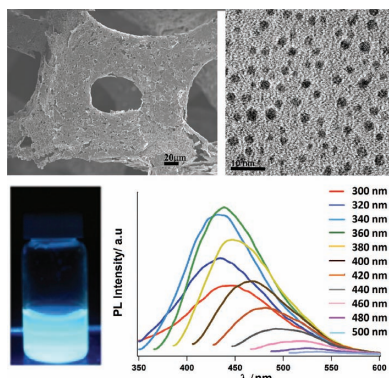


3D hierarchical ZnCo_2O_4 twin spheres are prepared via a convenient polyol process and subsequent thermal annealing. A multistep splitting in situ dissolution recrystallization originating from 1D nanorods is first proposed to understand the formation of the 3D nanoarchitectures. Lithium-ion batteries prepared with the 3D materials display remarkable performance in energy storage.

Optical Sensors

A. Ananthanarayanan, X. Wang,
P. Routh, B. Sana, S. Lim, D.-H. Kim,
K.-H. Lim, J. Li, P. Chen* 3021–3026

Facile Synthesis of Graphene Quantum Dots from 3D Graphene and their Application for Fe^{3+} Sensing

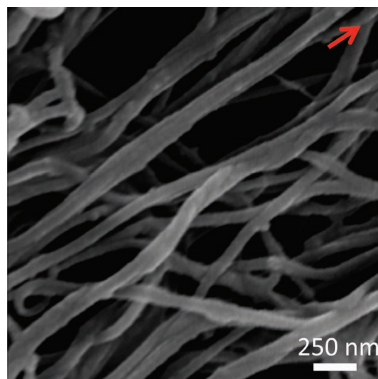


A facile and high-yield synthesis method for high quality and strongly photoluminescent graphene quantum dots (GQDs) by electrochemically exfoliating free standing three dimensional graphene foam is demonstrated. The synthesized GQDs are utilized for specific optical detection of ferric ions.

Extracellular Matrix

Q. Xing, C. Vogt, K. W. Leong,
F. Zhao* 3027–3035

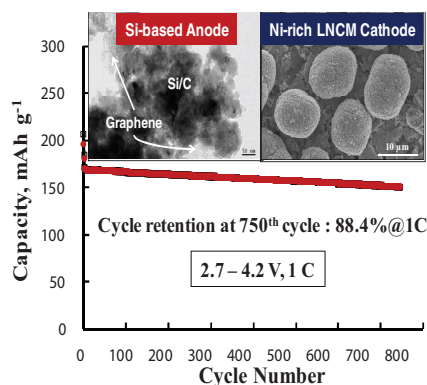
Highly Aligned Nanofibrous Scaffold Derived from Decellularized Human Fibroblasts



A highly aligned nanofibrous extracellular matrix scaffold is fabricated from a decellularized human fibroblast cell sheet. The scaffold, designed for potential tissue engineering applications, is composed of natural protein nanofibers (around 80 nm in diameter), and has good biocompatibility.

FULL PAPERS

A novel lithium-ion battery system based on a Si/C composite anode internally wired with a small amount of graphene sheet (~6 wt%) and a nanostructured layered-composite cathode successfully demonstrates a high energy density (240 Wh kg^{-1} at least) as well as an unprecedented excellent cycling stability of up to 750 cycles between 2.7 and 4.2 V at 1C.

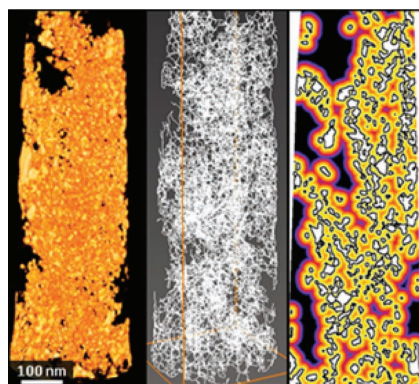


Energy Storage

C. Chae, H.-J. Noh, J. K. Lee,*
B. Scrosati,* Y.-K. Sun*3036–3042

A High-Energy Li-Ion Battery Using a Silicon-Based Anode and a Nano-Structured Layered Composite Cathode

The nanoscale morphology of a hierarchically structured photoanode for a hybrid solar cell is investigated. By performing electron tomography on a micropillar extracted from a complete device, and by using analytical tools from stochastic geometry, the 3D hierarchical network is quantitatively analyzed to determine the nanoscale structure of the photoanode.

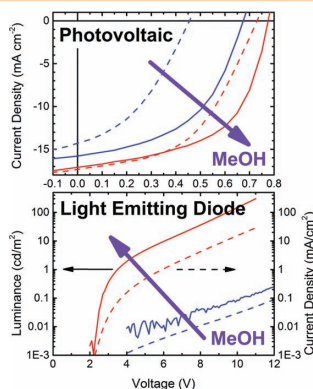


Hybrid Solar Cells

G. Divitini,* O. Stenzel,
A. Ghadirzadeh, S. Guarnera,
V. Russo, C. S. Casari, A. Li Bassi,
A. Petrozza, F. Di Fonzo, V. Schmidt,
C. Ducati3043–3050

Nanoscale Analysis of a Hierarchical Hybrid Solar Cell in 3D

A polar non-solvent treatment switches anode surfaces from barrier-limited hole injection/extraction to ohmic behavior. This is caused by the removal of polar hydroxyl groups, increasing the anode work function. In photovoltaic devices, a two-fold enhancement in hole extraction raises the fill-factor and open-circuit voltage, leading to high power-conversion efficiency. In light-emitting diodes, hole injection and luminance intensity increase by 3 orders of magnitude.

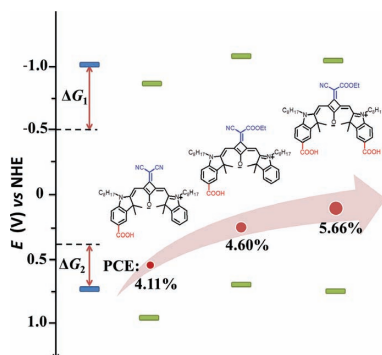


Anodes

Z.-K. Tan, Y. Vaynzof, D. Credgington,
C. Li, M. T. L. Casford, A. Sepe,
S. Huettner, M. Nikolka, F. Paulus,
L. Yang, H. Sirringhaus, N. C. Greenham,
R. H. Friend*3051–3058

In-Situ Switching from Barrier-Limited to Ohmic Anodes for Efficient Organic Optoelectronics

A new molecular design strategy on near-infrared squaraine dyes is developed to fine tune energy levels and absorption spectrum. The power conversion efficiency and device stability of dye-sensitized solar cells based on HSQ4 are improved with a high IPCE response (80%) at a wavelength of 720 nm due to the ideal energy levels and molecular structure.



Solar Cells

C. Qin, Y. Numata, S. Zhang, X. Yang,
A. Islam, K. Zhang, H. Chen,
L. Han*3059–3066

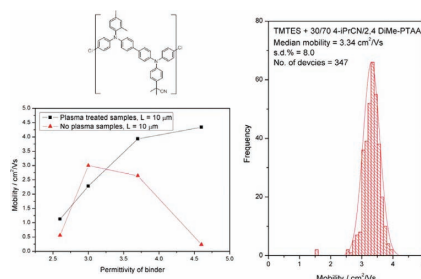
Novel Near-Infrared Squaraine Sensitizers for Stable and Efficient Dye-Sensitized Solar Cells

FULL PAPERS

Organic Electronics

K. L. McCall,* S. R. Rutter, E. L. Bone, N. D. Forrest, J. S. Bissett, J. D. E. Jones, M. J. Simms, A. J. Page, R. Fisher, B. A. Brown, S. D. Ogier 3067–3074

High Performance Organic Transistors Using Small Molecule Semiconductors and High Permittivity Semiconducting Polymers

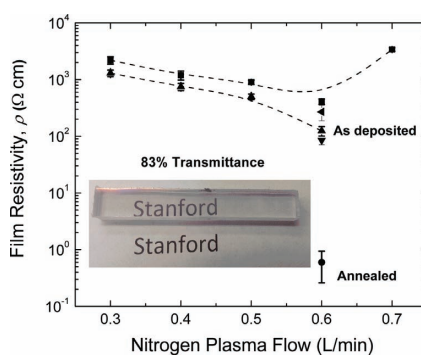


High mobility organic semiconductor formulations with excellent uniformity are prepared by combining a small molecule and high permittivity semiconducting oligomers. The use of these high- k ($k > 3.3$) oligomers allows control of the performance by manipulation of the surface energy of the substrate. Organic thin film transistors results with mobilities of $5 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$, standard deviation $<10\%$ and on/off ratios of 10^9 are presented.

Transparent Conductive Layers

S. Dong, M. Watanabe, R. H. Dauskardt* 3075–3081

Conductive Transparent $\text{TiN}_x/\text{TiO}_2$ Hybrid Films Deposited on Plastics in Air Using Atmospheric Plasma Processing

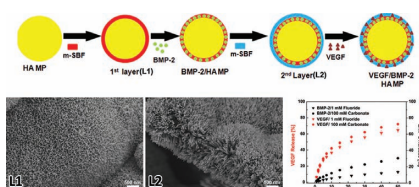


The successful deposition of conductive transparent $\text{TiN}_x/\text{TiO}_2$ hybrid films on polycarbonate substrates is demonstrated in air using atmospheric plasma processing. The visible transmittance ranges from 71% to 83% and the film resistivity is in the range $\sim 6.0 \times 10^{-1}$ to $2.4 \times 10^5 \text{ ohm cm}$. It provides a new promising way to fabricate transparent conductive films with low cost.

Growth Factor Release

X. Yu, A. Khalil, P. N. Dang, E. Alsberg, W. L. Murphy* 3082–3093

Multilayered Inorganic Microparticles for Tunable Dual Growth Factor Delivery

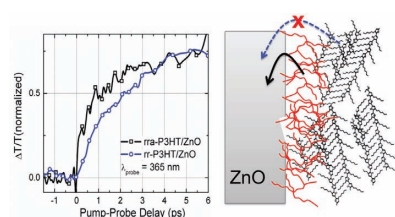


A multilayered, mineral coated micro-particle platform is developed for tunable dual growth factor delivery. Distinct release kinetics of BMP-2 and VEGF is achieved by binding the growth factors on different coating layers and manipulating the intrinsic properties of the mineral coatings. This multiple protein delivery system has immense potential in tissue engineering to better mimic the natural healing process.

Photovoltaics

A. R. S. Kandada, S. Guarnera, F. Tassone, G. Lanzani, A. Petrozza* 3094–3099

Charge Generation at Polymer/Metal Oxide Interface: from Molecular Scale Dynamics to Mesoscopic Effects



The role of interface morphology in charge generation at prototypical hybrid interfaces made of metal-oxide films and P3HT is investigated using femtosecond UV-Vis-NIR transient absorption measurements. The results point to a better injection efficiency from the disordered phase of the polymer than from the aggregate phase.