ADVANCED FUNCTIONAL MATERIALS

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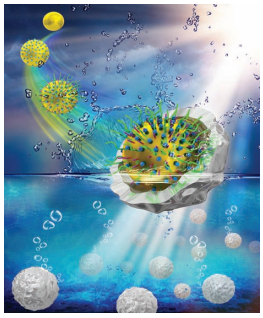
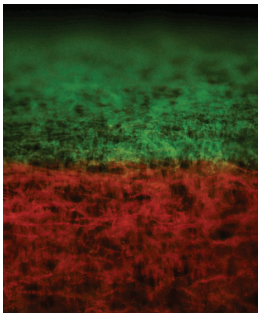


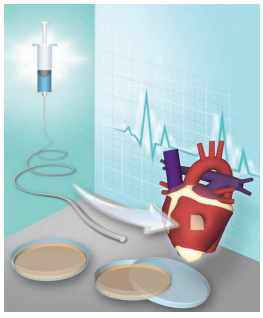
Photocatalysis

On page 5816, Hua Kuang and co-workers report the fabrication of gold-gap-silver nanostructures (GGS NSs) with distinctive plasmon-induced chiroptical performance in the visible region. The nanogap size of the GGS NSs can be tailored by altering the amount of chiral cysteine. The chiral GGS NSs show unusual circularly polarized photocatalytic activity when irradiated with circularly polarized light.

Controlled Polymerization

The development of a high performance bi-functional scaffold for use at gliding tissue interfaces is reported by Molly M. Stevens and co-workers on page 5748. By using controlled radical polymerization to grow dense polymer brushes from the surface of electrospun fibers, robust scaffolds with opposing cell adhesive and anti-fouling surfaces are prepared with excellent spatial control.



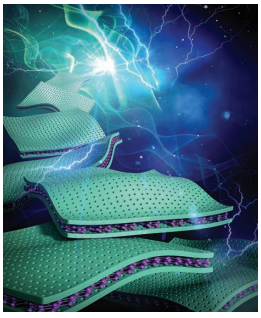


Tissue Engineering

Electrospun nanofibrous materials have been developed for use as scaffolds for regenerating engineered cardiac tissues. On page 5726, Xiaohui Zhang, Feng Xu, and co-workers present an overview of the design strategies for controlling the chemical, structural, and biological properties of electrospun scaffolds, and the performance of advanced electrospun scaffolds for promoting the functionalities of cardiac tissues. Electrospun scaffolds are demonstrated to hold great potential for cardiac tissue engineering applications.

Electrocatalysts

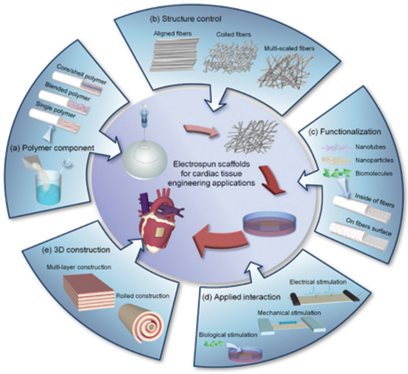
On page 5768, Huanting Wang and co-workers report the synthesis of zeolitic-imidazolate-framework (ZIF)/graphene oxide (GO) sandwich-like composites with ultrasmall ZIF nanocrystals (≈20 nm in size) that fully cover the GO via a homogenous nucleation followed by uniform deposition and confined growth process. The ZIF/GO composites are further converted to N-doped nanoporous carbon/graphene nano-sandwiches, which act as non-precious metal catalysts with excellent performance for electrochemical oxygen reduction reaction.



FEATURE ARTICLE

Electrospun Scaffolds

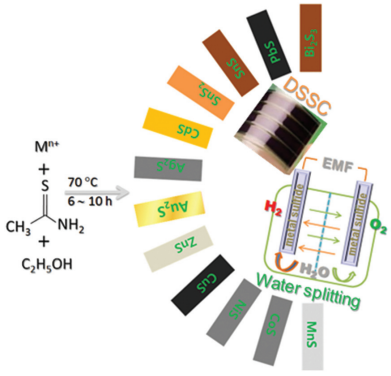
Electrospinning has shown great potential for cardiac tissue engineering applications, as a controllable and versatile technique for fabricating nanofibrous scaffolds. An overview of recent advances in various electrospun scaffolds for engineering functional cardiac tissues is provided, with emphasis on the fabrication of advanced electrospun scaffolds and design strategies to improve performance in cardiac tissue engineering applications.



FULL PAPERS

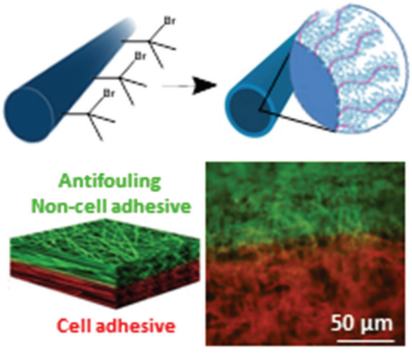
Thin Films

A solution-based general protocol for the deposition of large varieties of metal sulfide thin films from an ethanol bath on a variety of conducting and nonconducting substrates is presented. As a proof-of-concept for application, a NiS film is investigated as an example, and it is demonstrated to be an outstanding electrocatalytic counter electrode for triiodide reduction in dye-sensitized solar cells. It also exhibits potentially good electrocatalyst activity for the hydrogen evolution reaction and oxygen evolution reaction from water.



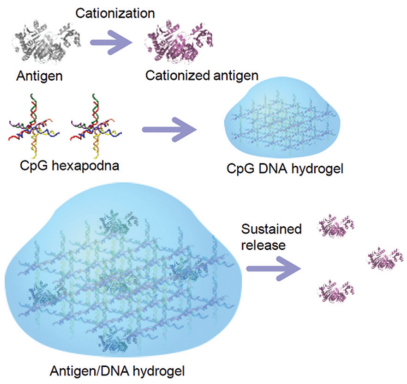
Antifouling

Cell-adhesive and opposing antifouling surfaces are produced within a single construct for use in tissue engineering of biological interfaces. Different functional groups are zonally organized within a continuously electrospun scaffold before postprocessing modification with a versatile, surface-initiated controlled radical polymerization production of an effective antifouling polymer bottlebrush in a predetermined, specific location.



Hydrogels

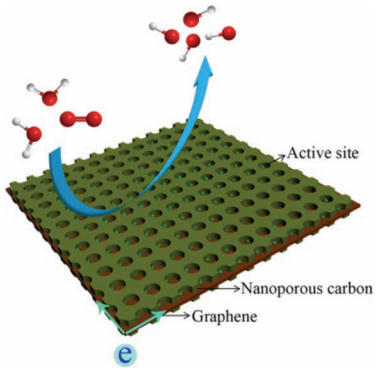
An immunostimulatory DNA hydrogel-based sustained release system using cationized antigen that can electrostatically interact with DNA is developed. This system can induce antigen-specific immune responses, which leads to effective inhibition of antigen-positive tumor growth in mice. This provides experimental evidence for future clinical applications of this system to induce potent antitumor immunity.



CONTENTS

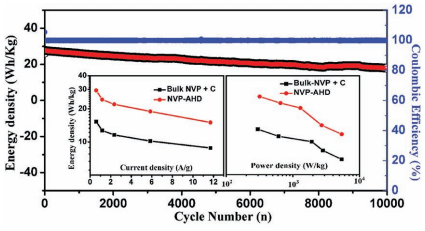
FULL PAPERS

Electrocatalysts



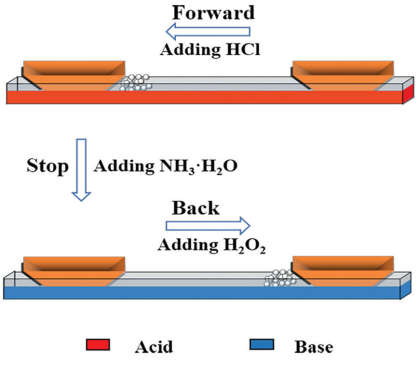
A zeolitic-imidazolate-framework nanocrystal layer-protected carbonization route is developed to prepare N-doped carbon/graphene nano-sandwiches. These act as a highly active and stable nonprecious metal catalyst for oxygen reduction.

Pseudocapacitors

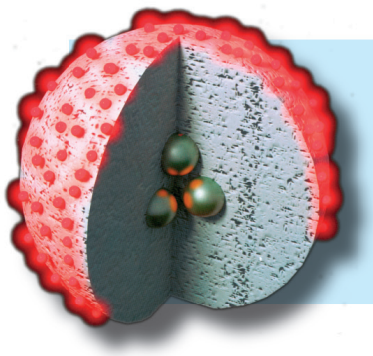


A novel symmetric Na-ion pseudocapacitor that operates on oxidation–reduction reactions occurring on both electrodes with an identical active material, viz., $Na_3V_2(PO_4)_3$ encapsulated inside nanoporous carbon, is designed. When used in a full-cell utilizing highly reversible, high-rate, and cost-effective Na-ion intercalational pseudocapacitance, this device can bridge the performance gap between batteries and supercapacitors.

Smart Materials



To improve the intelligence of smart devices and realize round-way smart motions, a smart device is fabricated with two types of actuators of magnesium–acid system and platinum-hydrogen-peroxide system at the opposite ends. Under acidic conditions, the magnesium reacts with acid to propel the device forward; changing to alkaline, the device stops motion; adding hydrogen peroxide, it moves back.



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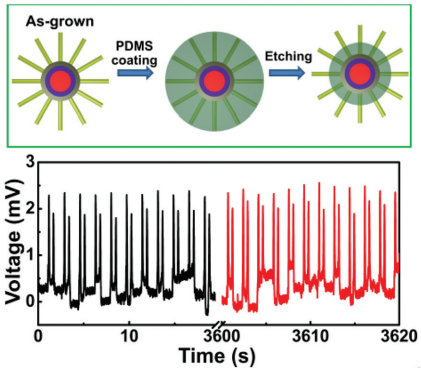
FULL PAPERS

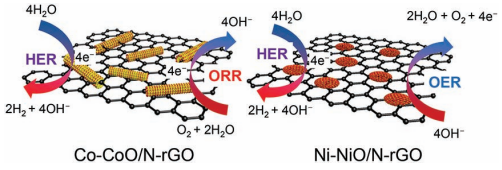
Zn Nanowires

A novel approach to combining surface coating and plasma etching techniques is introduced to enhance the mechanical reliability of Kevlar microfiber-ZnO nanowires hybrid structure. This is successfully applied to fabricate a high-reliability Kevlar fiber-ZnO nanowire hybrid nanogenerator. The nanogenerator can act as a self-powered system to detect the UV intensity quantitatively.



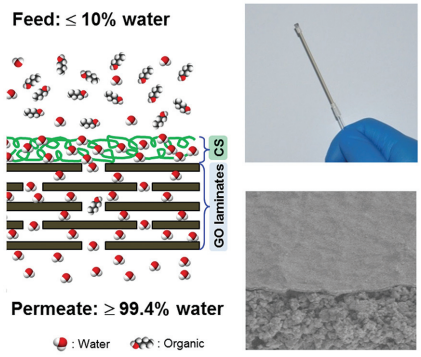
Electrocatalysts

A new class of multifunctional electrocatalysts, composed of Co–CoO/N–rGO and Ni–NiO/N–rGO is synthesized via a pyrolysis of graphene oxide and cobalt or nickel salts. The two catalysts show excellent activities for oxygen reduction reaction (ORR), hydrogen evolution reaction (HER), or oxygen evolution reaction (OER). In particular Co–CoO/N–rGO shows comparable performance to Pt/C in zinc-air batteries.



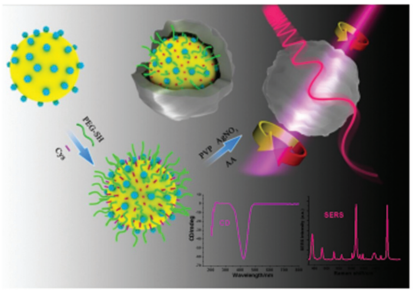
Bio-Inspired Membranes

A bio-inspired membrane that couples an ultrathin surface water-capturing polymeric layer and graphene oxide laminates exhibits highly selective water permeation with an excellent water flux of over 10 000 g m^{-2} h^{-1}. This bio-inspired strategy opens the door to explore nanochannels derived from 2D or 3D materials for highly efficient molecular transport.



Photocatalysis

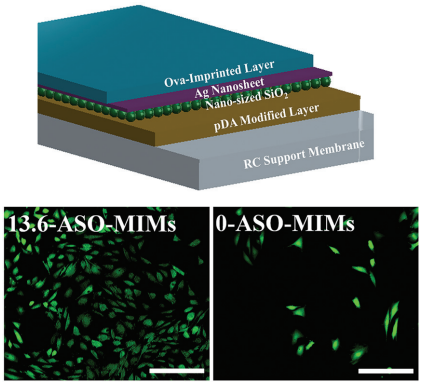
Guided by L/D-cysteine, gold-gap-silver nanostructures (GGS NSs) with interior nanogaps, which display exceptionally strong chiroptical activity in the visible light region, are prepared. Based on the fabricated GGS NSs, unexpected circularly polarized photocatalytic activity is discovered under the irradiation with circularly polarized light.



FULL PAPERS

Regenerative Medicine

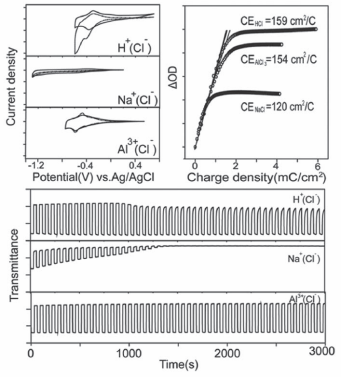
A Multiple-Functional Ag/SiO_2/Organic Based Biomimetic Nanocomposite Membrane for High-Stability Protein Recognition and Cell Adhesion/Detachment



Multiple-functional Ag/SiO_2/organic based molecularly imprinted membranes (ASO-MIMs) are prepared for high-stability protein recognition and cell adhesion/detachment. Because of the high affinity of ASO-MIMs (comparable to that of the natural receptor) and the innocuity to bioprotein (compared to covalent interactions), the approach reported is a promising candidate for large-scale applications in protein recognition and cell-based regenerative medicine.

Electrochromism

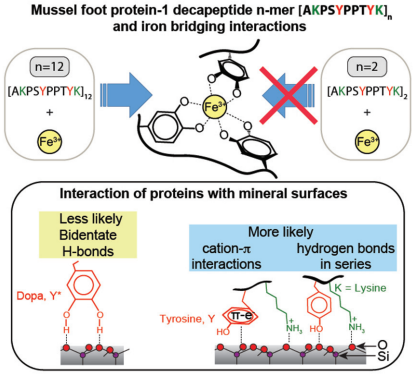
Unconventional Aluminum Ion Intercalation/Deintercalation for Fast Switching and Highly Stable Electrochromism



Using Al^{3+} as insertion ions in electrochromic applications allows for fast switching, high-contrast, and highly stable electrochromic behavior. It also makes it possible to overcome the existing problems encountered by the conventional insertion ions. The new, low-cost insertion ion is beneficial for the fabrication of more stable and economical electrochromic devices.

Protein Coatings

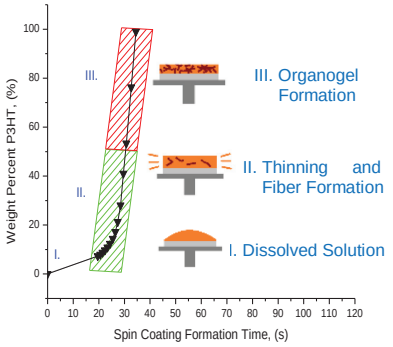
Peptide Length and Dopa Determine Iron-Mediated Cohesion of Mussel Foot Proteins



Fe^{3+}-mediated bridging of the mussel foot proteins (mfps) is attributed to two equally influential parameters: peptide architecture and 3,4-dihydroxyphenylalanine (Dopa) residues in the protein. In addition, serial "hydrogen bonding" and cation–π interactions between the aromatic residues in the protein and a mineral surface are more probable than bidentate H-bonding interactions in adhering mfps to the surface.

Organic Electronics

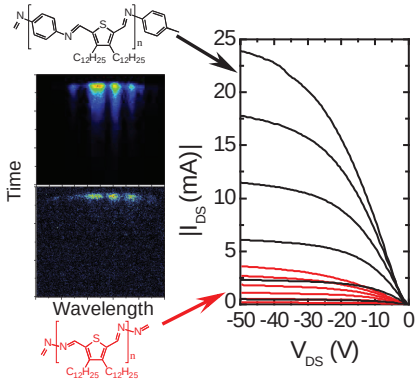
Rapid and Facile Formation of P3HT Organogels via Spin Coating: Tuning Functional Properties of Organic Electronic Thin Films



Poly(3-hexylthiophene) organogels offer exploitable electronic properties. These gels agglomerate into 3D percolating networks that span the active layer of a thin-film device. Novel spin-coating conditions that produce organogels in a rapid deposition process are discussed, including the interplay of kinetics and solution thermodynamics in organogel formation, control of the network size, and the correlation of structure to electronic properties.

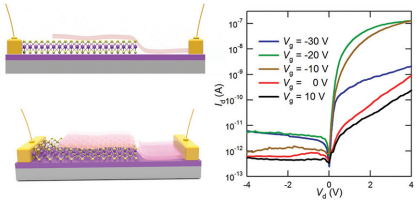
FULL PAPERS

A single-wall carbon nanotube (SWNT) selective dispersion is obtained using polyazines and polyazomethines. Both polymers have didodecylthiophene units with direct nitrogen atoms in their backbone. The additional benzene ring in polyazomethines, which results in a stiffer polymer backbone, triggers different interaction with SWNTs. The high extraction yield of the SWNT dispersion by polyazomethines is essential for large-scale separation of SWNT.



Carbon Nanotubes

Through the marriage of MoS_2 and rubrene, a novel organic–inorganic van der Waals heterostructure is demonstrated with a gate-tunable rectifying behavior. Good photoresponse properties are also obtained from the heterojunction with a photoresponsitivity of 500 A mW^{-1} and a fast response time.



Hybrid Materials