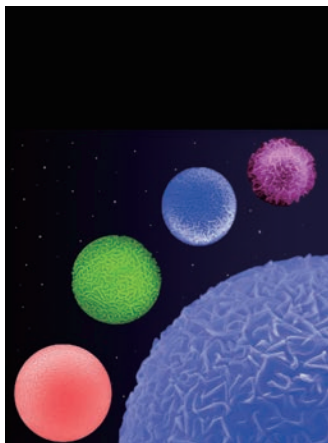


ADVANCED FUNCTIONAL MATERIALS

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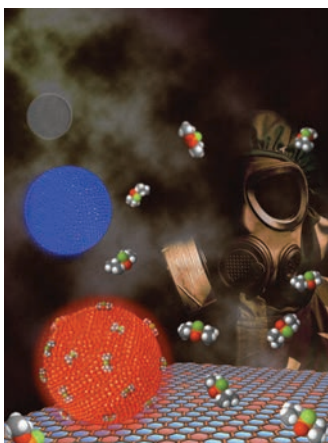


Microfluidics

The topographies of particles can significantly affect their chemical and physical properties. On page 1692, Jintao Zhu and co-workers present a facile, yet versatile approach to generate convoluted polymer microparticles through interfacial instabilities of emulsion droplets. Due to the adsorption of surfactant and co-surfactant to the interface, the organic/water interfacial area can spontaneously increase by folding or deforming of the interface, ultimately yielding highly variegated particles.

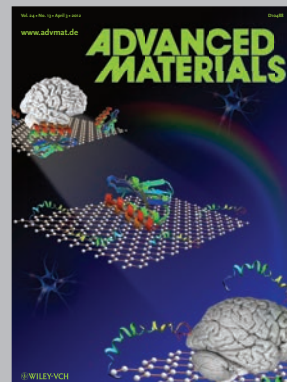
Biological Templates

Wing scales from 175 000 species of butterflies and moths provide huge numbers of textures for the development of surface-enhanced Raman scattering (SERS) substrates. On page 1578, Jiajun Gu, Di Zhang, and co-workers unveil how the sub-wavelength structures naturally arranged in depth in copper scale replicas can enhance the SERS properties. The finding helps bring sensitive and affordable SERS substrates to ordinary laboratories as consumables for trace-amount chemical detection.



Sensors

On page 1632, Jinsang Kim and co-workers report the investigation of polydiacetylene (PDA) liposomes for equipment-free detection of warfare agents. The optimized oxime-modified PDA (OX-PDA) liposome in the solid state shows a selective and rapid optical transition upon exposure to as little as 160 ppb of diisopropylfluorophosphate (DFP), a nerve agent simulant. The results provide an insightful molecular design principle for PDA-based colorimetric sensors and suggest portable sensory patches for rapid, selective, sensitive, and convenient colorimetric detection of organophosphate nerve agents.



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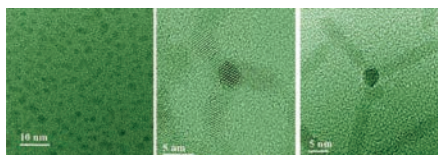
FEATURE ARTICLE

Nanostructures

L. J. Zhao, L. F. Hu,
X. S. Fang*.....1551–1566

Growth and Device Application of CdSe Nanostructures

Cadmium selenide (CdSe) nanostructures are a promising material for applications fields such as photodetectors, field-effect transistors (FETs), field emitters, solar cells, light-emitting diodes (LEDs), memory devices, biosensors, and biomedical imaging. CdSe quantum dots, one of the luminescent semiconductor nanocrystals, have attracted interest for bioanalytical labeling applications in recent years. Additionally, CdSe nano-tetrapods have potential advantages in photovoltaic devices because their shape makes it impossible for them to lie flat within the film.

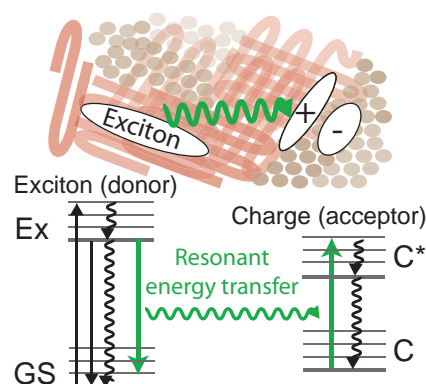


FULL PAPERS

Organic Semiconductors

J. M. Hodgkiss, S. Albert-Seifried,
A. Rao, A. J. Barker, A. R. Campbell,
R. A. Marsh, R. H. Friend*...1567–1577

Exciton-Charge Annihilation in Organic Semiconductor Films

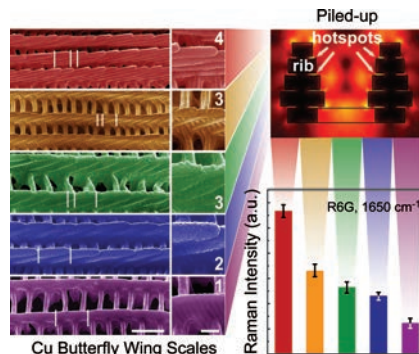


Time-resolved optical spectroscopy is used to probe exciton-charge annihilation reactions in organic semiconductor films. A strong effect due to the optical resonance between singlet excitons and charges is found. The pronounced morphology and excitation density dependence of exciton-charge annihilation described has important implications for the application of time-resolved spectroscopy to organic photovoltaic blends.

Biological Templates

Y. W. Tan, J.-J. Gu,* L. H. Xu,
X. N. Zang, D. X. Liu, W. Zhang,
Q. L. Liu, S. M. Zhu,
H. L. Su, C. L. Feng, G. L. Fan,
D. Zhang*.....1578–1585

High-Density Hotspots Engineered by Naturally Piled-Up Subwavelength Structures in Three-Dimensional Copper Butterfly Wing Scales for Surface-Enhanced Raman Scattering Detection

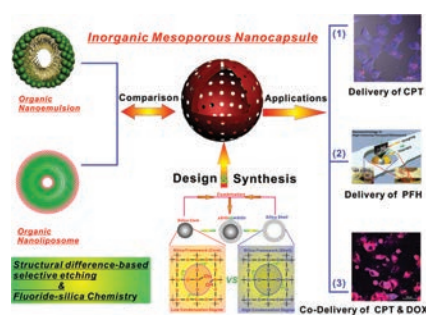


Piled-up hotspots, which are engineered naturally by subwavelength structures in Cu butterfly wing scales, significantly enhance the Raman signals of analytes. These results will help identify the optimal scale morphologies out of ca. 175 000 butterfly species for biotemplates to replicate for surface-enhanced Raman scattering (SERS) applications and bring affordable high-quality SERS substrates as consumables to ordinary laboratories across the world.

Emulsions

Y. Chen, Y. Gao, H. Chen,* D. Zeng,
Y. Li,* Y. Zheng, F. Li, X. Ji,
X. Wang, F. Chen, Q. He,
L. Zhang, J. Shi*.....1586–1597

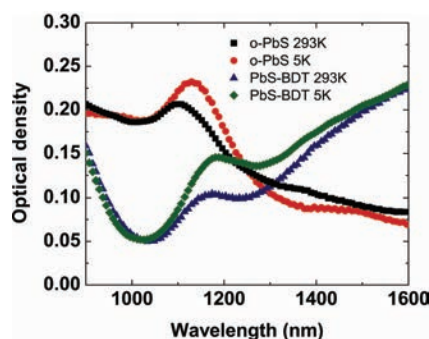
Engineering Inorganic Nanoemulsions/ Nanoliposomes by Fluoride-Silica Chemistry for Efficient Delivery/ Co-Delivery of Hydrophobic Agents



A simple and efficient drug-formulation protocol is developed to solve the delivery problem of hydrophobic agents. The protocol uses inorganic mesoporous silica nanocapsules as a promising alternative to traditional organic emulsions and liposomes while preserving the advantages of inorganic materials. This is demonstrated by delivery of drugs for cancer chemotherapy and surgery as well as the co-delivery of molecules for enhanced chemotherapy of drug-resistant cancer.

FULL PAPERS

Peculiar temperature-dependent electrical and optical properties of cross-linked PbS nanocrystal thin films are demonstrated. Extensive modeling suggests diffusion-dominated charge transport through the inhomogeneously coupled nanocrystal arrays. After benzenedithiol treatment, the thin films exhibit unusual optical properties that can be attributed to partial relaxation of the quantum confinement and opening of alternative recombination pathways.

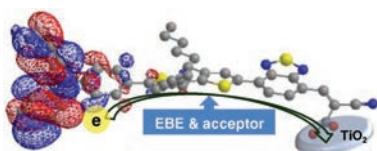


Nanocrystals

K. Szendrei, M. Speirs, W. Gomulya, D. Jarzab, M. Manca, O. V. Mikhnenko, M. Yarema, B. J. Kooi, W. Heiss, M. A. Loi* 1598–1605

Exploring the Origin of the Temperature-Dependent Behavior of PbS Nanocrystal Thin Films and Solar Cells

A combined computational and experimental design approach provides insight into the functioning of organic photosensitizer dyes for solar cell applications. Comparing calculations with measurements reveals that the exciton binding energy and quantum yield are inversely correlated. When a strong electron-accepting moiety is inserted in the middle of the dye framework, the light-to-electric energy conversion behavior significantly deteriorates.

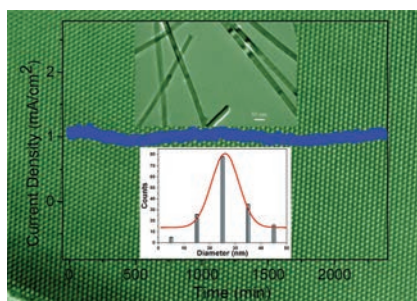


Solar Cells

B.-G. Kim, C.-G. Zhen, E. J. Jeong, J. Kieffer,* J. Kim* 1606–1612

Organic Dye Design Tools for Efficient Photocurrent Generation in Dye-Sensitized Solar Cells: Exciton Binding Energy and Electron Acceptors

A highly stable field emitter based on thin, quasi-aligned SnO₂ nanowire ensembles with uniform diameter is reported. Field-emission measurements of these SnO₂ nanowire ensembles showed low turn-on and threshold voltages and very long-term stability of more than 2400 min. The excellent field emission characteristics are mainly attributed to their high crystallinity, high aspect ratio, uniform 1D geometry and diameter distribution, and quasi-aligned growth.

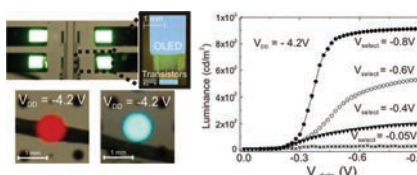


Nanowires

X. S. Fang,* J. Yan, L. F. Hu,* H. Liu, P. S. Lee 1613–1622

Thin SnO₂ Nanowires with Uniform Diameter as Excellent Field Emitters: A Stability of More Than 2400 Minutes

Active matrix organic light-emitting devices (AMOLEDs) based on printed organic thin-film electrochemical transistors (OETs) are demonstrated. These efficient light-emitting pixels are characterized by high luminance at low operating voltages and by extremely small transistor dimensions with respect to the OLED active area. The use of a high capacitance gel-electrolyte as the transistor gate dielectric layer and graded emissive layer (G-EML) OLED architectures are essential.



Thin-Film Transistors

D. Braga, N. C. Erickson, M. J. Renn, R. J. Holmes,* C. D. Frisbie* 1623–1631

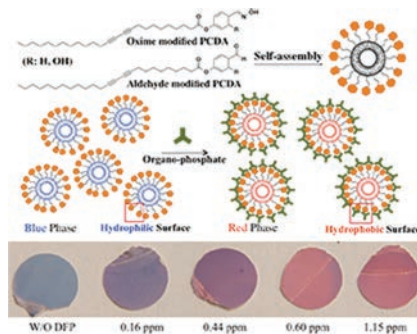
High-Transconductance Organic Thin-Film Electrochemical Transistors for Driving Low-Voltage Red-Green-Blue Active Matrix Organic Light-Emitting Devices

FULL PAPERS

Sensors

J. Lee, S. Seo, J. Kim*1632–1638

Colorimetric Detection of Warfare Gases by Polydiacetylenes Toward Equipment-Free Detection

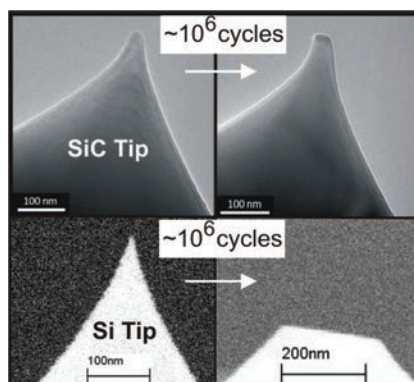


Polydiacetylene (PDA) liposomes having oxime (OX) functionality are rationally designed and synthesized to selectively and sensitively detect organophosphate (OP) nerve agents. Solutions, gel-pads, and solid films of OX-PDA liposome demonstrate convenient, rapid, selective, and sensitive colorimetric detection of nerve agent simulants through intra-liposomal repulsion and interliposomal hydrophobic aggregation.

Nanostructures

M. A. Lantz,* B. Gotsmann, P. Jaroenapibal, T. D. B. Jacobs, S. D. O'Connor, K. Sridharan, R. W. Carpick1639–1645

Wear-Resistant Nanoscale Silicon Carbide Tips for Scanning Probe Applications

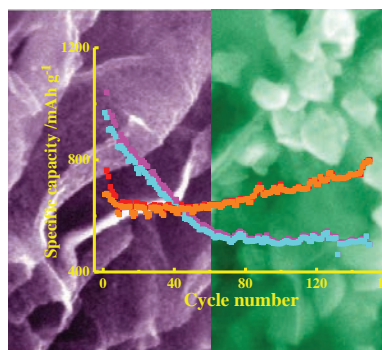


A novel process is described whereby the surfaces of nanoscale Si tips are exposed to carbon ions and then annealed to form a strong silicon carbide (SiC) layer. The nanoscale sharpness is largely preserved and the tips exhibit a wear resistance orders of magnitude greater than conventional silicon tips and at least 100-fold higher than monolithic, SiO-doped diamond-like carbon (DLC) tips.

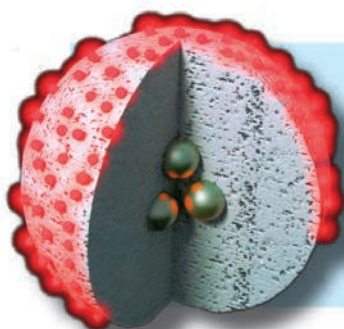
Batteries

X. Li, X. Meng, J. Liu, D. Geng, Y. Zhang, M. N. Banis, Y. Li, J. Yang, R. Li, X. Sun,* M. Cai, M. W. Verbrugge1647–1654

Tin Oxide with Controlled Morphology and Crystallinity by Atomic Layer Deposition onto Graphene Nanosheets for Enhanced Lithium Storage



Both amorphous and crystalline SnO_2 are deposited onto graphene nanosheets (GNS) using atomic layer deposition. The amorphous SnO_2 -GNS is more effective than the crystalline SnO_2 -GNS in overcoming electrochemical and mechanical degradation due to the intrinsically isotropic nature; it delivers a higher coulombic efficiency, higher energy capacity, and a superior cycling stability.



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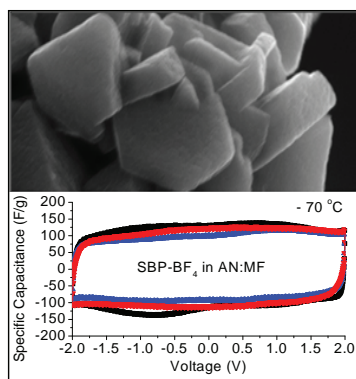
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FULL PAPERS

Uniform, microporous, zeolite-templated carbons produced at low pressures demonstrate excellent ion transport and electroadsorption in pores at low temperatures. When used with a carefully designed electrolyte, these properties allow for fabrication of supercapacitors with an unprecedented combination of high specific capacitance, rapid charging ability, and high energy density characteristics at ultralow temperatures.

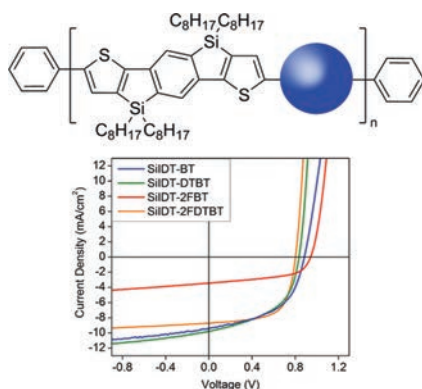


Supercapacitors

Y. Korenblit, A. Kajdos, W. C. West, M. C. Smart, E. J. Brandon, A. Kvit, J. Jagiello, G. Yushin*1655–1662

In Situ Studies of Ion Transport in Microporous Supercapacitor Electrodes at Ultralow Temperatures

Fluorine is introduced into silaindacenodithiophene based semiconducting polymers with the aim to improve the photovoltaic as well as the charge carrier properties. The influence of the thienyl spacers and fluorine atoms on molecular packing and active layer morphology of the new polymers is investigated with regard to device performance.

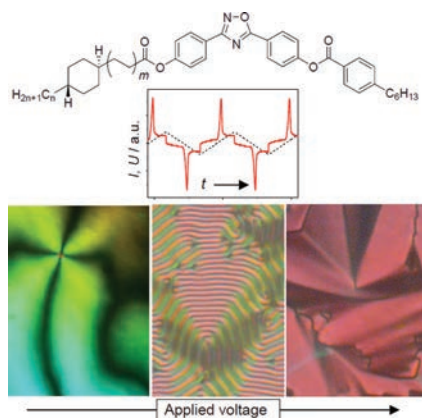


Solar Cells

B. C. Schroeder, Z. Huang, R. S. Ashraf,* J. Smith, P. D'Angelo, S. E. Watkins, T. D. Anthopoulos, J. R. Durrant, I. McCulloch1663–1670

Silaindacenodithiophene-Based Low Band Gap Polymers – The Effect of Fluorine Substitution on Device Performances and Film Morphologies

1,2,4-Oxadiazole-derived bent-core liquid crystals incorporating one or two cyclohexane rings form nematic phases composed of cybotactic clusters that show ferroelectric-like polar switching and electric field induced fan-like textures, representing special electro-convection patterns.

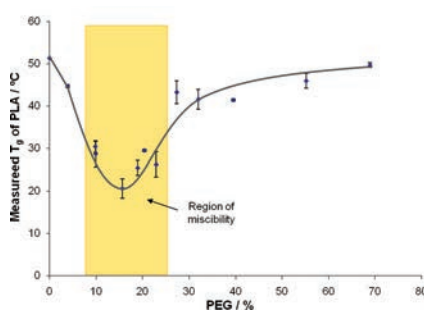


Liquid Crystals

G. Shanker, M. Nagaraj, A. Kocot, J. K. Vij, M. Prehm, C. Tschierske*1671–1683

Nematic Phases in 1,2,4-Oxadiazole-Based Bent-Core Liquid Crystals: Is There a Ferroelectric Switching?

Supercritical CO₂ (scCO₂) is used to blend polymers poly(D,L-lactic acid) (P_{DL}LA) and poly(ethylene glycol) (PEG) at surprisingly low temperatures. Differential scanning calorimetry (DSC) data highlight an unusual region of polymer miscibility between 8 and 25 wt% PEG. This miscibility region directly affects the viscosity of the blends in scCO₂ and the particle yield from spraying. The particles produced also confirm the presence of this miscibility region.



Polymers

C. A. Kelly, A. Naylor, L. Illum, K. M. Shakesheff, S. M. Howdle*1684–1691

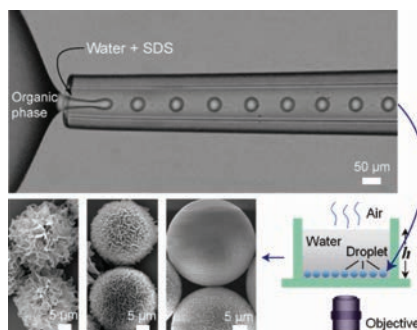
Supercritical CO₂: A Clean and Low Temperature Approach to Blending P_{DL}LA and PEG

FULL PAPERS

Microfluidics

S. Q. Liu, R. H. Deng, W. K. Li,
J. T. Zhu*1692–1697

**Polymer Microparticles with
Controllable Surface Textures
Generated through Interfacial
Instabilities of Emulsion Droplets**

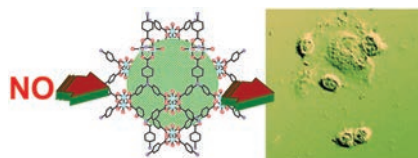


A facile, yet versatile approach to generate hierarchical polymer microparticles through interfacial instabilities of emulsion droplets is presented. This novel method allows a continuous fine tuning of surface textures and particle morphologies by varying cosurfactant content and/or solvent evaporation rate.

Sensors

P. Wu, J. Wang,* C. He, X. Zhang,
Y. Wang, T. Liu,*
C. Duan*1698–1703

**Luminescent Metal-Organic
Frameworks for Selectively Sensing
Nitric Oxide in an Aqueous Solution
and in Living Cells**

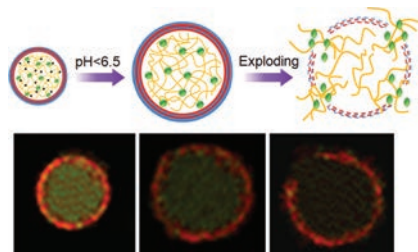


A new metal-organic framework (MOF)-based luminescence NO chemosensor with triphenylamine blue emitters is consolidated by the well-established $\text{Cu}_2(\text{O}_2\text{CR})_4$ paddlewheel units and successfully applied in luminescence detection of NO in aqueous solution and bioimaging of NO in living cells. The quenched triphenylamine-based emission is recovered upon encapsulating NO directly. The sensor exhibits excellent selectivity for NO over other reactive species in biological systems.

Drug Delivery

J. Zhang, X.-D. Xu, Y. Liu, C.-W. Liu,
X.-H. Chen, C. Li, R.-X. Zhuo,
X.-Z. Zhang*1704–1710

**Design of an “Active Defense” System
as Drug Carriers for Cancer Therapy**

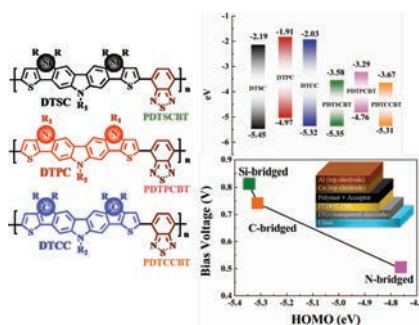


A novel intelligent “active defense” system that can specially respond to cancerous tissues and explosively release drugs is designed and demonstrated. This “active defense” system consists of a biodegradable dextran microgel core cross-linked by Schiff's base and a surrounding layer formed through layer by layer (LbL) assembly. It is triggered by the tumor environment to act as an exploding microcapsule.

Polymers

J.-S. Wu, Y.-J. Cheng,* T.-Y. Lin,
C.-Y. Chang, P.-I. Shih,
C.-S. Hsu*1711–1722

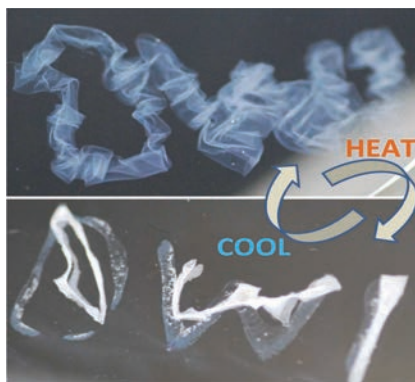
**Dithienocarbazole-Based Ladder-
Type Heptacyclic Arenes with Silicon,
Carbon, and Nitrogen Bridges:
Synthesis, Molecular Properties, Field-
Effect Transistors, and Photovoltaic
Applications**



A new class of alternating donor-acceptor copolymers containing ladder-type dithienosilolo-carbazole (DTSC), dithienopyrrolo-carbazole (DTPC), and dithienocyclopenta-carbazole (DTCC) units is developed. The photovoltaic device using poly(dithienosilolo-carbazole-*alt*-benzothiadiazole) (PDTSCBT) as the p-type material delivers a promising efficiency. The embedded silole units, which lower the highest occupied molecular orbital (HOMO) energy level of PDTSCBT, are responsible for the highest open circuit voltage value of the device.

FULL PAPERS

Responsive core/shell microparticles are used for the production of macroscopic materials such as films, fibers, and gels. Both aqueous and tetrahydrofuran gels are formed. By cross-linking of the particles, the temperature responsiveness of the particles is translated to the aqueous gels, films, and fibers, making them shrink and swell. This is used for post-incorporation of nanoparticles that can be taken up from the surrounding solution during swelling.

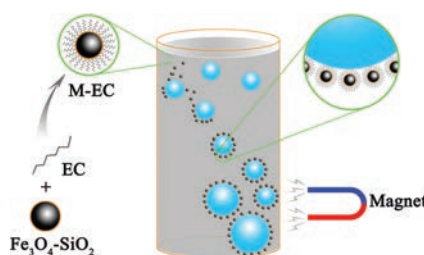


Self-Assembly

C. W. Pester, A. Konradi, B. Varnholt,
P. van Rijn,* A. Böker 1724–1731

Responsive Macroscopic Materials From Self-Assembled Cross-Linked SiO₂-PNIPAAm Core/Shell Structures

A novel interfacially active and magnetically responsive nanoparticle is designed and prepared by directly grafting bromoesterified ethyl cellulose (EC-Br) onto the surface of amine-functionalized magnetite (Fe₃O₄) nanoparticles. The tagging of stable emulsified water droplets by the resulting nanoparticles enhances coalescence and rapid separation of the emulsified water droplets by an external magnetic field.

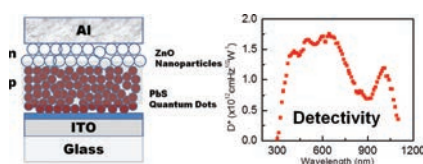


Magnetic Materials

J. Peng, Q. Liu, Z. Xu,*
J. Masliyah 1732–1740

Synthesis of Interfacially Active and Magnetically Responsive Nanoparticles for Multiphase Separation Applications

A schematic structure of a p–n junction photodiode, which comprises a nearly fully depleted p-type layer of PbS nanocrystal quantum dots and an n-type layer of ZnO nanoparticles, is shown. This device architecture allows us to significantly reduce noise current and obtain high detectivity of more than $10^{12} \text{ cm Hz}^{1/2} \text{ W}^{-1}$.

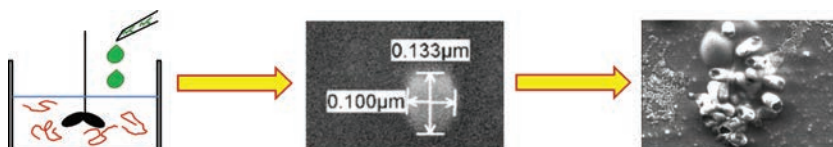


Quantum Dots

B. N. Pal, I. Robel, A. Mohite,
R. Laocharoensuk, D. J. Werder,
V. I. Klimov* 1741–1748

High-Sensitivity p–n Junction Photodiodes Based on PbS Nanocrystal Quantum Dots

Composite nanoparticles from cellulose acetate and a hydrophilic polysaccharide are prepared in situ using a nanoprecipitation technique. Hydrophilic polysaccharides of different charge and functionality can be applied, which allow very specific modification of the nanoparticle surfaces. The composite nanoparticles can be used for solubilizing hydrophobic compounds in an aqueous environment and for the nanostructuring of surfaces in order to introduce strong antimicrobial activities.



Nanoparticles

M. R. Kulterer,* V. E. Reichel, R. Kargl,
S. Köstler, V. Sarbova, T. Heinze,
K. Stana-Kleinschek,
V. Ribitsch* 1749–1758

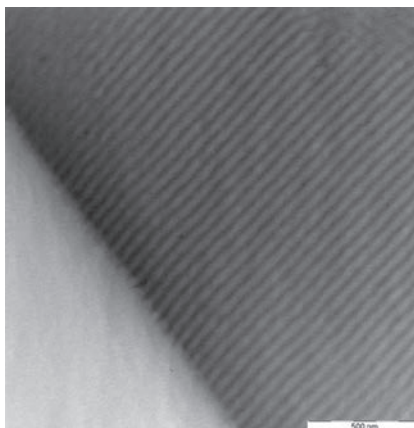
Functional Polysaccharide Composite Nanoparticles from Cellulose Acetate and Potential Applications

FULL PAPER

Membranes

M. G. Buonomenna,* G. Golemme,*
C. M. Tone, M. P. De Santo, F. Ciuchi,
E. Perrotta.....1759–1767

**Nanostructured Poly(styrene-*b*-butadiene-*b*-styrene) (SBS)
Membranes for the Separation of
Nitrogen from Natural Gas**



Tuning the morphology of poly(styrene-*b*-butadiene-*b*-styrene) (SBS) co-polymer membranes by means of the preparation procedure enhances the selective permeation of methane and CO₂. New SBS membranes with outstanding gas separation properties are reported.