

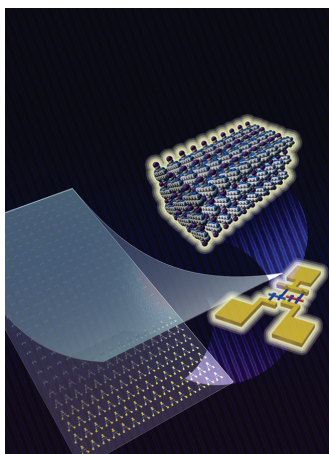
ADVANCED FUNCTIONAL MATERIALS

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Shape-Memory Materials

Vascularization in complex organisms plays an important role in reducing the characteristic diffusion length scale of tissue structures with large dimensions. This work by C. J. Bettinger and co-workers defines biomimetic strategies for vascularization of synthetic shape-memory materials. On page 4832, embedded microvascular networks accelerate phase transitions and increase recovery rates in stimuli-responsive polymers by reducing the characteristic diffusion length scale of the bulk material.

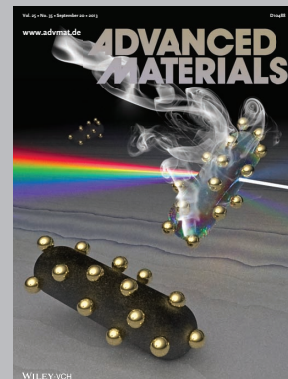
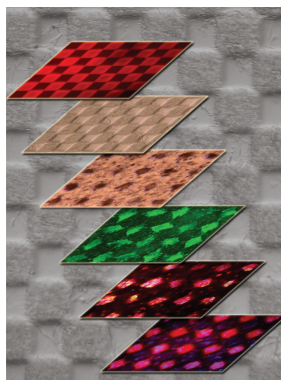


Molecular Electronics

Single-crystal organic nanowires are synthesized by M. M. Sung and co-workers using the self-assembly and crystallization of organic molecules within nanoscale channels of molds. The nanowires are then directly transferred to specific positions on substrates to generate nanowire arrays via a direct printing process, liquid-bridge-mediated nanotransfer molding. On page 4776, repeated application of the direct printing process is used to produce organic nanowire-integrated electronics with two- or three-dimensional complex structures on large-area flexible substrates.

Micropatterning

3D, dual-crosslinked, oxidized hydrogels with spatially tunable physical properties are micropatterned on page 4765 by O. Jeon and E. Alsberg. Photoencapsulated human adipose-derived stem cell proliferation rate and osteogenic and chondrogenic differentiation are found to be functions of the micropattern size. The physical properties in this system therefore introduce a new parameter for regulating various cellular behaviors, and a novel platform for studying the proliferation and differentiation of stem cells in a spatially controlled manner for tissue engineering and regenerative medicine applications.



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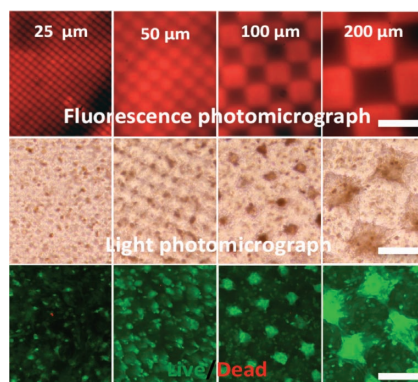
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FULL PAPERS

Micropatterning

O. Jeon, E. Alsberg*4765–4775

Regulation of Stem Cell Fate in a Three-Dimensional Micropatterned Dual-Crosslinked Hydrogel System



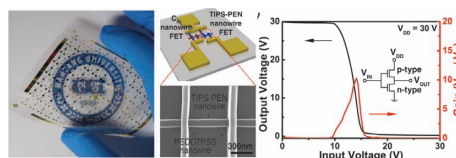
Three-dimensional micropatterning of dual-crosslinked oxidized, methacrylated alginate (OMA)/8-arm PEG amine (PEG) hydrogels containing human adipose-derived stem cells (hASCs) is employed to regulate hASC fate. The micropatterned dual-crosslinked OMA/PEG hydrogels for hASC encapsulation yield relatively uniform cell clusters, which scale in size with micropatterned dimensions.

Molecular Electronics

K. S. Park, B. Cho, J. Baek, J. K. Hwang, H. Lee, M. M. Sung*4776–4784

Single-Crystal Organic Nanowire Electronics by Direct Printing from Molecular Solutions

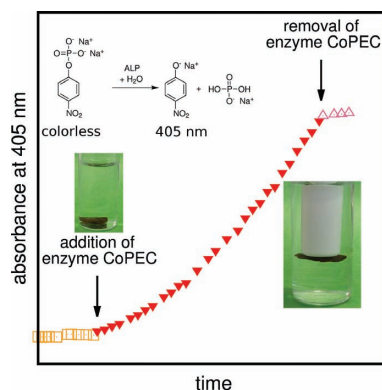
Single-crystal organic nanowire arrays are generated by a direct printing method that enables the simultaneous synthesis, alignment, and patterning of nanowires. Repeated application of the direct printing process can be used to produce high-performance organic nanowire-integrated electronics with two- or three-dimensional complex structures.



Hydrogels

P. Tirado, A. Reisch, E. Roger, F. Boulmedais, L. Jierry, P. Lavalley, J.-C. Voegel, P. Schaaf, J. B. Schlenoff, B. Frisch*4785–4792

Catalytic Saloplastics: Alkaline Phosphatase Immobilized and Stabilized in Compacted Polyelectrolyte Complexes

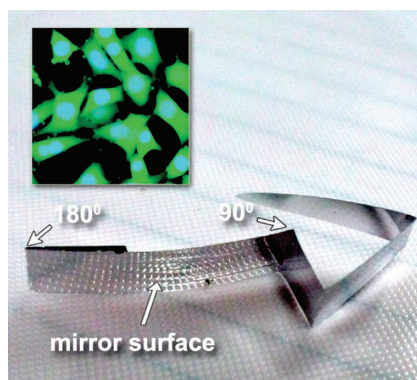


Alkaline phosphatase (ALP) is immobilized in compact polyelectrolyte complexes (CoPECs). The materials obtained in this way retain the biocatalytic activity of the enzyme, protect it from elevated temperature, and allow its fine tuning by salt concentration and temperature. Co-immobilization of magnetic particles yields easily handleable magnetic materials.

Metallic Glass

H.-J. Yu, J.-Q. Wang,* X.-T. Shi, D. V. Louzguine-Luzgin, H.-K. Wu,* J. H. Perepezko*4793–4800

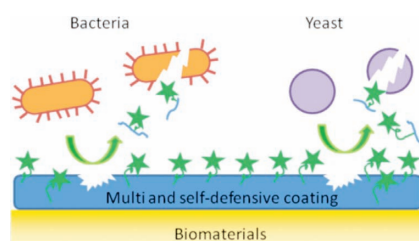
Ductile Biodegradable Mg-Based Metallic Glasses with Excellent Biocompatibility



Mg-based metallic glasses have good ductility and excellent cell compatibility when properly alloyed by Yb. The good bending and tensile ductility is likely due to the formation of dense shear bands and large plastic zones. The improved cell compatibility can be attributed to the good corrosion resistance and the reduced release of cations and hydrogen.

FULL PAPERS

Polysaccharide multilayer films, based on antimicrobial peptide functionalized hyaluronic acid as polyanion and chitosan as polycation, are deposited on planar surfaces with the aim of designing a self-defensive coating against both bacteria and yeasts.

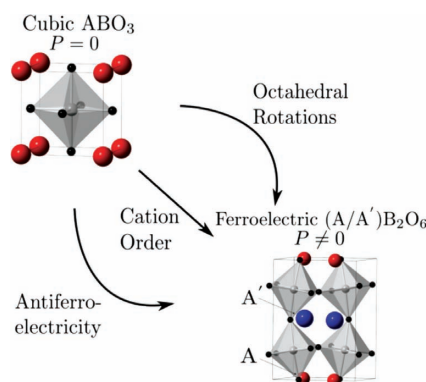


Antimicrobial Coatings

G. Cado, R. Aslam, L. Séon, T. Garnier, R. Fabre, A. Parat, A. Chassepot, J.-C. Voegel, B. Senger, F. Schneider, Y. Frère, L. Jierry, P. Schaaf, H. Kerdjoudj, M.-H. Metz-Boutigue, F. Boulmedais*4801–4809

Self-Defensive Biomaterial Coating Against Bacteria and Yeasts: Polysaccharide Multilayer Film with Embedded Antimicrobial Peptide

A microscopic theory for hybrid improper ferroelectrics is reported, whereby a spontaneous polarization emerges from an antiferroelectric state owing to the combination of octahedral rotations and cation ordering. A materials design framework is constructed based on crystal-chemistry descriptors rooted in group theory, enabling the design of artificial oxides with large electric polarizations and small energetic switching barriers.

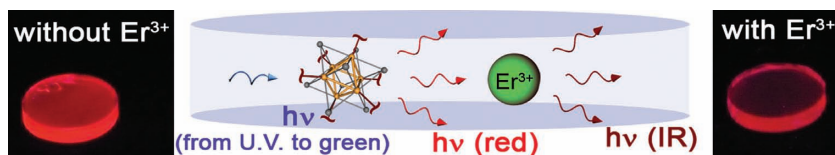


Ferroelectrics

A. T. Mulder, N. A. Benedek, J. M. Rondinelli, C. J. Fennie* ... 4810–4820

Turning ABO₃ Antiferroelectrics into Ferroelectrics: Design Rules for Practical Rotation-Driven Ferroelectricity in Double Perovskites and A₃B₂O₇ Ruddlesden-Popper Compounds

Integrating Er³⁺ ions in a hybrid Mo₆-PMMA hybrid matrix enables the sensitization of its IR photoluminescence upon irradiation anywhere in the octahedral metallic cluster absorption band. Meanwhile, it causes a noticeable decrease of the Mo₆ red luminescence. Mo₆ clusters being covalently linked to polymer strands, the hybrid material shows excellent aging behavior, leaving promising perspectives for telecom applications.



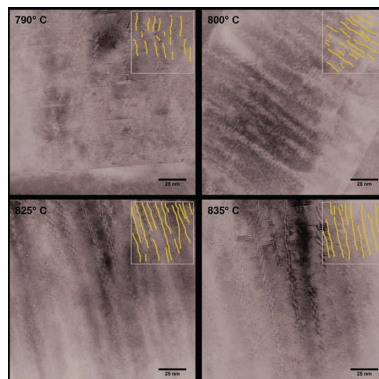
Luminescence

Y. Molard,* C. Labbé, J. Cardin, S. Cordier4821–4825

Sensitization of Er³⁺ Infrared Photoluminescence Embedded in a Hybrid Organic-Inorganic Copolymer containing Octahedral Molybdenum Clusters



Average BaZrO₃ nanorod lengths are shown to increase at a significantly higher rate in YBa₂Cu₃O_{7-x}, compared to composite films double-doped with Y₂O₃ nanoparticles and BaZrO₃, when the growth temperature is increased. From this, the significance of interactive effects between dopants is demonstrated; this can provide additional control over nanostructured composite films.



Thin Films

F. J. Baca,* T. J. Haugan, P. N. Barnes, T. G. Holesinger, B. Maiorov, R. Lu,* X. Wang, J. N. Reichart, J. Z. Wu*4826–4831

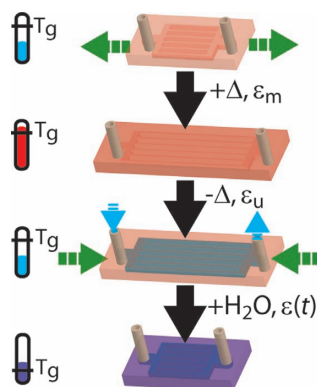
Interactive Growth Effects of Rare-Earth Nanoparticles on Nanorod Formation in YBa₂Cu₃O_x Thin Films

FULL PAPERS

Shape-Memory Materials

A. Balasubramanian, R. Morhard,
C. J. Bettinger*4832–4839

Shape-Memory Microfluidics

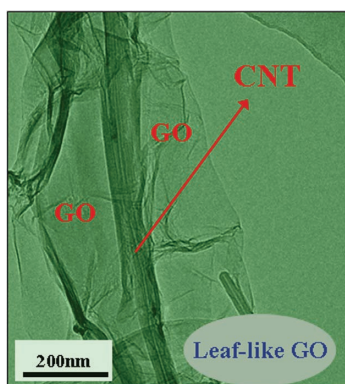


Vascularization in complex organisms plays an important role in reducing the characteristic diffusion length scale of tissue structures with large dimensions. This strategy is recapitulated in synthetic shape-memory materials. Vascular networks accelerate phase transitions and increase recovery rates in stimuli-responsive polymers by reducing the characteristic diffusion length scale of the bulk material.

Energy Storage

Z. Y. Guo, J. Wang, F. Wang,
D. D. Zhou, Y. Y. Xia,*
Y. G. Wang*4840–4846

Leaf-like Graphene Oxide with a Carbon Nanotube Midrib and Its Application in Energy Storage Devices



A novel leaf-like graphene oxide (GO) with a carbon nanotube (CNT) midrib is prepared from vapor growth carbon fiber (VGCF) using the conventional Hummers method. The CNT midrib provides a natural electron diffusion path for this leaf-like GO, and therefore, this leaf-like GO with a CNT midrib displays excellent performance when applied in energy storage devices, including Li-O₂ batteries, Li-ion batteries, and supercapacitors.

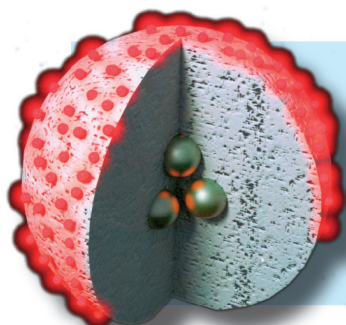
Nanostructures

H. K. Wang, K. P. Dou, W. Y. Teoh,
Y. W. Zhan, T. F. Hung, F. H. Zhang,
J. Q. Xu, R. Q. Zhang,*
A. L. Rogach*4847–4853

Engineering of Facets, Band Structure, and Gas-Sensing Properties of Hierarchical Sn²⁺-Doped SnO₂ Nanostructures



Flower-like hierarchical SnO₂ nanostructures are assembled from single-crystalline SnO₂ nanosheets with high-index (11 $\bar{3}$) and (10 $\bar{2}$) exposed facets. Sn²⁺ self-doping leads to formation of tunable oxygen vacancy bandgap states and extended absorption in the visible spectral range. This work highlights the possibility of simultaneous engineering of surface energetics and electronic properties of SnO₂ based materials.



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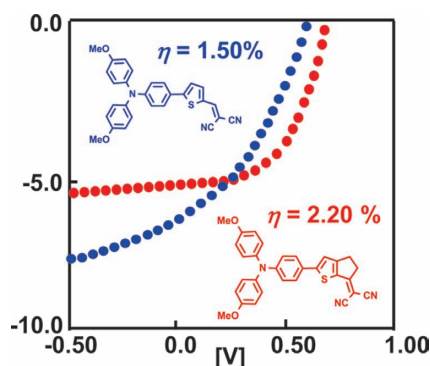
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FULL PAPERS

Covalent bridging of the dicyanovinyl group with the adjacent thiophene ring of small push-pull molecular donors based on triaryl amines leads to a significant improvement of the efficiency of the resulting organic solar cells due to the simultaneous increase of the fill factor and open-circuit voltage.

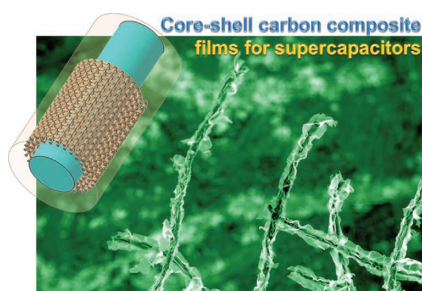


Organic Solar Cells

D. Demeter, V. Jeux, P. Leriche, P. Blanchard, Y. Olivier, J. Cornil, R. Po, J. Roncali*4854–4861

Tuning of the Photovoltaic Parameters of Molecular Donors by Covalent Bridging

Direct synthesis of multi-layer graphene and porous carbon woven composite films by chemical vapor deposition is reported. The composite films integrate the dual advantages of graphene and porous carbon, having not only the excellent electrical properties and flexibility of graphene but also the porous characteristics of amorphous carbon, creating a new platform for a variety of applications, such as supercapacitors.



Supercapacitors

X. Li, X. B. Zang, Z. Li, X. M. Li, P. X. Li, P. Z. Sun, X. Lee, R. J. Zhang, Z. H. Huang, K. L. Wang, D. H. Wu, F. Y. Kang, H. W. Zhu*4862–4869

Large-Area Flexible Core–Shell Graphene/Porous Carbon Woven Fabric Films for Fiber Supercapacitor Electrodes