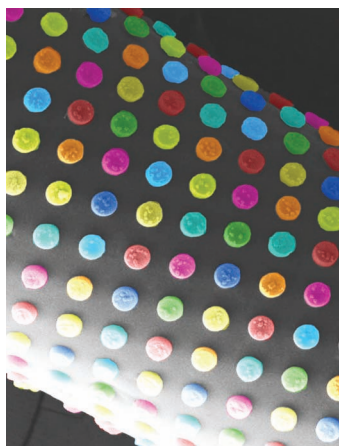


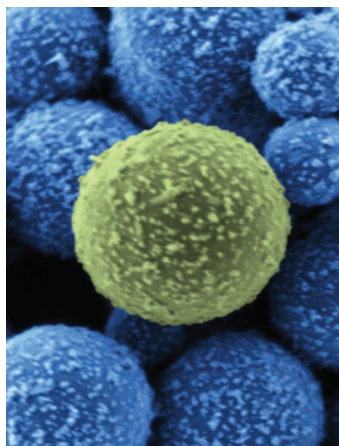
ADVANCED FUNCTIONAL MATERIALS

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Bioactive Membranes

Folded bioactive membranes are made in a single-step process via the self-assembly of multidomain peptides with hyaluronic acid in combination with soft-lithography. As Alvaro Mata and co-workers report on page 430, the hierarchical membrane exhibits well-defined functional nanofibers bearing biomolecular signals and precise post micropatterns. These bioactive membranes have broad potential applications in tissue engineering and regenerative medicine.

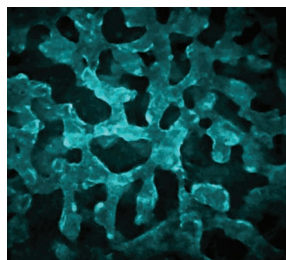


Organic–Inorganic Hybrids

Functional metal oxide/polymer hybrids with diverse properties (magnetic, optical, and catalytic) are prepared from both aqueous and alcoholic media. As reported on page 451 by Katharina Landfester, Rafael Muñoz-Espí, and co-workers, the inorganic nanocrystals are precipitated in situ on the surface of functionalized polymer particles. The image shows iron oxide nanoparticles on the surface of functionalized polystyrene beads.

Rheology

The origins of viscoelasticity in bijels are investigated for the first time to elucidate links between the physicochemical properties of bijels and their ability to be used as soft scaffolds for advanced materials synthesis. On page 417, Ali Mohraz and co-workers report that robust and flexible bijel processing is linked to trapping of the interfacial colloids in a primary van der Waals minimum.



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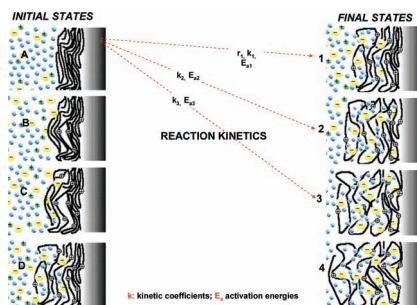
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FEATURE ARTICLE

Chemical Kinetics

T. F. Otero,* J. G. Martinez.....404–416

Structural and Biomimetic Chemical Kinetics: Kinetic Magnitudes Include Structural Information



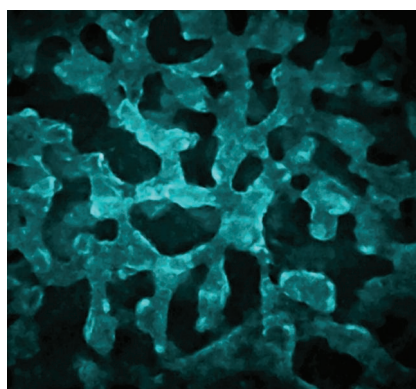
Reaction coefficients, activation energies, and reaction orders for a reaction change are reported for different packed conformational structures selected as the initial state. The kinetic magnitudes include quantitative information about the structural conformational state of the chains and the chemical kinetics become structural chemical kinetics. The results are described using the electrochemically stimulated conformational relaxation (ESCR) model.

FULL PAPERS

Rheology

M. N. Lee, J. H. J. Thijssen, J. A. Witt, P. S. Clegg, A. Mohraz* 417–423

Making a Robust Interfacial Scaffold: Bijel Rheology and its Link to Processability

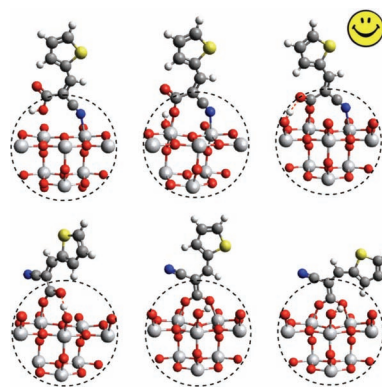


The origins of viscoelasticity in bijels are investigated for the first time to elucidate links between the physicochemical properties of bijels and their ability to be used as soft scaffolds for advanced materials synthesis. Robust and flexible bijel processing is linked to trapping of the interfacial colloids in a primary van der Waals minimum.

Solar Cells

Y. Jiao, F. Zhang, M. Grätzel, S. Meng*424–429

Structure–Property Relations in All-Organic Dye-Sensitized Solar Cells

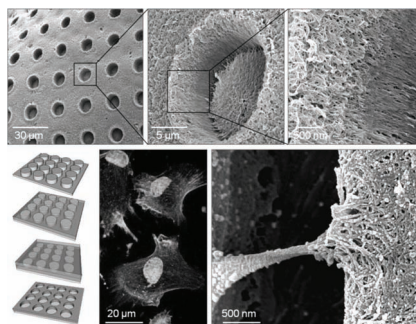


An important structural feature at the interface, Ti–N anchoring, is inferred from energetics, vibrational, and electronic data for a broad group of all-organic dyes on TiO₂. This feature contributes to the observed efficiency improvement in all-organic cyanoacrylate dye-sensitized solar cells. The main results are based on first-principles molecular dynamics and real-time time-dependent density functional theory simulations, accompanied with experimental confirmation.

Self-Assembly

A. C. Mendes, K. H. Smith, E. Tejeda-Montes, E. Engel, R. L. Reis, H. S. Azevedo, A. Mata* 430–438

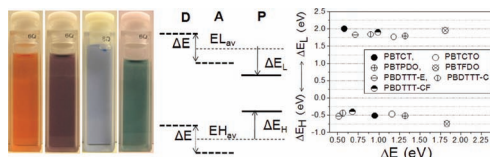
Co-Assembled and Microfabricated Bioactive Membranes



Hierarchically structured self-assembled membranes that incorporate both biomolecular and topographical signaling elements are fabricated in a single step process. The spontaneous co-assembly of hyaluronic acid and a multidomain peptide of opposite charge guided by microfabricated structures provides a simple method for producing a complex membrane scaffold for tissue engineering applications.

FULL PAPERS

A strong acceptor lowers both the highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) levels of conjugated polymers (CPs), ultimately producing a narrowed band-gap. The energy level difference between the CP and the constituent monomers converge to a constant value, providing an energy level prediction tool. Organic photovoltaic performance is correlated with the CP's energy levels, and a 6.78% power conversion efficiency is achieved.

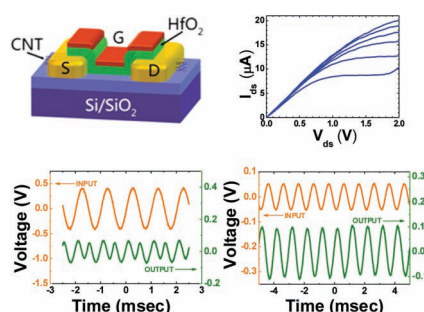


Photovoltaics

B.-G. Kim, X. Ma, C. Chen, Y. Ie, E. W. Coir, H. Hashemi, Y. Aso, P. F. Green, J. Kieffer, J. Kim*.....439–445

Energy Level Modulation of HOMO, LUMO, and Band-Gap in Conjugated Polymers for Organic Photovoltaic Applications

Field-effect transistors fabricated on large diameter carbon nanotubes can be used as the core to realize multifunctional AC circuits, including a high-efficiency ambipolar frequency doubler, in-phase amplifier, and inverted amplifier. An AC amplifier with voltage gain of 2 is realized due to current saturation of the carbon nanotube field-effect transistors.

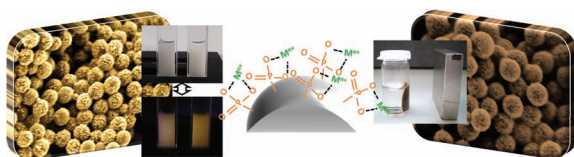


Carbon Nanotubes

Z. X. Wang, Z. Y. Zhang,* H. Zhong, T. Pei, S. B. Liang, L. J. Yang, S. Wang, L.-M. Peng*.....446–450

Carbon Nanotube Based Multifunctional Ambipolar Transistors for AC Applications

Functional metal oxide/polymer hybrids with diverse properties (magnetic, optical, and catalytic) are prepared from both aqueous and alcoholic media. Surface-functionalized polymer particles with phosphonate and phosphate groups are synthesized with specifically designed surface-active monomers (surfmers) and used as nucleation surfaces for the controlled in situ crystallization of cerium, iron, and zinc oxide nanocrystals.

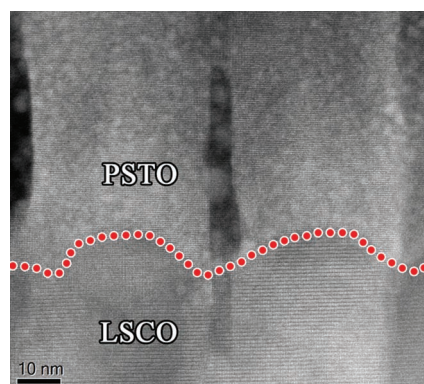


Hybrid Materials

V. Fischer, I. Lieberwirth, G. Jakob, K. Landfester,* R. Muñoz-Espí*....451–466

Metal Oxide/Polymer Hybrid Nanoparticles with Versatile Functionality Prepared by Controlled Surface Crystallization

The possibility to tailor ferroelectricity by controlling epitaxial strain in thin films and heterostructures of complex metal oxides is well established. It is demonstrated that apart from this mechanism, 3D film growth during heteroepitaxy can be employed to favor specific domain configurations that lead to step-like polarization switching and a giant nonlinear dielectric response in sub-switching AC electric fields.



Structure–Property Relationships

M. Tyunina,* L. Yao, M. Plekh, J. Levoska, S. van Dijken*467–474

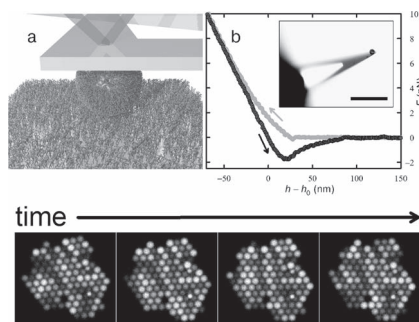
Epitaxial Ferroelectric Heterostructures with Nanocolumn-Enhanced Dynamic Properties

FULL PAPERS

Self-Assembly

T. E. Kodger, J. Sprakel*475–482

Thermosensitive Molecular, Colloidal, and Bulk Interactions Using a Simple Surfactant

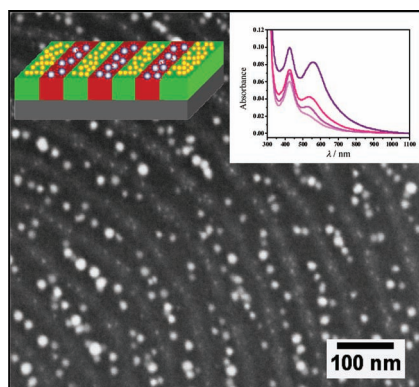


A simple method of rendering the interactions between nanoparticles thermosensitive using a thermoresponsive surfactant is described. The surfactant, based on poly(*N*-isopropylacrylamide) (pNIPAm), passively adsorbs to surfaces, eliminating the necessity for chemical surface modification. This interaction and resulting self-assembly is investigated using colloid probe atomic force microscopy (CP-AFM), rheology, and confocal microscopy.

Composite Materials

A. Horechyy,* B. Nandan,*
N. E. Zafeiropoulos,
P. Formanek, U. Oertel,
N. C. Bigall, A. Eychmüller,
M. Stamm*483–490

A Step-Wise Approach for Dual Nanoparticle Patterning via Block Copolymer Self-Assembly

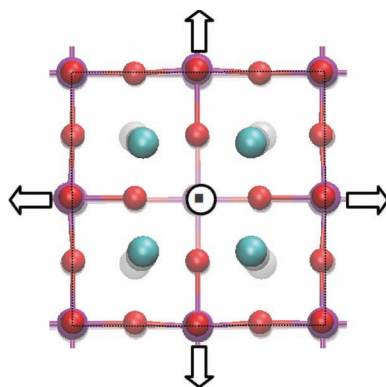


Ternary composites composed of two types of pre-synthesized nanoparticles selectively localized in different domains of a microphase-separated poly(styrene-*b*-vinylpyridine) block copolymer (BCP) are prepared using a step-wise approach. The BCP thin films containing polystyrene-coated silver nanoparticles (NP1) are prepared to give the NP1/BCP composites. Citrate-stabilized secondary nanoparticles (NP2) are then deposited from their aqueous dispersion atop of the poly(vinylpyridine) microdomains to give ordered ternary NP1/NP2/BCP structures.

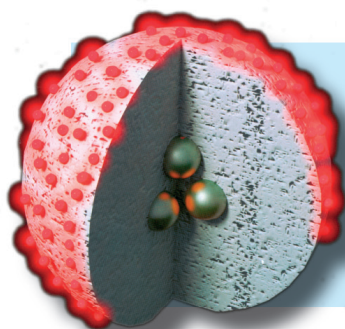
Ferroelectric Materials

C. L. Freeman,* J. A. Dawson,
J. H. Harding, L.-B. Ben,
D. C. Sinclair491–495

The Influence of A-Site Rare Earth Ion Size in Controlling the Curie Temperature of $\text{Ba}_{1-x}\text{RE}_x\text{Ti}_{1-x/4}\text{O}_3$



Computer simulations show that local relaxations around defect clusters explain the effect of rare-earth doping on the Curie temperature in BaTiO_3 . La and Gd induce similar relaxations, leading to distortion and tilting of the surrounding TiO_6 octahedra. Larger distortions are observed for La, consistent with the greater lowering of the Curie temperature.



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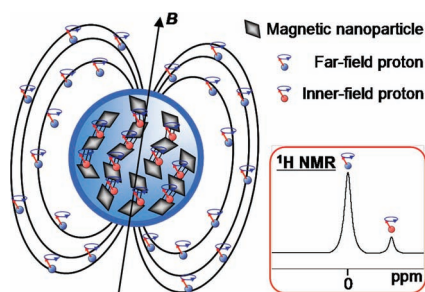
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FULL PAPERS

A new method is proposed that uses **superparamagnetic contrast agents** to generate positive contrast in magnetic resonance imaging (MRI). The nanostructure consists of octahedral manganese ferrite nanoparticles embedded in spherical nanogels. The nanocomposites are strongly magnetized in an external magnetic field and produce a unique NMR frequency shift in water protons. This structure shows potential for use in MR spectroscopic imaging.

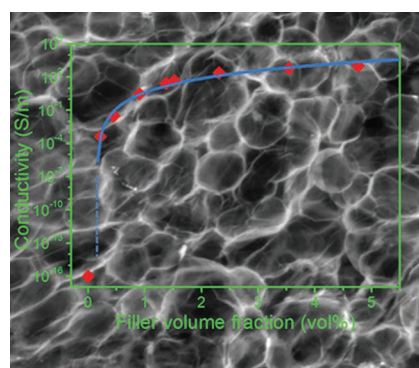


Biomedical Applications

E. S. G. Choo, E. Peng, R. Rajendran, P. Chandrasekharan, C.-T. Yang, J. Ding, K.-H. Chuang,* J. M. Xue*496–505

Superparamagnetic Nanostructures for Off-Resonance Magnetic Resonance Spectroscopic Imaging

A simple and effective route to fabricate **polymer composites** with 3D interconnected graphene networks using a self-assembly and hot-press process is presented. The obtained composites exhibit a very high conductivity at low graphene loading.

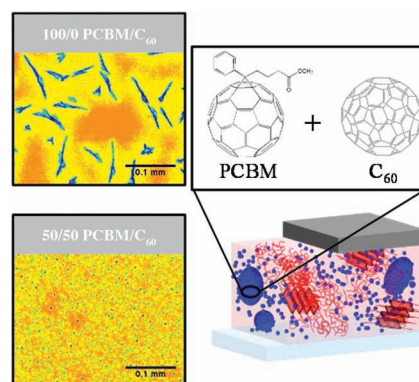


Nanocomposites

C. Wu, X. Huang,* G. Wang,* L. Lv, G. Chen, G. Li, P. Jiang*506–513

Highly Conductive Nanocomposites with Three-Dimensional, Compactly Interconnected Graphene Networks via a Self-Assembly Process

A simple strategy for the reduction of the size of large [6,6]-phenyl C_{61} butyric acid methyl ester (PCBM) crystallites is reported. The addition of C_{60} to the fullerene phase of poly(3-hexylthiophene) (P3HT)/PCBM solar cells provides a simple means to reduce the size of large PCBM aggregates that lead to the degradation of performance at operational temperatures and thereby improve the long-term performance of such devices.



Solar Cells

J. J. Richards, A. H. Rice, R. D. Nelson, F. S. Kim, S. A. Jenekhe, C. K. Luscombe, D. C. Pozzo*514–522

Modification of PCBM Crystallization via Incorporation of C_{60} in Polymer/Fullerene Solar Cells