ADVANCED FUNCTIONAL MATERIALS

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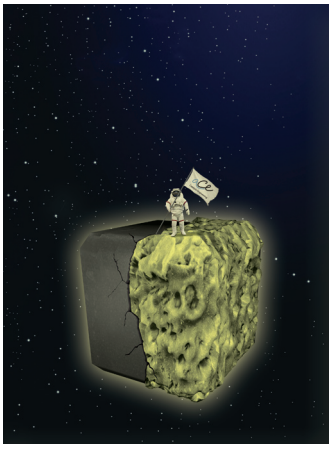
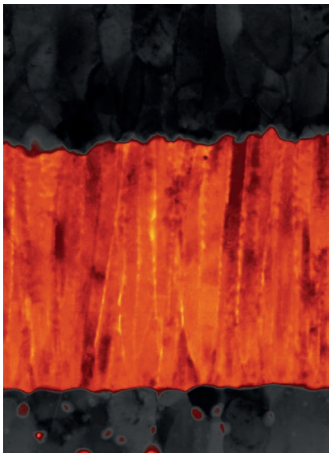


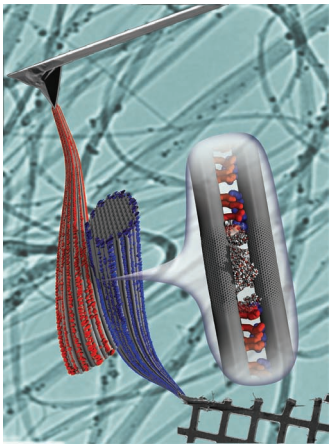
Zeolites

On page 1923 Javier Pérez-Ramírez and co-workers establish methods involving acid and optionally base treatments to prepare hierarchical FAU and LTA-type zeolites. By conquering the latter Al-rich frameworks, the full compositional and topological flexibility desired in the design of hierarchical zeolites by post-synthetic strategies is accomplished. Upon functionalization, the mesoporous X, Y, and A zeolites display superior performance as base catalysts. Carolina Flores is acknowledged for perfecting the cover artwork.

Thin Films

On page 1957 Barbara Scherrer and co-workers report changes in electrical conductivity at low temperatures that occur when grain size, grain shape, and the porosity of nanoporous zirconia-based thin films are varied. The cover image shows a false-colored scanning transmission electron microscopy (STEM) image of a yttria stabilized zirconia (YSZ) thin film with a thickness of about 300 nm contacted with platinum. The bright areas within the YSZ thin film are pores, which conduct protons at temperatures below 400 °C.





Carbon Nanotubes

On page 1883 Markus J. Buehler, Horacio D. Espinosa, and co-workers report a study designed to probe the interfacial shear strength between carbon nanotube (CNT) bundles, which is a key element in the bottom-up hierarchical design of CNT fibers with unprecedented mechanical performance. The back cover image blends renderings from atomistic and coarse-grain molecular dynamics simulations with scanning electron microscopy images of shearing between surface-functionalized double-walled nanotube (DWNT) bundles. The background shows a mat of CNT bundles from which a pair of bundles is selected for testing.

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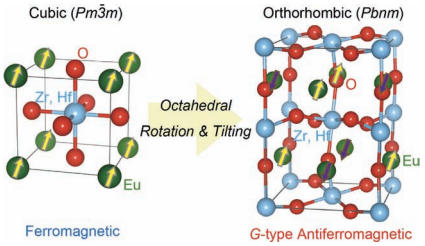
FULL PAPERS

Perovskites

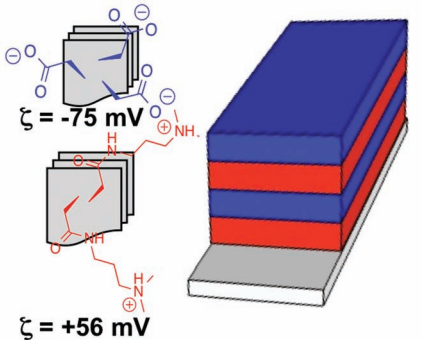
Strong Spin-Lattice Coupling Through Oxygen Octahedral Rotation in Divalent Europium Perovskites



First-principles calculations reveal that in divalent europium perovskites $EuMO_3$ (M = Ti, Zr, and Hf), antiferomagnetic superexchange interactions via nd states of the B-site M cations (n = 3, 4, and 5, respectively) are enhanced by rotations of the MO_6 octahedra. The octahedral rotations involved in a structural change from cubic $Pm\bar{3}m$ to orthorhombic $Pbnm$ structures point the M nd orbitals at the Eu sites, leading to a significant overlap between the M nd and Eu 4f orbitals.

Graphene

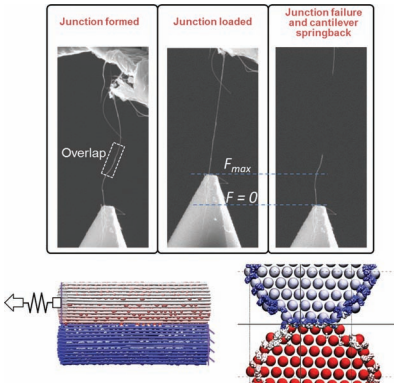
Functional Graphenic Materials Via a Johnson–Claisen Rearrangement



The hydroxyl functionalities in graphene oxide (GO) are subjected to Johnson–Claisen rearrangement conditions, which trades the labile CO bond for a robust CC bond. Further functionalization allows for the synthesis of highly charged, water-soluble graphene. The negatively and positively charged graphenes (zeta potentials of –75 mV and +56 mV), are successfully used to build layer-by-layer (LBL) constructs.

Carbon Nanotubes

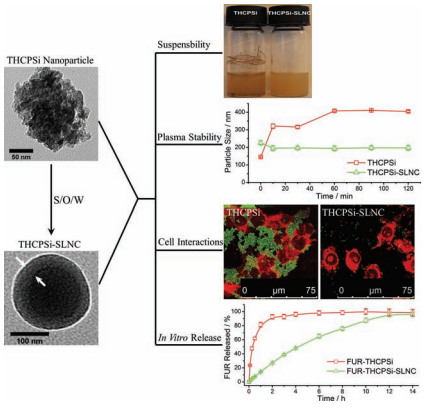
Atomistic Investigation of Load Transfer Between DWNT Bundles "Crosslinked" by PMMA Oligomers



In situ chemical vapor deposition functionalization of CNT bundles by PMMA-like oligomers enhances the shear strength of the bundle junctions by about an order of magnitude compared with "bare" van der Waals (vdW) interactions between pristine CNTs. Through a combination of nanomechanics experimental studies and multiscale simulations, the enhancement of shear strength is attributed to an interlocking mechanism of polymer chains in the bundles, dominated by vdW interactions, and stretching and alignment of chains during shearing.

Drug Delivery

Nanostructured Porous Silicon-Solid Lipid Nanocomposite: Towards Enhanced Cytocompatibility and Stability, Reduced Cellular Association, and Prolonged Drug Release



Thermally hydrocarbonized porous silicon–solid lipid nanocomposites (THCPSi–SLNCs) on a ratio 1:1 prepared by the solid-in-oil-in-water emulsion solvent evaporation method are produced in order to enhance the suspensibility of the nanoparticles and the stability against aggregation in aqueous buffer solutions, as well as to increase the particle surface smoothness and cytocompatibility, reduce the particle's cellular association, increase the in vitro stability in human plasma, and prolong the loaded drug release.

FULL PAPERS

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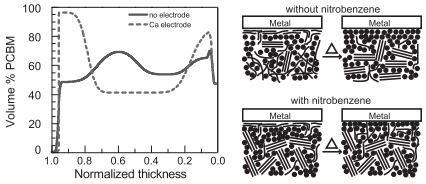
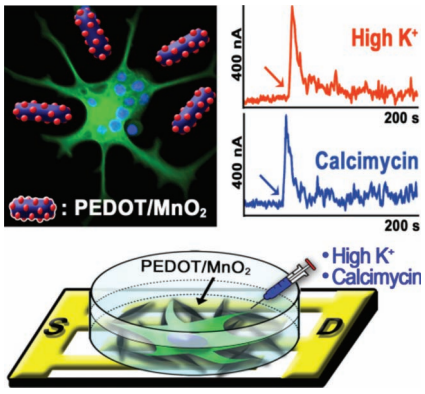
Photovoltaic Devices



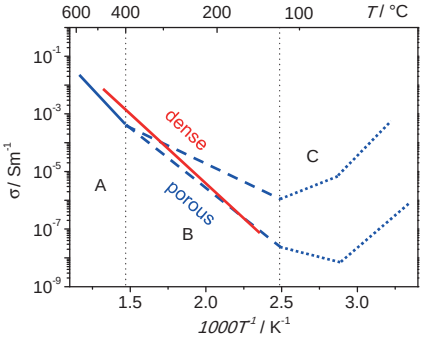
It is shown that the metal capping electrode in an organic photovoltaic device affects the stratification of materials in the bulk heterojunction (BHJ) and that solvent additives can inhibit stratification. It is found that some metals can donate charge to (6,6)-phenyl-C_{61}-butyric acid methyl ester (PCBM). The enrichment and charging of PCBM at the interface with the metal increases device power conversion efficiency.

Bioelectronics

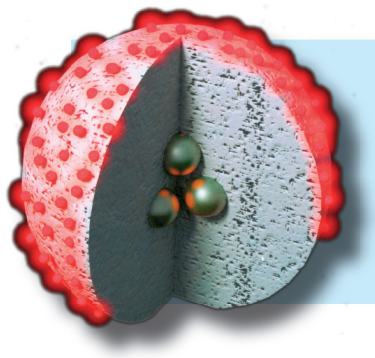


A poly(3,4-ethylenedioxythiophene) (PEDOT)/MnO_2 nanoellipsoid is fabricated for facilitating the neurite outgrowth during differentiation and detecting exocytized biomolecules from PC12 cells. PC12 cells co-incubated with PEDOT/MnO_2 nanoellipsoids and nerve growth factor demonstrate enhanced neurite outgrowth. Exocytosis of catecholamines is electrically detected by a PEDOT/MnO_2 nanoellipsoid sensor.

Thin Films



The electrical conductivity below 400 °C of porous yttria stabilized zirconia (YSZ) deviates from the oxygen-ion conductivity due to proton conduction via chemisorbed water in the form of hydroxyl groups at the inner surface. Below 120 °C, proton conductivity via physisorbed water in the nanoporous microstructures sets in (Grotthuss mechanism). Dense thin films show oxygen-ion conductivity only and no proton conductivity is present.



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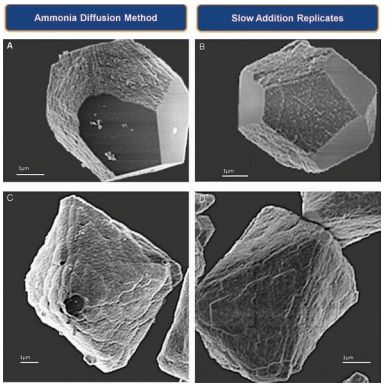
Elucidation of the changes in solution that accompany $CaCO_3$ precipitation by the widely used ammonia diffusion method enables replication of calcite mesocrystals via a simple and highly reproducible titration-based method. The experiments also demonstrate that aggregation-based growth, which generates these complex structures, is promoted by high and constant supersaturation levels, giving insight into the mechanisms of mesocrystal formation.



Crystallization