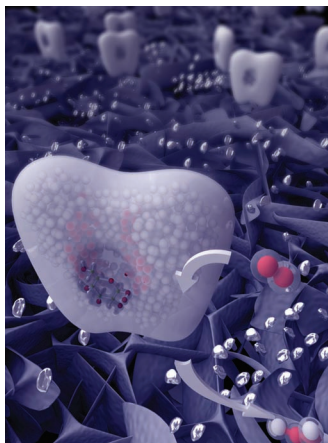


ADVANCED FUNCTIONAL MATERIALS

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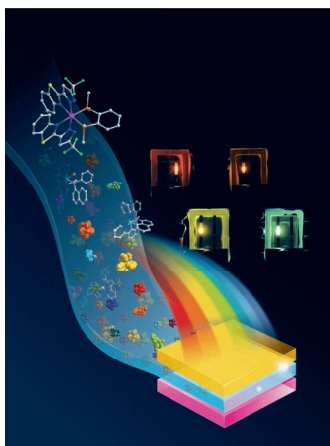


Biosensors

The enzyme glucose oxidase is immobilized on a 3D matrix consisting of multilayered graphene petal nanosheets peppered with Pt nanoparticles. Glucose binds within the enzyme pocket producing H_2O_2 , while consuming O_2 , during electrochemical glucose sensing. As reported on page 3399 by Timothy S. Fisher and co-workers the size, morphology, and density of the Pt nanoparticles are manipulated to enhance sensor performance. Enzymes are enlarged to illustrate functionality.

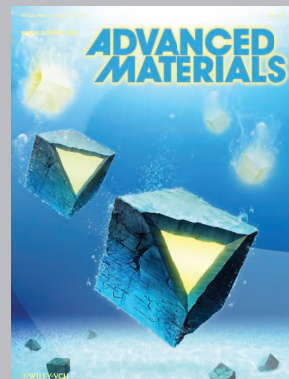
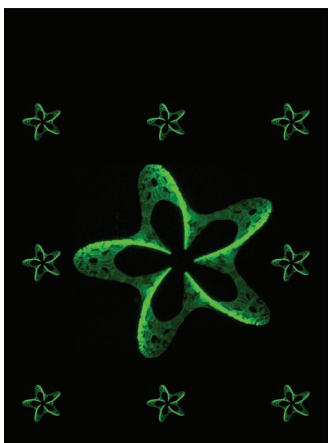
Organic Light-Emitting Diodes

Preparation and characterization of a new class of emissive Os(II) complexes is reported by Hao-Wu Lin, Yun Chi, Pi-Tai Chou, and co-workers on page 3491. The complexes all show bright emission spanning the visible region from green to saturated red and a series of solution-processed organic light-emitting diodes (OLEDs) using the complexes as the dopant are successfully fabricated, demonstrating excellent device performance with an external quantum efficiency of 15% and power efficiency of up to 50 lm W^{-1} .



3D Photografting

This $180 \mu\text{m}$ wide, 3D pattern is produced by laser-induced immobilization of fluorescent molecules onto a polymeric matrix. On page 3429 Aleksandr Ovsianikov, Robert Liska, and co-workers report a versatile and straightforward photografting method based on photolysis of an aromatic azide via multiphoton absorption. Because multiphoton-induced reactions occur in a confined area within the laser focal spot, accurate functionalization with high spatial resolution in 3D is possible. The presented results indicate the great potential of the 3D, site-specific, functionalization method for applications in microarray-based proteome analysis, studies of cell-surface interactions, sensing applications, and drug screening.



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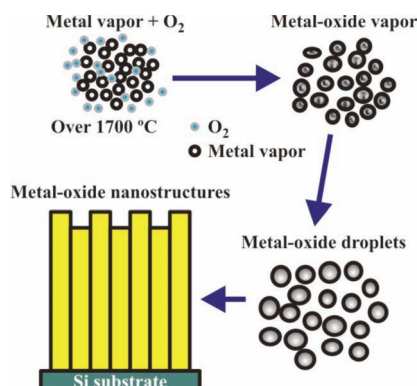
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FEATURE ARTICLE

Metal-Oxide Nanostructures

R. S. Devan, R. A. Patil, J.-H. Lin,
Y.-R. Ma* 3326–3370

One-Dimensional Metal-Oxide Nanostructures: Recent Developments in Synthesis, Characterization, and Applications



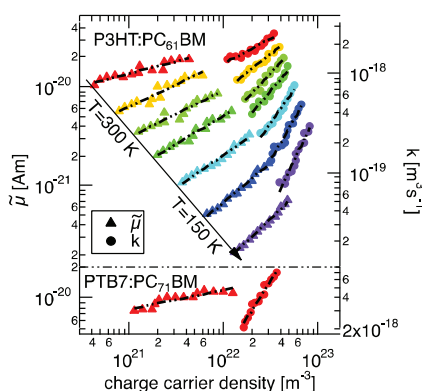
Three processes are involved in the vapor-solid (VS) growth mechanism for the synthesis of 1D metal-oxide nanostructures: i) thermal sublimation from the hot metal filament, ii) chemical vapor reaction of the sublimated heavy metal vapor with ambient oxygen gas, and iii) condensation of the heavy metal-oxide vapor into 1D nanostructures.

FULL PAPERS

Solar Cells

D. Rauh, C. Deibel,*
V. Dyakonov* 3371–3377

Charge Density Dependent Nongeminate Recombination in Organic Bulk Heterojunction Solar Cells

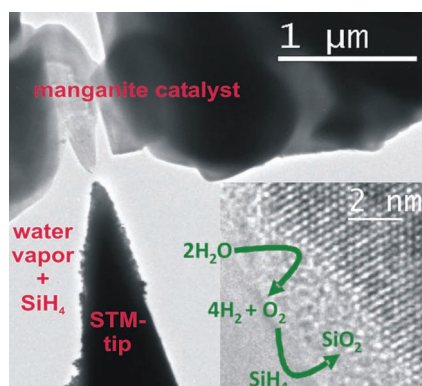


It is shown that the often reported recombination orders, which are higher than two for organic photovoltaic solar cells, cannot be explained by the charge carrier density, n , dependence of the mobility, μ , alone, as the Langevin recombination prefactor k exhibits a different n dependence than μ . The discrepancy is explained by a more complex recombination process including trap states and phase separation.

Catalysts

S. Raabe, D. Mierwaldt, J. Ciston,
M. Uijtewaal, H. Stein, J. Hoffmann,
Y. Zhu, P. Blöchl,
C. Jooss* 3378–3388

In Situ Electrochemical Electron Microscopy Study of Oxygen Evolution Activity of Doped Manganite Perovskites

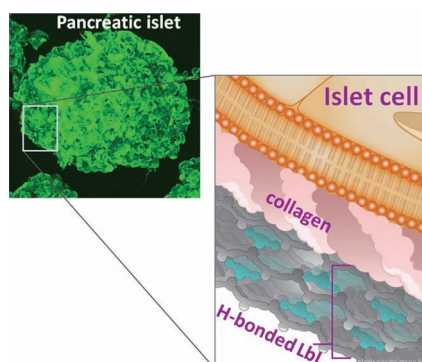


An in situ study of the water splitting reaction using Pr-doped calcium manganite catalysts in an environmental transmission electron microscope is presented. A gaseous Si-containing marker material provides direct observation of oxygen evolution via SiO_2 growth on active catalyst domains. The reaction is most likely driven by an electron beam induced potential and can be controlled by applying bias voltages via a PtIr STM-tip. Comparing in situ and ex situ experiments as well as band structure calculations allows for evaluating the role of doping, defect formation, and corrosive degradation.

Biomaterials

V. Kozlovskaya, O. Zavgorodnya,
Y. Chen, K. Ellis, H. M. Tse, W. Cui,
J. A. Thompson,
E. Kharlampieva* 3389–3398

Ultrathin Polymeric Coatings Based on Hydrogen-Bonded Polyphenol for Protection of Pancreatic Islet Cells

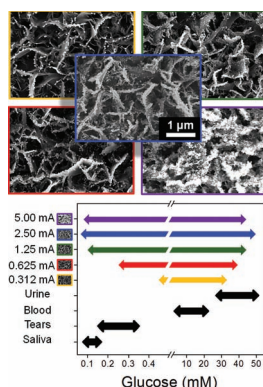


Living pancreatic mammalian islets are modified with ultrathin cytoprotective polymeric coatings deposited on the islet surfaces via hydrogen-bonded layer-by-layer assembly (H-bonded LbL) of a natural polyphenol with poly(*N*-vinylpyrrolidone). The coating material demonstrates immunomodulatory properties suppressing pro-inflammatory cytokine synthesis and prolongs insulin secretion of the islets, the features critical for islet cell transplantation for diabetes treatment.



FULL PAPERS

A controllable electrochemical deposition technique is used to deposit Pt nanoparticles of varying size and density onto multilayered graphene petal nanosheets (MGPNs). The Pt/MGPNs are converted to glucose biosensors by electrodepositing the enzyme glucose oxidase with the conductive polymer poly(3,4-ethylenedioxythiophene) (PEDOT) onto the electrode surface. The glucose linear sensing range is optimized by varying the Pt nanoparticle size and density.

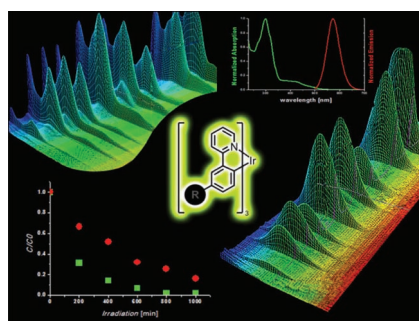


Biosensors

J. C. Claussen, A. Kumar, D. B. Jaroch, M. H. Khawaja, A. B. Hibbard, D. M. Porterfield, T. S. Fisher* 3399–3405

Nanostructuring Platinum Nanoparticles on Multilayered Graphene Petal Nanosheets for Electrochemical Biosensing

Combinatorial synthesis in combination with a chromatography based separation and characterization allows for the rapid screening of new phosphorescent iridium complexes as emitters for organic light-emitting diodes. The approach provides information on the photophysical properties, phosphorescence efficiencies, and photostabilities of the new compounds and speeds up the discovery of promising new emitters for solution processing.

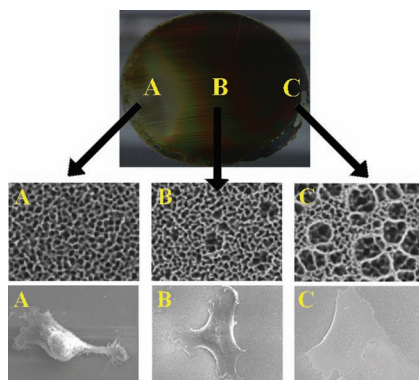


Organic Light-Emitting Diodes

A. Hohenleutner, S. Schmidbauer, R. Vasold, D. Joosten, P. Stoessel, H. Buchholz, B. König* 3406–3413

Rapid Combinatorial Synthesis and Chromatography Based Screening of Phosphorescent Iridium Complexes for Solution Processing

An asymmetric anodization procedure is used to produce n-type porous silicon (pSi) gradients with pore sizes ranging from tens to hundreds of nanometers in diameter and changes in the ridge nanoroughness from a few to tens of nanometers. The results demonstrate that the gradient format allows in-depth screening of surface parameters that are important for the control of mammalian cell behavior, thereby advancing the development of new and improved biomaterials for orthopaedic and tissue engineering applications.

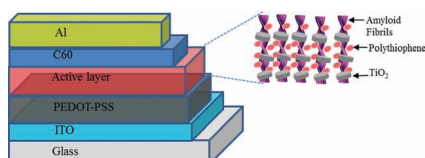


Tissue Engineering

P.-Y. Wang, L. R. Clements, H. Thissen, A. Jane, W.-B. Tsai,* N. H. Voelcker* 3414–3423

Screening Mesenchymal Stem Cell Attachment and Differentiation on Porous Silicon Gradients

The templating effect of β -lactoglobulin amyloid fibrils is used for the first time to synthesize titanium dioxide (TiO_2) hybrid nanowires with titanium (IV) bis (ammonium lactato) dihydroxide (TiBALDH) as the precursor. Furthermore, β -lactoglobulin protein fibrils also exhibit electrostatic complexes with water-soluble counter charged semi-conductive polythiophenes. In this way, amyloid fibrils allow design of the active layer for heterojunction photovoltaic devices with a power conversion efficiency of 0.72%.



Photovoltaics

S. Bolisetty, J. Adamcik, J. Heier, R. Mezzenga* 3424–3428

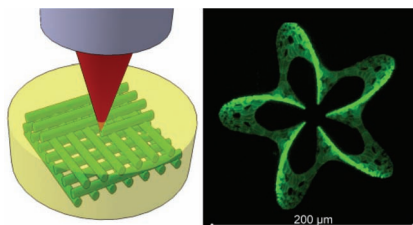
Amyloid Directed Synthesis of Titanium Dioxide Nanowires and Their Applications in Hybrid Photovoltaic Devices

FULL PAPERS

Patterning

A. Ovsianikov,* Z. Li, J. Torgersen,
J. Stampfl, R. Liska*3429–3433

Selective Functionalization of 3D Matrices Via Multiphoton Grafting and Subsequent Click Chemistry



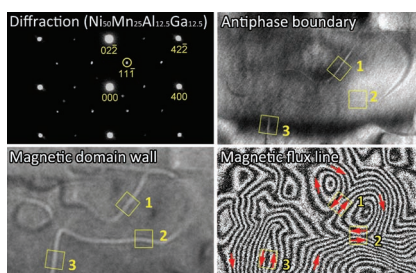
The use of aromatic azide compounds for selective multiphoton-induced photo-grafting within a poly(ethylene glycol) (PEG)-based 3D matrix is reported. A highly selective molecule immobilization with good lateral resolution in 3D is achieved and patterns are further functionalized by means of a click reaction. The 3D site-specific functionalization method has potential applications in microarray-based proteome analysis, studies of cell-surface interactions, sensing applications, and drug screening.

Magnetic Materials

H. S. Park,* Y. Murakami,
K. Yanagisawa,
T. Matsuda, R. Kainuma, D. Shindo,
A. Tonomura3434–3437

Electron Holography Studies on Narrow Magnetic Domain Walls Observed in a Heusler Alloy

$\text{Ni}_{50}\text{Mn}_{25}\text{Al}_{12.5}\text{Ga}_{12.5}$



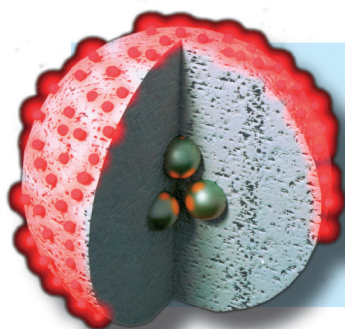
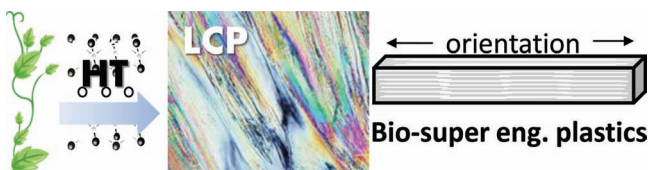
Peculiar magnetic domain walls produced in a Heusler alloy are studied using electron holography. The observations reveal unexpectedly narrow magnetic domain walls, the width of which shows perfect agreement with that of the antiphase boundaries (e.g., only 3 nm). This method provides beneficial information for obtaining a deeper understanding of the magnetic order in the vicinity of an interface.

Catalysts

M. Chauzar, S. Tateyama, T. Ishikura,
K. Matsumoto, D. Kaneko, K. Ebitani,
T. Kaneko*3438–3444

Hydrotalcites Catalyze the Acidolysis Polymerization of Phenolic Acid to Create Highly Heat-Resistant Bioplastics

Hydrotalcites efficiently catalyze acidolysis copolymerizations of bioavailable coumarates such as acetylated *p*-coumaric acid and caffeic acid to prepare liquid crystalline polymers exhibiting a clear orientation state on the surface of the glass fibers (GF). The GF-reinforced resins show an extremely high softening temperature of 305 °C while keeping a high mechanical strength of 85 MPa and modulus over 1 GPa.



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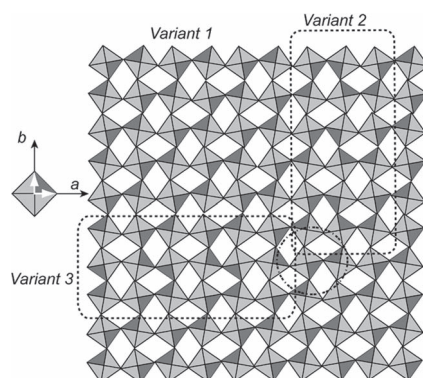
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FULL PAPERS

The structure of $\text{Na}_{1/2}\text{Bi}_{1/2}\text{TiO}_3$ (NBT) is studied using transmission electron microscopy (TEM). NBT consists of nanoscale twin domains featuring in-phase and anti-phase octahedral tilting. The coherence length of the in-phase tilting is limited to a few unit cells and is at least one order of magnitude shorter than that of anti-phase tilting. Assemblages of such nanodomains exhibit average anti-phase tilting with monoclinic pseudo-symmetry.

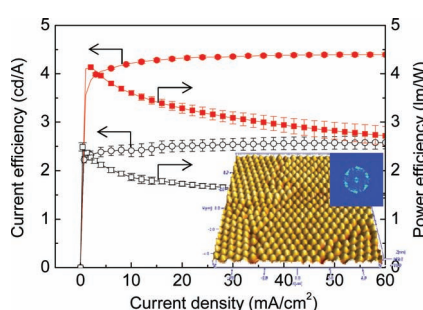


Ceramics

I. Levin,* I. M. Reaney3445–3452

Nano- and Mesoscale Structure of $\text{Na}_{1/2}\text{Bi}_{1/2}\text{TiO}_3$: A TEM Perspective

An organic light-emitting diode device with a defective hexagonal-close-packed array can effectively extract the waveguide modes over all emission wavelengths and angles without spectral changes and directionality because of the broadening of the periodicity and the random orientation from the defective array pattern.



Organic Light-Emitting Diodes

W. H. Koo, W. Youn, P. Zhu, X.-H. Li, N. Tansu, F. So*3454–3459

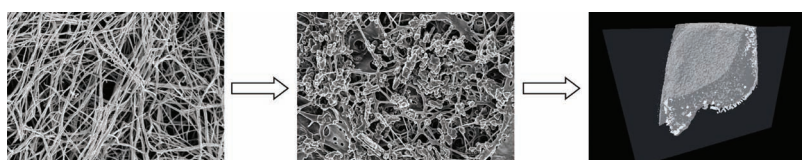
Light Extraction of Organic Light Emitting Diodes by Defective Hexagonal-Close-Packed Array

The influence of a selection of biopolymers on the mineralization of calcium carbonate is investigated. Nanofibrillar collagen hydrogels are found to be particularly effective in stabilizing amorphous calcium carbonate (ACC). Upon immersion in phosphate containing solutions the ACC and poorly crystalline calcium carbonate are readily converted to carbonated hydroxyapatite, enabling formation of a stiff bone-like composite containing 78 wt% mineral, essentially equivalent to cortical bone.

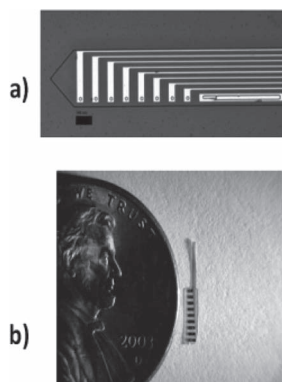
Biomimetics

D. C. Bassett, B. Marelli, S. N. Nazhat, J. E. Barralet*3460–3469

Stabilization of Amorphous Calcium Carbonate with Nanofibrillar Biopolymers



8-channel cortical probes are fabricated using the transfer-by-polymerization process with substrates that soften under physiological conditions. Single unit action potential recordings are shown from rat somatosensory cortex with a shape memory polymer (SMP)-gold electrode array during an acute experiment.



Flexible Electronics

T. Ware, D. Simon, D. E. Arreaga-Salas, J. Reeder, R. Rennaker, E. W. Keefer, W. Voit*3470–3479

Fabrication of Responsive, Softening Neural Interfaces

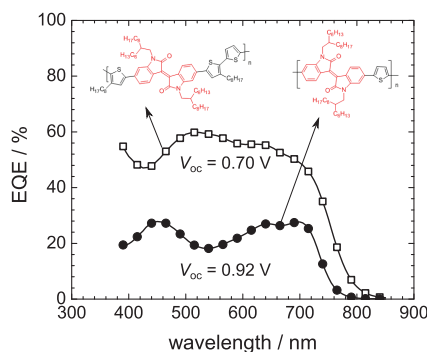


FULL PAPERS

Solar Cells

K. Vandewal,* Z. Ma, J. Bergqvist,
Z. Tang, E. Wang, P. Henriksson,
K. Tvingstedt, M. R. Andersson,
F. Zhang, O. Inganäs*3480–3490

Quantification of Quantum Efficiency and Energy Losses in Low Bandgap Polymer:Fullerene Solar Cells with High Open-Circuit Voltage

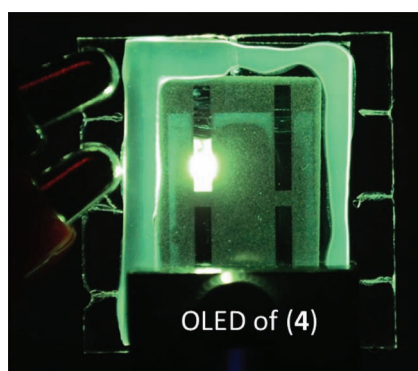


Polymer:fullerene photovoltaic devices comprising two isoindigo containing polymers show large differences in open-circuit voltage (V_{oc}) and external and internal quantum efficiencies. Instead of morphology, an almost vanishing energetic difference between the optical gap of the polymer and energy of the charge transfer state is responsible for the lower photocurrent produced by the high V_{oc} device.

Organic Light-Emitting Diodes

B.-S. Du, J.-L. Liao, M.-H. Huang,
C.-H. Lin, H.-W. Lin,* Y. Chi,*
H.-A. Pan, G.-L. Fan, K.-T. Wong,
G.-H. Lee, P.-T. Chou*3491–3499

Os(II) Based Green to Red Phosphors: A Great Prospect for Solution-Processed, Highly Efficient Organic Light-Emitting Diodes

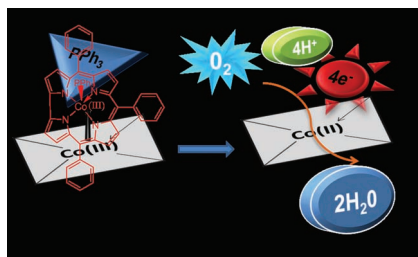


Fine-tuning the emission hue of Os(II) phosphors from saturated red to green is achieved using benzothiazolyl or benzimidazolyl chromophores plus a chelating diphosphine, from which the highly efficient PhOLEDs are fabricated using a solution process.

Fuel Cells

H.-C. Huang, I. Shown, S.-T. Chang,
H.-C. Hsu, H.-Y. Du, M.-C. Kuo,
K.-T. Wong, S.-F. Wang, C.-H. Wang,*
L.-C. Chen, K.-H. Chen*3500–3508

Pyrolyzed Cobalt Corrole as a Potential Non-Precious Catalyst for Fuel Cells

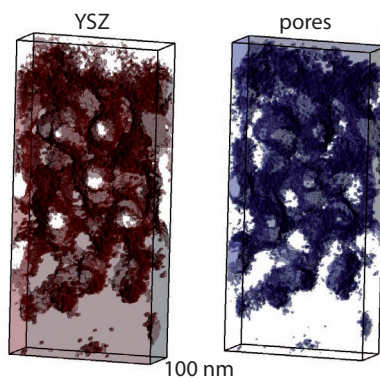


Pyrolyzed Co-corrole supported by carbon black catalyzes the oxygen reduction reaction (ORR) by a direct four-electron reduction pathway for the reduction of O_2 to H_2O and exhibits high activity as the cathode catalyst of polymer electrolyte fuel cells. The pyrolysis changes the coordination structure and oxidation state of Co-corrole, leading to the increase in ORR activity.

Ceramics

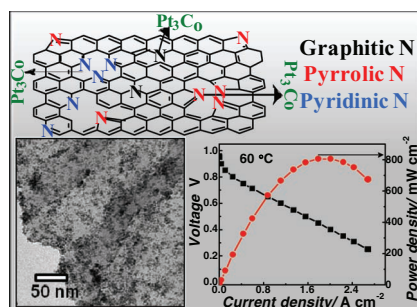
B. Scherrer,* J. Martynczuk,
H. Galinski, J. G. Grolig,
S. Binder, A. Bieberle-Hütter,
J. L. M. Rupp, M. Prestat,
L. J. Gauckler3509–3518

Microstructures of YSZ and CGO Thin Films Deposited by Spray Pyrolysis: Influence of Processing Parameters on the Porosity



The porosity evolution of yttria-stabilized zirconia (YSZ) and gadolinium-doped ceria (CGO) thin films deposited by spray pyrolysis is presented. The pore distribution is analyzed by focused ion beam tomography. The YSZ of the reconstruction is colored in brown and the pores in blue. About 43 vol% of porosity develops during annealing at 800 °C for 20 h.

A novel method for the synthesis of Pt–Co alloy nanoparticles dispersed on nitrogen-doped graphene is developed. The as-prepared electrocatalysts show excellent oxygen reduction reaction (ORR) activity and stability in acidic medium for proton exchange membrane fuel cell (PEMFC) applications due to the high dispersion and alloying effect of Pt–Co, along with the inherent electrocatalytic activity of nitrogen-doped graphene as the supporting material.



Fuel Cells

B. P. Vinayan, R. Nagar, N. Rajalakshmi, S. Ramaprabhu*3519–3526

Novel Platinum–Cobalt Alloy Nanoparticles Dispersed on Nitrogen-Doped Graphene as a Cathode Electrocatalyst for PEMFC Applications