ADVANCED FUNCTIONAL MATERIALS

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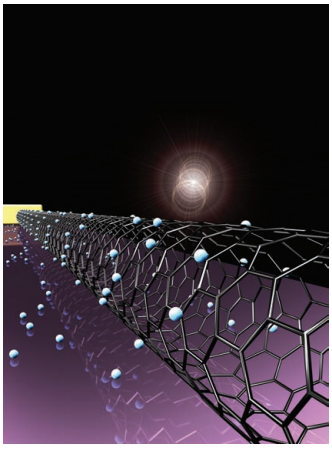
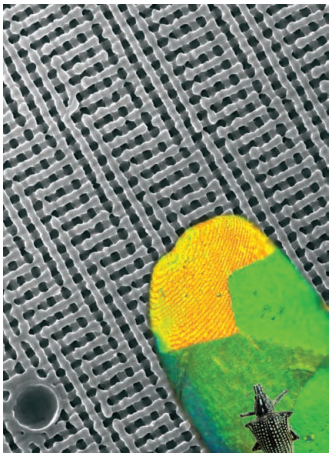


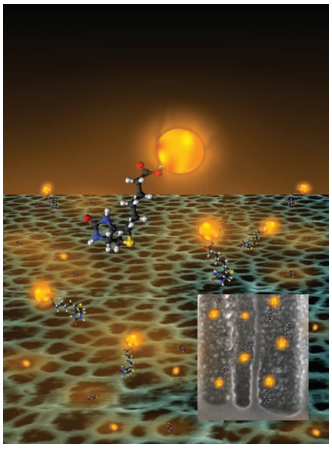
Carbon Nanotubes

A simple and effective way to develop hybrid phototransistors with extraordinary optoelectronic properties is demonstrated by M. S. Jeong, Y. H. Lee and co-workers. On page 3653, they decorate single-walled carbon nanotube (SWCNT) surfaces with semiconducting quantum dots. This hybrid structure shows a clear negative photoresponse and optical switching behavior, which could be further tuned by applying an external gate bias. Moreover, this hybrid structure shows an enhancement in the 'optical Stark effect' without applying any external electric field.

Photonic Crystals

The beetle *Entimus imperialis* forms photonic crystals with a bicontinuous cubic structure of the diamond type in cuticular scales that show brilliant colors within well-defined domains. On page 3615, H.-O. Fabritius and co-workers report how the beetles tune the structural parameters and composition of these biological photonic crystals to achieve opposite extremes for their optical properties: the brightest colors possible or a colorless appearance.





Biosensors

G. Gaur, D. S. Koktysh, and S. M. Weiss report on page 3604 a dual-mode optical biosensor that incorporates quantum dots as refractive index signal amplifiers and bio-recognition fluorescence probes in a three-dimensional nanoporous silicon matrix. The inherently size-selective nanopores with extremely high surface areas support the highly efficient capture and immobilization of quantum dot-labeled target biomolecules. This approach is promising for sensitive and low-cost point-of-care diagnostics.

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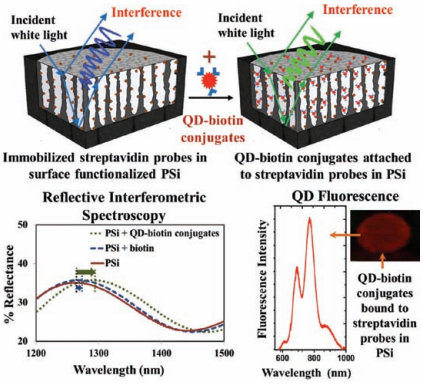
Biosensors

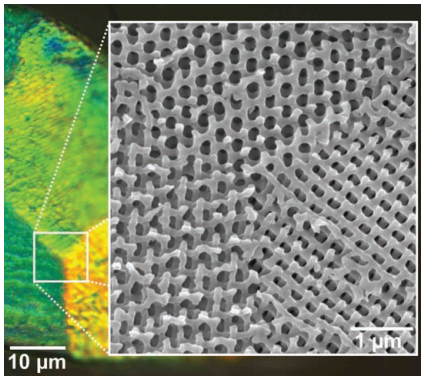
Immobilization of Quantum Dots in Nanostructured Porous Silicon Films: Characterizations and Signal Amplification for Dual-Mode Optical Biosensing



White light reflective interferometric spectroscopy and fluorescence measurements are used to implement a novel dual-mode optical porous silicon biosensor. Quantum dots act as signal amplifiers resulting in over an order of magnitude increase in sensor response and providing a secondary means of biomolecule-specific recognition through their distinct fluorescence spectra.

Photonic Crystals

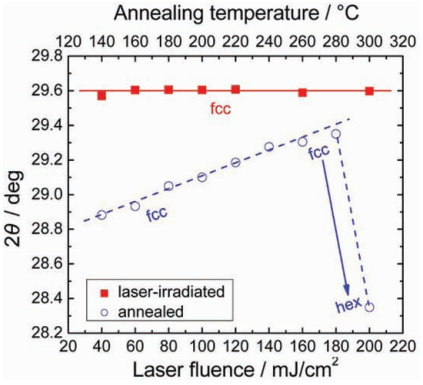
Extreme Optical Properties Tuned Through Phase Substitution in a Structurally Optimized Biological Photonic Polycrystal



The cuticular photonic polycrystals formed by the beetle *Entimus imperialis* are a perfect example of a natural diamond-type triply periodic bicontinuous cubic structure with structural parameters that are optimized to open up the largest possible photonic stop gaps. Depending on whether the cuticular network is complemented by air or SiO_2, the optical properties of individual domains vary from bright coloration to no coloration and transparency.

Phase-Change Materials

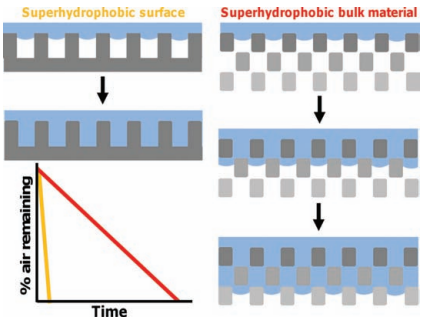
Single Pulse Laser-Induced Phase Transitions of PLD-Deposited $Ge_2Sb_2Te_5$ Films



The effect of laser fluence on the crystalline nature of $Ge_2Sb_2Te_5$ films is studied in detail. Large structural differences between the laser-irradiated and thermally annealed films are revealed to be caused by the high heating rate and short duration of the laser pulse.

Biomaterials

A Mechanistic Study of Wetting Superhydrophobic Porous 3D Meshes



Superhydrophobic, porous, 3D materials composed of poly(ε-caprolactone) (PCL) and poly(glycerol monostearate-*co*-ε-caprolactone) (PGC-C18) as a hydrophobic dopant are fabricated using the electrospinning technique. These materials are distinct from 2D superhydrophobic surfaces with maintenance of air at the surface and within the bulk of the material, and, thus, these functional materials can be considered for new applications where time and rate of wetting dictate performance.

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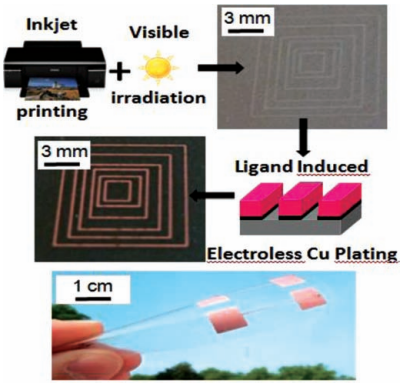
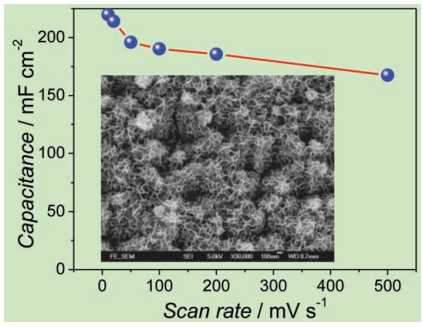
Polymer Grafting



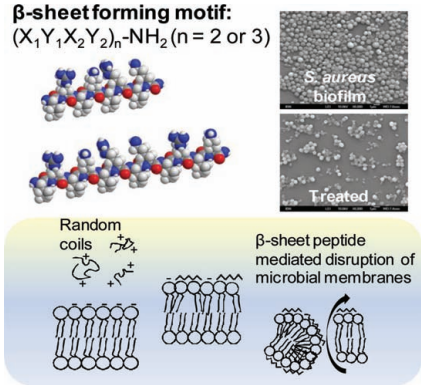
A photoassisted and inkjet-printed covalent polymer grafting method based on the photoreduction of aryldiazonium is presented. This powerful and versatile method to obtain local surface functionalization is combined with the ligand induced electroless plating process to obtain metal patterns onto flexible and transparent substrates with excellent mechanical and electrical properties, which may find applications in flexible electronics devices.

Supercapacitors

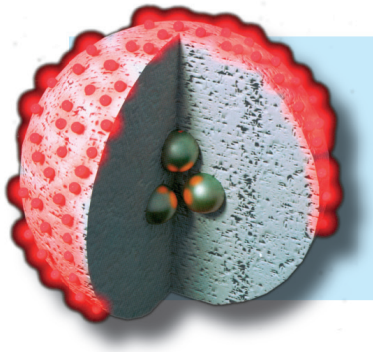


A hierarchical nickel compound (HNC) film is prepared using a facile, one-step, and binder-free method. The HNC demonstrates both large capacitance and superior rate capability. The capacitance reduction is only 24%, even when the scan rate is increased by 50 times. The HNC also exhibits an excellent cycle life.

Antimicrobial Peptides



Synthetic β-sheet folding antimicrobial peptides (AMPs) based upon simple recurring amphiphilic sequences of $(X_1Y_1X_2Y_2)_n$ are designed to enhance their clinical applicability. The peptide length, types of cationic, and hydrophobic residues are systematically varied to identify broad spectrum AMPs with excellent selectivities for microbial membranes. Additionally, the strong antibiofilm and endotoxin neutralization activities of optimized β-sheet forming peptide sequences are demonstrated.



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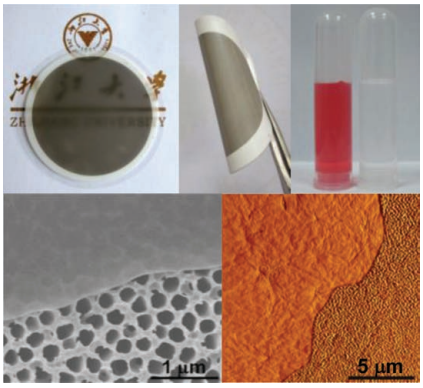
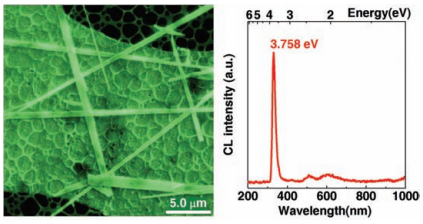
Ultrathin graphene nanofiltration membranes (uGNMs) are fabricated on microporous substrates. These graphene membranes (no more than 53-nm thick) are thin enough to have excellent flexibility and can be bent without any breakage. The uGNMs show high pure water flux and high retention for organic dyes. The dark red Direct Red 81 solution turns into colorless after filtration.



Graphene

Cathodoluminescence (CL) modulation of ZnS nanostructures by controlled morphologies, Fe/Mn doping, and measurement temperature is demonstrated. A comprehensive investigation of CL of ZnS nanostructures reveals a sharp UV band-gap emission at room temperature. The ZnS nanostructures show potential applications in luminescent materials as well as short-wavelength nanolaser light sources.



Luminescence