ADVANCED FUNCTIONAL MATERIALS

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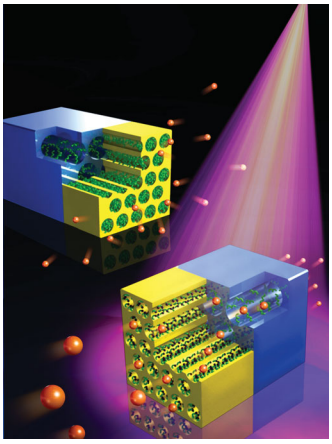
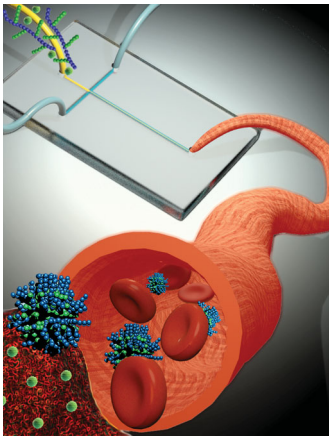


Ion Gating

Artificial heterogeneous nanochannels with light-responsive ion transport properties are demonstrated by Z. Liu, J. Zhai, and co-workers on page 424. Their fabrication includes coating an anatase TiO_2 porous layer onto an alumina porous supporter, followed by chemical modification with octadecyltrimethoxysilane (OTS) molecules. The decomposition of OTS molecules by TiO_2 photocatalysis under UV light contributes to a change of surface wettability and an asymmetric distribution of surface negative charges, which realize the ion gating and regulatable ion rectification characteristics simultaneously.

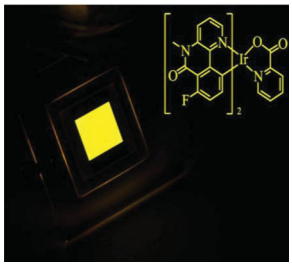


Drug Delivery

The use of solvent-free microfluidics to fine-tune the physical and chemical properties of chitosan nanoparticles for drug delivery is demonstrated by J. J. VanDersarl, P. Renaud, and co-workers on page 432. Controlling the time of mixing to within milliseconds during nanoparticle self-assembly enables the adjustment of nanoparticle size, surface charge, and compactness, as well as drug-loading efficiency. These drug-loaded nanoparticles can be passively targeted to tumors, benefiting from enhanced permeability and retention, along with pH-responsive release characteristics.

Organic Light-Emitting Diodes

On page 555, J.-H. Jou et al. present a highly efficient, iridium-based, yellow emitter with both dry- and wet-processability. The yellow organic LED device exhibits, at 1000 cd m^{-2}, an efficacy of 75 lm W^{-1} via evaporation deposition, the highest among all reported dry-processed yellow OLEDs, and 52 lm W^{-1} via spin-coating, the highest among all wet-processed counterparts.



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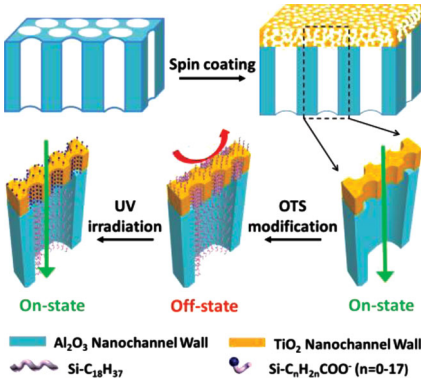
Ion Gating

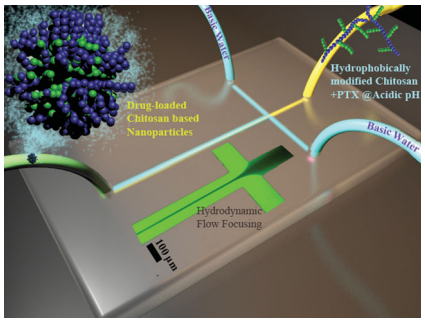
Light-Gating Titania/Alumina Heterogeneous Nanochannels with Regulatable Ion Rectification Characteristic



Artificial nanochannels based on chemically modified TiO_2/Al_2O_3 heterogeneous porous membranes are described. The irreversible decomposition of octadecyltrimethoxysilane (OTS) molecules by TiO_2 photocatalysis under ultraviolet light results in a change of surface wettability and an asymmetric distribution of surface negative charges simultaneously, which contributes to the ion gating and regulatable ion rectification.

Drug Delivery

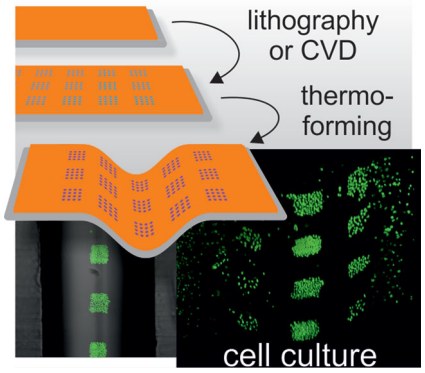
On-Chip Fabrication of Paclitaxel-Loaded Chitosan Nanoparticles for Cancer Therapeutics



Using microfluidics to precisely regulate self-assembly conditions, a number of nanoparticle properties are tuned to optimize drug-delivery efficacy. These parameters include size, zeta potential, and pH responsiveness. These nanoparticles are stable during circulation at physiological pH, but if they encounter a tumor cell, where the pH is lower, they rapidly release their anti-cancer drug cargo.

Micropatterning

Biofunctional Micropatterning of Thermoformed 3D Substrates

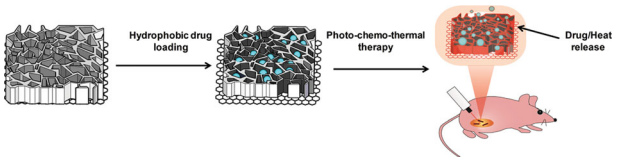


Chemical vapor deposition polymerization and maskless projection lithography with protein adsorption by photobleaching (MPL-PAP) in combination with microscale thermoforming are presented as two versatile technologies to create patterned biofunctionalized 3D substrates. These technologies provide new perspectives for bioanalytical applications and 3D cell culture platforms.

Nanostructures

NIR-Triggered Synergic Photochemothermal Therapy Delivered by Reduced Graphene Oxide/Carbon/Mesoporous Silica Nanocookies

Formed by a one-pot, scalable emulsion method and triggered by near infrared irradiation, photosensitive nanoparticles with a silica/carbon nanostructure supported on a reduced graphene oxide substrate can control release of hydrophobic chemotherapy drugs with synergistic hyperthermia effects, eradicating tumor cells in vivo and in vitro on demand.



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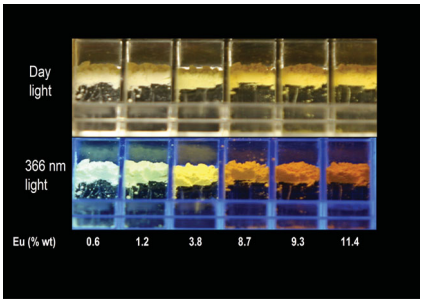
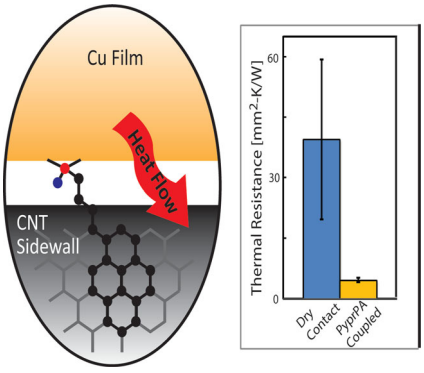
An amorphous $Si_3B_3N_7$ network serves as a universal host for various activator ions to be used as inorganic phosphors, particularly for LED-based lighting devices. This solution-based synthesis route provides significant advantages, e.g., tuning the emission color of the phosphors via codoping with more than one activator ion in high purity and homogeneity.



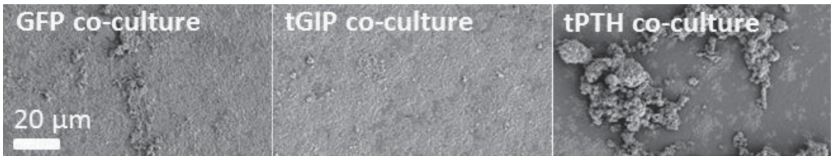
Ceramics

A pyrenylpropyl phosphonic acid surface modifier is developed for coupling carbon nanotubes to metal oxide surfaces to reduce the thermal contact resistance. The modifier is demonstrated through experiment to reduce the thermal contact resistance between vertically aligned carbon nanotube forests and Cu oxide surfaces by roughly 9-fold, enabling carbon nanotube-based thermal interface materials with thermal resistances comparable to conventional metallic solders.



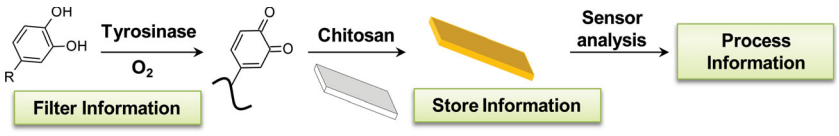
Carbon Nanotubes

A method for modulating bone remodeling by osteoblasts and osteoclasts using cell-tethered parathyroid hormone (tPTH) and glucose-dependent insulinotropic peptide (tGIP) is described. Cell-modified silk film biomaterial surfaces are reconstructed from scanning electron microscope images into three-dimensional surface models using image processing for quantitative measurement of surface characteristics. tPTH increases remodeled surface roughness while tGIP has the opposite effect.



Tissue Engineering

An enzyme is used to "filter" chemical information and write this information to a hydrogel film, which then serves as a permanent storage medium that can be 'read' repeatedly, interactively, and by multiple sensor modalities. Potentially, this approach will be applicable for problems such as analysis of the health benefits of dietary phenols.



Bioelectronics

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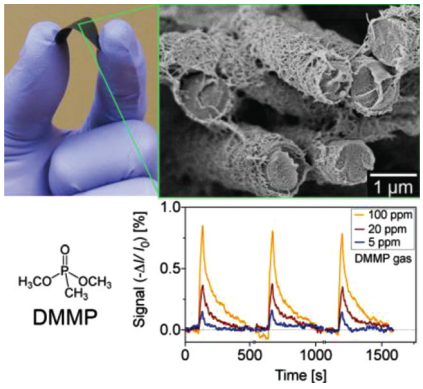
Flexible Sensors

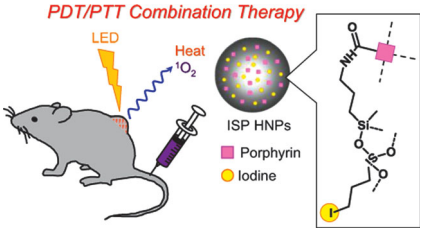
Spray-Layer-by-Layer Carbon Nanotube/Electrospun Fiber Electrodes for Flexible Chemiresistive Sensor Applications



Flexible sensory material based on conformal multi-walled carbon nanotube (MWNT) films on a porous electrospun-polymeric fiber mat is constructed using a vacuum-assisted spray layer-by-layer assembly. The resulting thin MWNT films coat individual electrospun fibers with controlled loading and electrical conductivity. The MWNT/electrospun fiber electrodes display reversible responses and high sensitivity for detecting DMMP in aqueous and vapor phases.

Theranostics

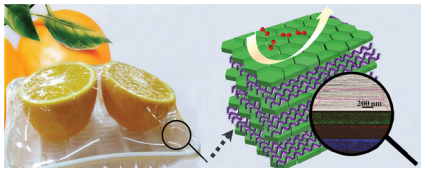
Photostable Iodinated Silica/Porphyrin Hybrid Nanoparticles with Heavy-Atom Effect for Wide-Field Photodynamic/Photothermal Therapy Using Single Light Source



Photodynamic/photothermal combination therapy using iodinated silica/porphyrin hybrid nanoparticles (ISP HNPs) inhibits tumor growth. The ISP HNPs have high photostability, and they efficiently generate both $^1O_2$ and heat with irradiation from an LED because of the external heavy-atom effect. The surface-modified ISP HNPs accumulate in tumor tissue. Light irradiation to the tumor leads to the death of tumor cells.

Oxygen Barriers

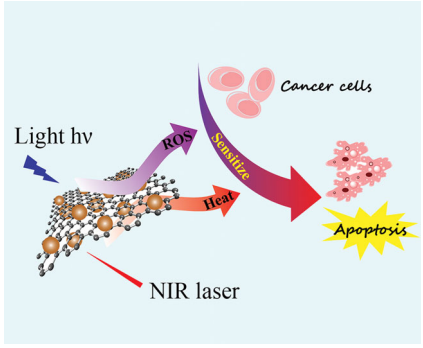
Transparent, Flexible Films Based on Layered Double Hydroxide/Cellulose Acetate with Excellent Oxygen Barrier Property



Transparent, flexible films with excellent oxygen barrier behavior are fabricated by spin-coating of cellulose acetate (CA) and layered double hydroxide (LDH) nanoplatelets alternately, followed by thermal annealing treatment. The resulting $(CA/LDH)_{20}$ film exhibits extraordinarily enhanced oxygene barrier property, superior to the previously reported inorganic-filled films.

Theranostics

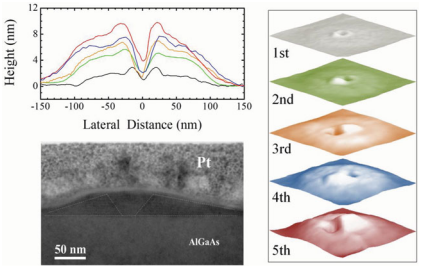
A Multi-synergistic Platform for Sequential Irradiation-Activated High-Performance Apoptotic Cancer Therapy



With the aid of sequential irradiation, highly integrated reduced graphene oxide–ZnO nanoparticle–hyaluronic acid nanoassemblies can serve as a multi-synergistic platform for targeted high-performance apoptotic cancer therapy. The reactive oxygen species generated by ZnO/rGo under light irradiation can effectively sensitize cancer cells to the subsequent NIR laser-induced apoptotic hyperthermia.

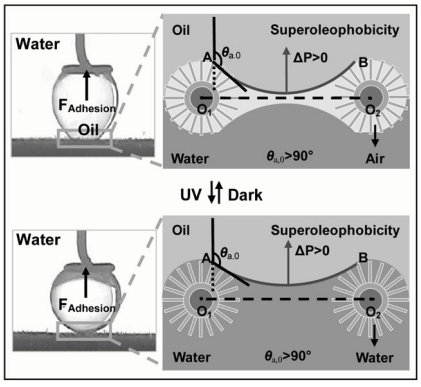
FULL PAPERS

The nanodroplets preferably form on pre-existing nanorings, which enables fabrication of vertically aligned nanostructures by droplet epitaxy. Nucleation thermodynamics and growth kinetics are proposed to explain the vertically correlated droplet epitaxy. Heterojunctions can be realized at the nanoscale by this method. In addition, the nucleation thermodynamics of these nanodroplets will allow site-controlled fabrication of nanostructures.



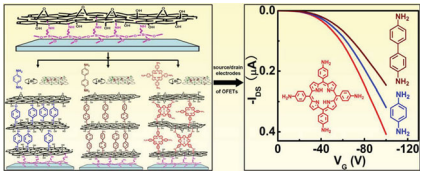
Nanorings

Phototunable oil adhesion underwater on micro/nanoscale hierarchical structured ZnO mesh films with switchable contact mode between UV irradiation and storage in the dark is demonstrated. This work is promising for photocontrollable underwater oil adhesion, and may also provide interesting insight into the design of novel materials and functional devices based on the controllable adhesion of oil at surfaces.



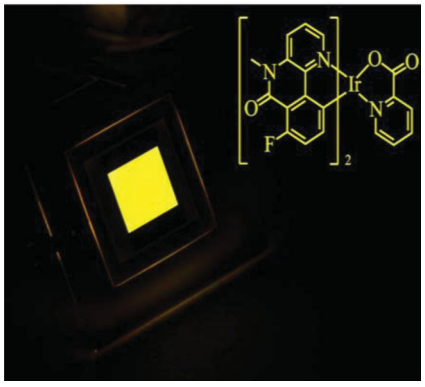
Oil Adhesion

Graphene-based ultrathin films simultaneously featured with tunable performance, controlled thickness, and high stability, are integrated using π-conjugated molecules as cross-linkages. The use of dual functional linkage endows our new protocol with broad opportunities for desired motives in terms of using elaborately-designed linkages of desired functions.



Organic Electronics

A highly efficient, iridium-based, yellow emitter with both dry- and wet-process feasibility is presented. The yellow OLED device exhibits, at 1000 cd m^{-2}, an efficacy of 75 lm W^{-1} via evaporation deposition, the highest among all reported dry-processed yellow OLEDs, and 52 lm W^{-1} via spin-coating, the highest among all wet-processed counterparts.



Organic Light-Emitting Diodes