ADVANCED FUNCTIONAL MATERIALS

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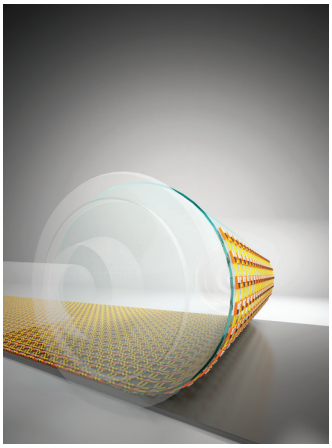
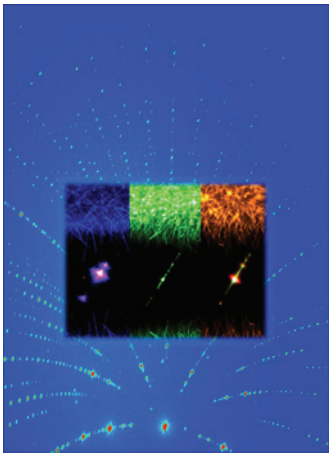


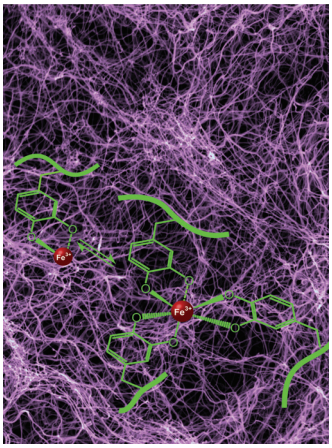
Stretchable Electronics

A stretchable and transparent indium-gallium-zinc-oxide (IGZO) thin-film transistor (TFT) with high electrical performance and scalability is reported by Jae-Hyun Kim, Jong-Hyun Ahn, and co-workers on page 2024. A load-controlled roll transfer method is realized for fully automated and scalable transfer of the IGZO TFTs from a rigid substrate to an elastomeric substrate. The IGZO TFTs exhibit stable electrical performance without deformation or breakage when stretched and twisted, demonstrating the potentiality of the load-controlled roll transfer in stretchable electronics.

Luminescent Nanoribbons

On page 1998 Zhengwei Pan and co-workers report three kinds of europium aluminate nanoribbons that exhibit new compositions, new crystal lattice structures, and new luminescence properties and mechanisms. These luminescent nanoribbons under ultraviolet light (on bulk nanoribbons) and their synchrotron X-ray microbeam excitation (on individual nanoribbons) are shown in the center image. Background image is a Laue microdiffraction pattern acquired at the Advanced Photon Source from the blue luminescent nanoribbon.





Supramolecular Polymers

A supramolecular hydrogel network is held intact through non-covalent interactions among low-molecular weight building blocks. The intermolecular interactions among the building blocks are important for stimuli-responsive modulation and self-healing properties. On page 2081 Aykutlu Dana, Mustafa O. Guler, and co-workers show that a mussel-inspired metal-ion coordination into the supramolecular polymer network is advantageous for improving mechanical properties as well as retaining the original properties of the network.

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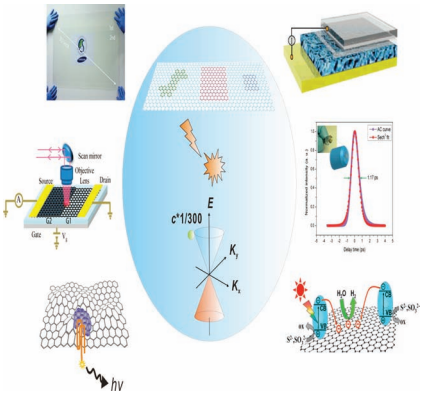
FEATURE ARTICLE

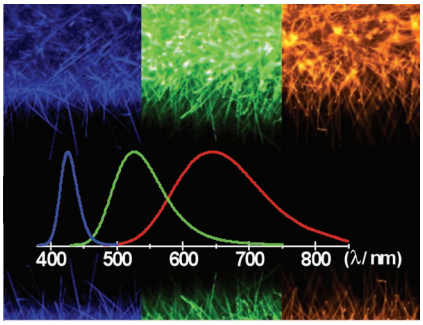
Graphene



Graphene, a two-dimensional, single-atom-thick carbon crystal arranged in honeycomb lattices, shows extraordinary electronic, mechanical, thermal, optical, and optoelectronic properties, and has great potential in next-generation electronics, optics, and optoelectronics. Recent progress of graphene-based nanomaterials in optical and optoelectronic applications is reviewed, including transparent conductive electrodes, photodetectors and phototransistors, photovoltaic/light-emitting devices, saturable absorbers for ultrafast lasers, and biological and photocatalytic applications.

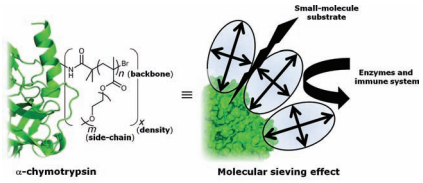
FULL PAPERS

Photonics



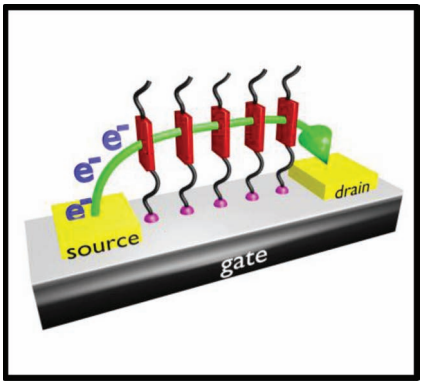
Three kinds of europium aluminate nanoribbons associated with luminescence colors of blue, green, and orange are fabricated by a strictly controlled thermal evaporation technique. These europium aluminates exhibit new compositions, new crystal lattice structures, and new luminescence properties and mechanisms. They have very promising applications in emerging optical technologies.

Drug Delivery



Protein-bound monolayers of poly(oligoethyleneglycol monomethylether methacrylate) (pOEGMA) display selective permeability or "molecular sieving" characteristics when in the correct conformation/packing regime. The first conformational/permeability diagram of protein-bound pOEGMA monolayers is presented and insight for the design of therapeutic bioconjugates and functional coatings with selective permeability properties is provided.

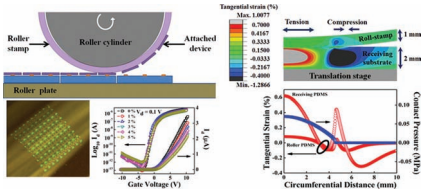
Field-Effect Transistors



Highly reproducible n-type self-assembled monolayer field-effect transistors (SAMFETs) based on a perylene derivative are reported. Electron mobilities of 1.5 × 10^{-3} cm^2 $V^{-1}s^{-1}$ and on/off current ratios up to 10^5 are obtained. By implementing n-type and p-type transistors in one device, a complimentary inverter based solely on SAMFETs is demonstrated for the first time.

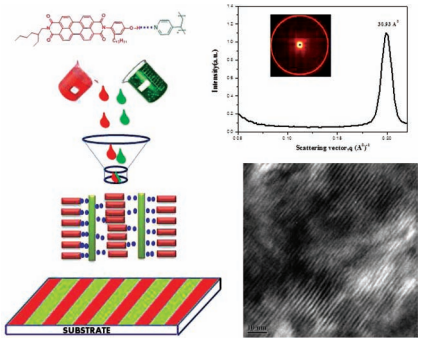
FULL PAPERS

A roll transfer printing method for In-Ga-Zn-O (IGZO) thin film transistors (TFTs) on a stretchable substrate is demonstrated. The TFTs' electrical performance is investigated under stretching and cyclic tests. Mechanics involved in the transferring process are investigated and simulated, which shows that the strain level experienced by the device's active layers is well below the maximum fracture level.



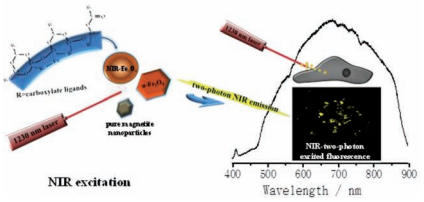
Stretchable Electronics

Supramolecular complex formation of an asymmetrical perylenebisimide (PDP-UPBI) with poly(4-vinylpyridine) (P4VP) via non-covalent specific interaction such as hydrogen bonding is described. The complexation results in the formation of uniform lamellar structures in the domain range of 5–10 nm.



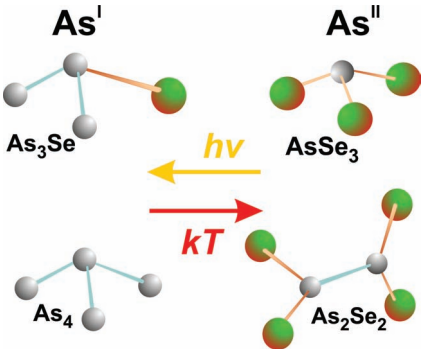
Self-Assembly

Near-infrared (NIR) fluorescence of Fe_3O_4 and α-Fe_2O_3 nanostructures is generatred by NIR laser excitation. These nanostructures act as cellular probes, as indicated by nonlinear microscopy, and have the potential to be further developed as a bifunctional contrast agents for tracking drug delivery and pharmacokinetics.



Magnetic Nanomaterials

X-ray photoelectron spectroscopy and spectroscopic ellipsometry are combined to study reversible switching in the structure and optical properties of $As_{50}Se_{50}$ thin films prepared by pulsed-laser deposition. Switching is driven by near-bandgap light illumination and thermal annealing. The mechanism, namely, the amorphous-to-amorphous transition, is unique for pulsed-laser-deposited films. No such effect is observed for films of the same composition prepared by thermal evaporation.



Thin Films

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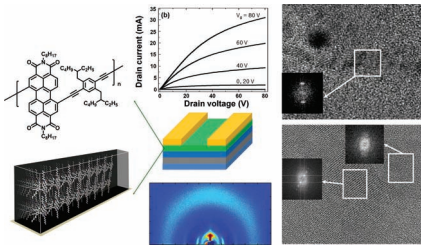
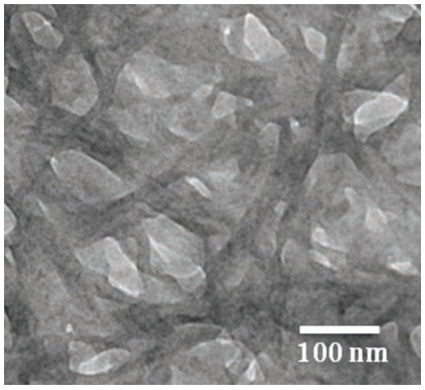
FULL PAPERS

Field-Effect Transistors



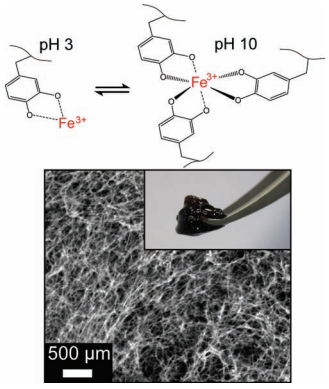
n-Channel polymer field-effect transistor (FET) devices are fabricated via a simple coating process using a suspension containing thermally stable nanowires prepared from a new perylene diimide polymer. The devices show excellent performance with remarkably high average electron mobilities, high on/off ratios, low threshold voltages, and negligible hysteresis. These properties are attributed to the formation of nanowires and ordered phases with a high degree of molecular ordering and a preferential orientation within the active polymer layer. This may lead to the low-cost mass production of high-performance n-channel FET devices.

Nanocomposites

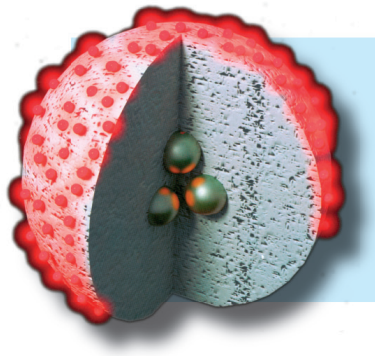


Because of the advantageously high surface-to-volume ratio at the nanometer-scale, highly functionalized aramid building blocks are achieved in the form of nanofibers and nanosheets, both of which can form complex nanostructures with tailorable macroscopic properties through treatment using phosphoric acid and glutaraldehyde. An aramid nanofiber network is formed from functionalized Kevlar nanofiber building blocks by the chemical treatment.

Hydrogels



A simple and versatile method for improving mechanical performance of supramolecular polymers is described. Inspired by a mussel curing mechanism, reversible iron cross-linking into a self-assembled peptide network significantly enhances the mechanical properties while having no impact on the β-sheet-driven self-assembly. The network retains its pH-dependent reversibility and self-healing properties.



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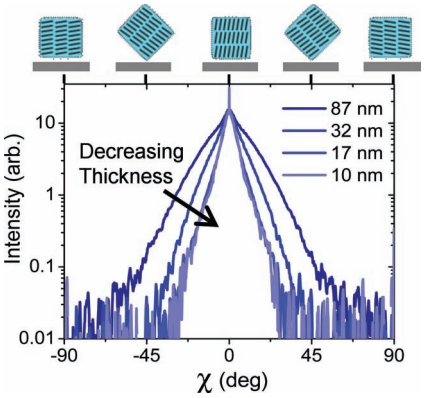
The effects of confinement on the morphology and charge transport properties of poly(2,5-bis(3-tetradecylthiophen-2-yl)thieno[3,2-b]thiophene) (PBTTT) are studied using quantitative X-ray diffraction and field-effect transistor measurements. Polymer crystallinity is found to limit charge transport in the thinnest films while crystalline texture and intergrain connectivity modulate carrier mobility in thicker films.



Organic Electronics