ADVANCED FUNCTIONAL MATERIALS

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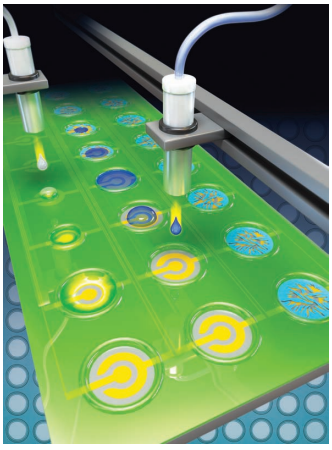
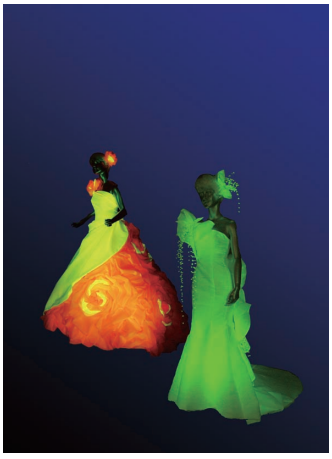


Organic Semiconductors

On page 5224, W. H. Lee, K. Cho, and co-workers demonstrate an inkjet printing process for the fabrication of TIPS-PEN crystals in microwells. First, the inkjet printing solvent produces the microwells by dissolving a polymer layer on an electrode-patterned gate dielectric layer (left lane in the image). Next, TIPS-PEN crystals are fabricated by inkjet printing TIPS-PEN ink into the inkjet-etched microwells (central lane). The final morphology of the transistors with TIPS-PEN crystals is shown in the right lane.

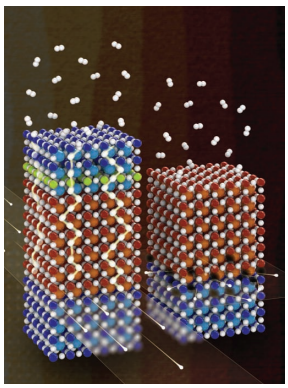


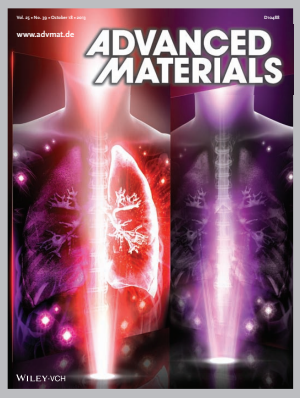
Transgenics

Transgenic silkworms are adapted for mass production of recombinant silks by T. Tamura and co-workers. They have fluorescent colors and a large amount of the cocoons can be harvested. Cooking and reeling methods are established on page 5232 for the production of recombinant silks without any loss of the fluorescent color. The mechanical properties of the modified silk are similar to those of commercial silks, and thus the modified silks can be used for making fabrics.

Thin Films

On page 5240, G. Koster and co-workers engineer defects in conducting interfaces in oxide $LaAlO_3$–$SrTiO_3$ (001) heterostructures by incorporating a strontium copper oxide nanolayer. The addition of this layer strongly reduces impurity scattering, allowing the creation of a higher-carrier mobility material. The layer suppresses oxygen defects by reducing the kinetic barrier for oxygen surface exchange in the heterointerfacial film system.





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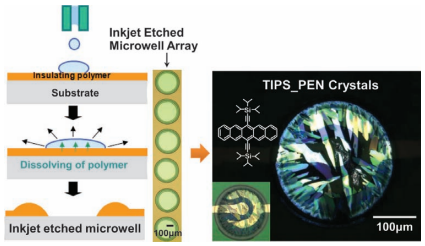
FULL PAPERS

Organic Semiconductors

D. Kwak, J. A. Lim, B. Kang,
W. H. Lee,* K. Cho* 5224–5231

Self-Organization of Inkjet-Printed Organic Semiconductor Films Prepared in Inkjet-Etched Microwells

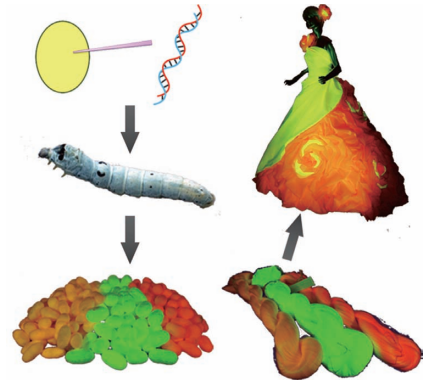


A facile nonconventional lithographic patterning technique is developed for fabricating banks with microwell structures by inkjet printing solvent droplets onto a polymer layer. 6,13-Bis(triisopropylsilylethynyl) pentacene (TIPS_PEN) is then inkjet-printed into the microwells for fabricating organic field-effect transistors. In addition to confining the inkjet-printed TIPS_PEN droplets, the microwells provide a platform onto which organic semiconductor molecules crystallize during solvent evaporation.

Transgenics

T. Iizuka, H. Sezutsu, K. Tatematsu,
I. Kobayashi, N. Yonemura,
K. Uchino, K. Nakajima, K. Kojima,
C. Takabayashi, H. Machii, K. Yamada,
H. Kurihara, T. Asakura, Y. Nakazawa,
A. Miyawaki, S. Karasawa, H. Kobayashi,
J. Yamaguchi, N. Kuwabara,
T. Nakamura, K. Yoshii,
T. Tamura* 5232–5239

Colored Fluorescent Silk Made by Transgenic Silkworms

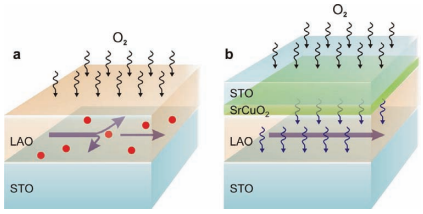


Transgenic silkworms are created to mass produce silks with fluorescent colors by introducing genes for fluorescent colored proteins. In addition, cooking and reeling methods that do not lead to loss of the fluorescent color are developed for the cocoons. The modified silk has mechanical properties similar to those of commercial silk and can be used for making fabrics.

Thin Films

M. Huijben, G. Koster,* M. K. Kruize,
S. Wenderich, J. Verbeeck, S. Bals,
E. Slooten, B. Shi, H. J. A. Molegraaf,
J. E. Kleibeuker, S. van Aert,
J. B. Goedkoop, A. Brinkman,
D. H. A. Blank, M. S. Golden,
G. van Tendeloo, H. Hilgenkamp,
G. Rijnders.....5240–5248

Defect Engineering in Oxide Heterostructures by Enhanced Oxygen Surface Exchange

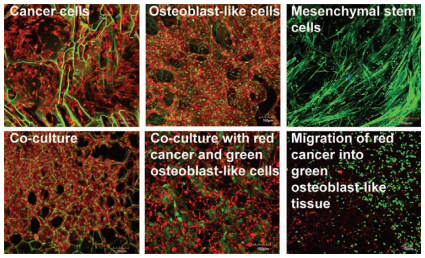


Defect engineering of conducting interfaces in oxide $LaAlO_3$–$SrTiO_3$(001) heterostructures by incorporation of a strontium copper oxide nanolayer strongly reduces the impurity scattering, opening the door to high carrier mobility materials. This remote cuprate layer facilitates enhanced suppression of oxygen defects by reducing the kinetic barrier for oxygen surface exchange in the heterointerfacial film system.

Cancer Cells

S. Talukdar, S. C. Kundu*.....5249–5260

Engineered 3D Silk-Based Metastasis Models: Interactions Between Human Breast Adenocarcinoma, Mesenchymal Stem Cells and Osteoblast-Like Cells



Bone metastasis depends on the complex interactions between the primary tumor and the metastatic niche. Metastasis models can illuminate this poorly understood phenomenon. *Antheraea mylitta* silk fibroin scaffold based 3D in vitro co-cultured tumor model systems can help in understanding the tumor-stroma interactions during metastasis as well as evaluate chemoresistance.

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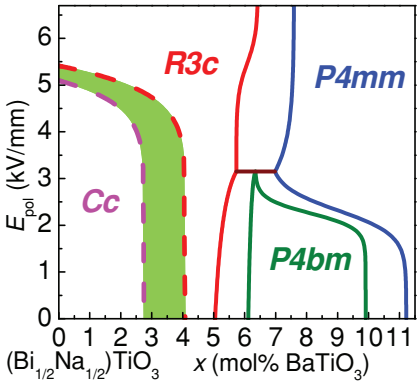
FULL PAPERS

A new phase boundary separating the *Cc* and *R3c* phases is revealed in (1–*x*)$(Bi_{1/2}Na_{1/2})TiO_3$–*x*$BaTiO_3$, the most extensively studied lead-free piezoelectric. The unique electron diffraction method leading to this discovery may also be used to facilitate the analysis of oxygen octahedra tilting in other perovskite ferroelectrics.

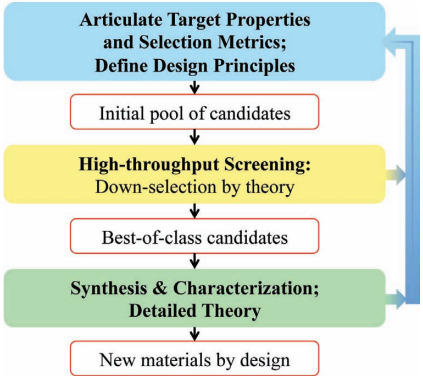


Piezoelectrics

C. Ma,* H. Guo,
X. Tan*.....5261–5266

A New Phase Boundary in $(Bi_{1/2}Na_{1/2})TiO_3$–$BaTiO_3$ Revealed via a Novel Method of Electron Diffraction Analysis

The Modality 2 inverse design is applied to the search for good p-type TCO from the well-documented compounds. Guided by the d^5 design principle, 13 Mn(II) ternary oxides from the ICSD are selected and narrowed to two "best-of-class" candidates by high-throughput first-principles computational screening. In the end, Li-doped Cr_2MnO_4 is obtained, as a novel p-type TCO by design.

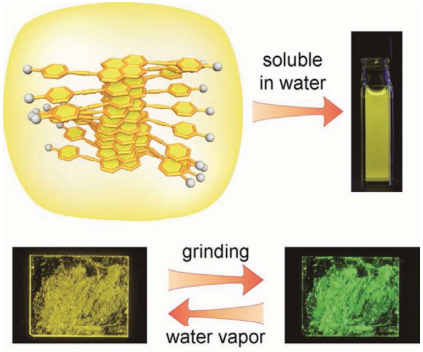


Inverse Design

H. Peng,* A. Zakutayev, S. Lany,
T. R. Paudel, M. d'Avezac, P. F. Ndione,
J. D. Perkins, D. S. Ginley,
A. R. Nagaraja, N. H. Perry,
T. O. Mason, A. Zunger..... 5267–5276

Li-Doped Cr_2MnO_4: A New p-Type Transparent Conducting Oxide by Computational Materials Design

A water-soluble mechanochromic luminescent pyrene derivative with two hydrophilic dendrons is reported. This amphiphilic dumbbell-shaped molecule forms micelles in water. Mechanical stimulation (grinding) of this pyrene derivative in the solid state results in a change of the photoluminescence from yellow to green. Subsequent exposure to water vapor induces recovery of the initial yellow photoluminescence.

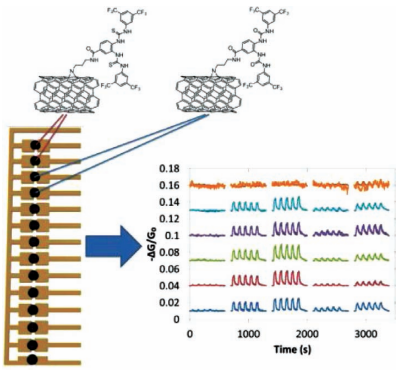


Sensors

Y. Sagara, T. Komatsu, T. Ueno,
K. Hanaoka, T. Kato,
T. Nagano*.....5277–5284

A Water-Soluble Mechanochromic Luminescent Pyrene Derivative Exhibiting Recovery of the Initial Photoluminescence Color in a High-Humidity Environment

Sensor arrays for cyclohexanone and nitromethane are fabricated using single-walled carbon nanotubes (SWCNTs) that are covalently functionalized with different types of selector units. The thiourea, urea and squaramide-based selectors are optimized for improved sensing response. The sensors can be easily fabricated and integrated into electronic circuits. Furthermore, they show a very high level of reproducibility and promising long-term stability.



Explosive Detection

J. M. Schnorr, D. van der Zwaag,
J. J. Walish, Y. Weizmann,
T. M. Swager* 5285–5291

Sensory Arrays of Covalently Functionalized Single-Walled Carbon Nanotubes for Explosive Detection

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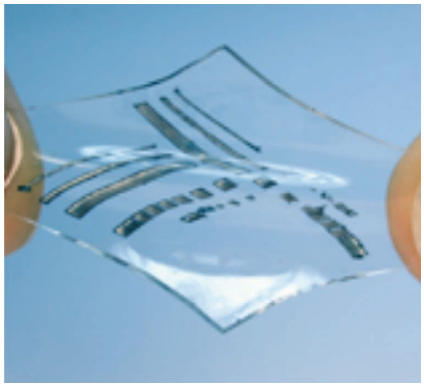
CONTENTS

FULL PAPERS

Stretchable Electronics

R. K. Kramer,* C. Majidi, R. J. Wood.....5292–5296

Masked Deposition of Gallium-Indium Alloys for Liquid-Embedded Elastomer Conductors



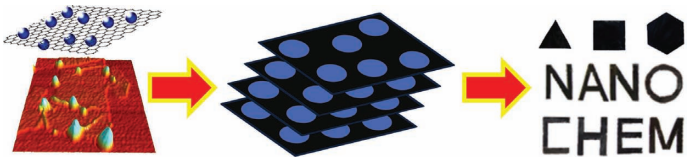
A fabrication method is introduced that utilizes masked deposition and selective wetting to produce hyperelastic electronic circuits that are composed of a thin elastomer film embedded with microchannels of liquid-phase gallium-indium (Ga-In) alloy. This method enables geometries that cannot be produced by injection and allows for the automated, high-volume production of Ga-In-based stretchable conductors.

Nanoscale Electrocatalysts

N. Zhu, S. Han, S. Gan, J. Ulstrup, Q. Chi*.....5297–5306

Graphene Paper Doped with Chemically Compatible Prussian Blue Nanoparticles as Nanohybrid Electrocatalyst

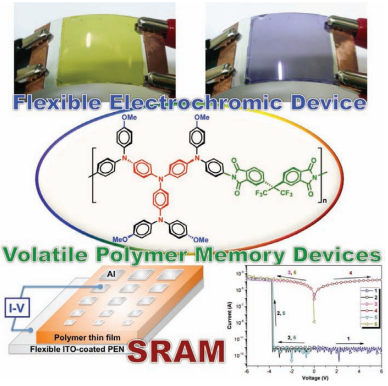
Water soluble and chemically compatible Prussian blue nanoparticles (PBNPs) and reduced graphene oxide (RGO) are synthesized. These two kinds of stable and low-cost nanoscale materials are used as building blocks to prepare electrically enhanced and functionally endorsed hybrid nanosheets, which are further transformed into free-standing graphene paper for high-performance electrocatalysis and application as flexible sensors.



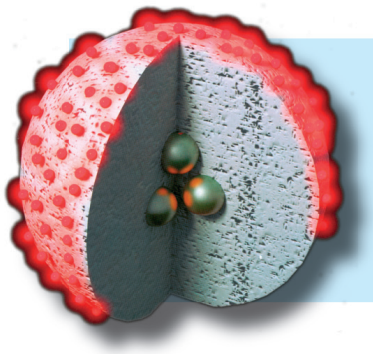
Flexible Electronics

H.-J. Yen, C.-J. Chen, G.-S. Liou*.....5307–5316

Flexible Multi-Colored Electrochromic and Volatile Polymer Memory Devices Derived from Starburst Triarylamine-Based Electroactive Polyimide



Flexible multi-colored electrochromic (EC) and volatile polymer memory devices are fabricated from starburst triarylamine-based polyimide. The polyimide possesses static random access memory behavior and longer retention time than other $C(CF_3)_2$-based polyimides. The flexible EC device showed multicolor electrochromism with excellent stability for long-term EC operation. The characteristics suggest that the novel starburst triarylamine-containing polyimide has great potential for future flexible electronics.



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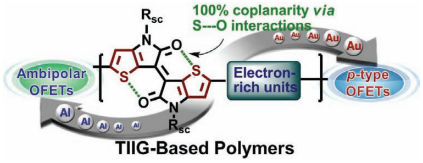
FULL PAPERS

A series of ultralow-bandgap polymers made by copolymerizing various electron-rich units with a newly conceived thienoisoindigo (TIIG) moiety is presented for organic field-effect transistors. Investigation of their field-effect performance indicates that the TIIG-based polymers can function as either a unipolar p-type or ambipolar semiconductor via the variation of the electrode metals, independent of the electron affinity of the counterparts.

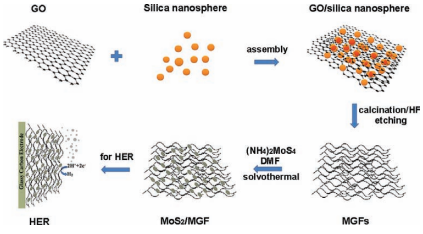


Semiconductors

G. K. Dutta, A.-R. Han, J. Lee, Y. Kim, J. H. Oh,* C. Yang*.....5317–5325

Visible-Near Infrared Absorbing Polymers Containing Thienoisoindigo and Electron-Rich Units for Organic Transistors with Tunable Polarity

A highly active electrocatalyst of MoS_2/MGF, where the MoS_2 nanoparticles are formed uniformly on mesoporous graphene foams (MGF) via a facile solvothermal approach, is reported. The MoS_2/MGF nanocomposites exhibit the high hydrogen evolution reaction activity with a low overpotential and large cathodic currents arising from MGF's high surface area, abundant mesopores, and highly conductive skeleton of graphene.



Energy Storage

L. Liao, J. Zhu, X. Bian, L. Zhu, M. D. Scanlon, H. H. Girault, B. H. Liu*.....5326–5333

MoS_2 Formed on Mesoporous Graphene as a Highly Active Catalyst for Hydrogen Evolution

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