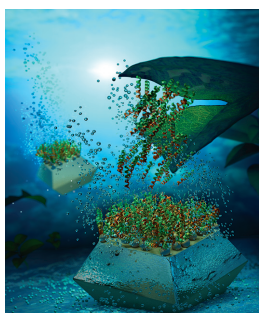


ADVANCED FUNCTIONAL MATERIALS

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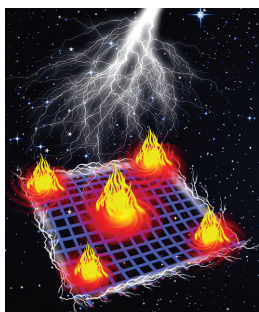
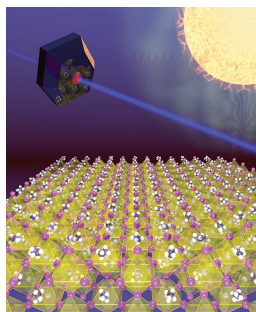


Hydrogen Evolution

In the Z-scheme of photosynthesis, two photosynthetic proteins, photosystem II and photosystem I, excite electrons step-wise using the light energy. On page 2369, K. T. Nam and team report a hybrid Z-scheme using photosystem I and a BiVO_4 semiconductor. In this study, step-wise charge separation in photosystem I and BiVO_4 enables the production of hydrogen from only water under visible light, for the first time.

Hybrid Perovskites

Hybrid organometal halide perovskites have been demonstrated to have outstanding performance as semiconductors for solar energy conversion. The understanding of their intrinsic properties is a fundamental step towards the technological exploitation of these materials. The article by G. R. Blake, J. Even, M. A. Loi, and co-workers on page 2378 investigates these intrinsic properties by studying the structural and photophysical properties of high quality single crystals of $\text{CH}_3\text{NH}_3\text{PbI}_3$ from room temperature to 5 K.

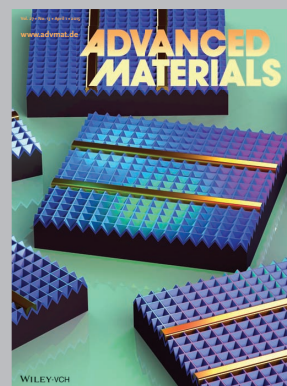
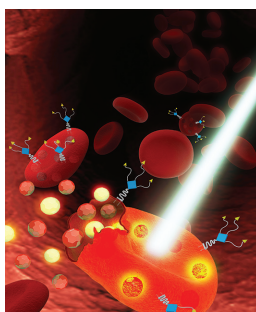


Thin Films

A 2D ultrathin Janus hybrid of polymer-grafted CNTs/GO film is fabricated by Y. Huang, J. Zhang, T. Chen, and co-workers on page 2428 using microcontact printed CNTs/GO as photo active surface to grow polymer brushes by self-initiated photografting and photopolymerization selectively from one side of CNTs/GO film. The achieved 2D Janus hybrid materials, with polymer layer as insulative carpet and CNTs/GO thin film as conductive element, serve as flexible and miniature electric carpet for heating micro-/nano devices locally.

Drug Delivery

On page 2386 Z. Liu and colleagues introduce a tumor angiogenesis targeting, near-infrared light stimulus-response red blood cell (RBC)-based drug delivery by incorporating various functional components within the RBC platform, for potential combined photothermal-chemotherapy of cancer.



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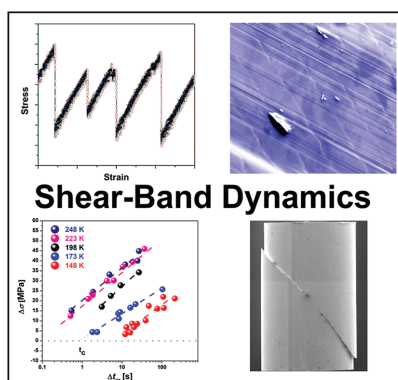
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FEATURE ARTICLE

Dynamic properties of shear bands are a key element for the design of plastically stable bulk metallic glasses. In this Feature Article, recent progress on in situ characterization of shear-band dynamics is summarized. The aim is to provide a comprehensive understanding of shear-band initiation, propagation, arrest, creep, and aging, and how they determine the plastic flow behavior of bulk metallic glasses.



Shear-Band Dynamics

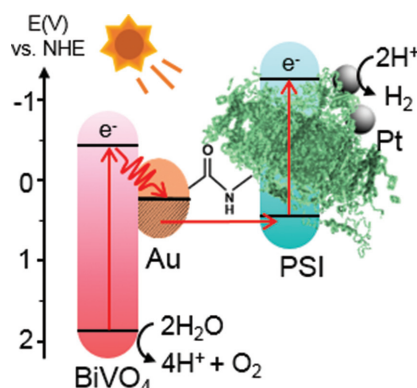
Deformation Dynamics

R. Maaß,* J. F. Löffler*2353–2368

Shear-Band Dynamics in Metallic Glasses

FULL PAPERS

The first hybrid Z-scheme by using photosystem I and a semiconductor in an all-linked structure is reported. The hybrid system produces hydrogen from water without the use of a reducing additive under visible light. This novel system provides a new means of using photosynthetic proteins in photocatalytic applications.

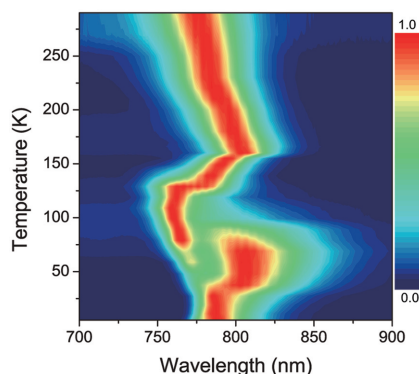


Hydrogen Evolution

Y. Kim, D. Shin, W. J. Chang,
H. L. Jang, C. W. Lee, H.-E. Lee,
K. T. Nam*2369–2377

Hybrid Z-Scheme Using Photosystem I and BiVO₄ for Hydrogen Production

Low-temperature photophysical investigations of CH₃NH₃PbI₃ single crystals indicate that the recombination in these perovskites is due to spontaneous band-to-band radiative transition at room temperature and to singlet-free-exciton and bound-triplet excitons below the phase transition temperature. The bound-triplet excitons are characterized by a decay dynamics of about 5 μs and by a saturation phenomenon due to many-body interactions.

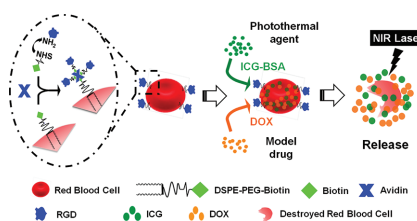


Hybrid Perovskites

H.-H. Fang, R. Raissa, M. Abdu-Aguye,
S. Adjokatse, G. R. Blake,* J. Even,*
M. A. Loi*2378–2385

Photophysics of Organic–Inorganic Hybrid Lead Iodide Perovskite Single Crystals

A tumor angiogenesis targeting red blood cell (RBC)-based drug delivery system is successfully fabricated by incorporating various functional components within the RBC platform, and is responsive to near-infrared light stimulus. As a proof of principle, RBC-based cancer cell targeted drug delivery and light-controlled drug release is demonstrated in vitro, achieving a marked synergistic therapeutic effect through the combined photothermal–chemotherapy.



Drug Delivery

X. Sun, C. Wang, M. Gao, A. Hu,
Z. Liu*2386–2394

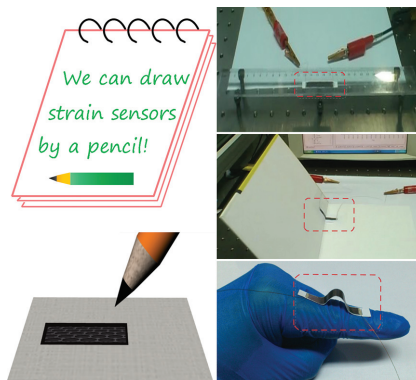
Remotely Controlled Red Blood Cell Carriers for Cancer Targeting and Near-Infrared Light-Triggered Drug Release in Combined Photothermal–Chemotherapy

FULL PAPERS

Flexible Electronics

X. Liao, Q. Liao, X. Yan, Q. Liang,
H. Si, M. Li, H. Wu, S. Cao,
Y. Zhang* 2395–2401

Flexible and Highly Sensitive Strain Sensors Fabricated by Pencil Drawn for Wearable Monitor

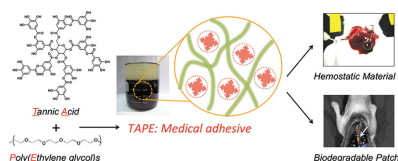


Easy-to-fabricate, cost-effective, soft, lightweight, versatile sensors revolutionize the sensing technology and can be applied in personal electronic devices, artificial intelligence systems, and structural health monitoring. The pen-on-paper approach endows the pencil trace based on a printing paper with strain-sensing capability for monitoring the rapid micro-strain structural variation, book folding, and human motion. The sensors are low carbon footprint, disposable, and green products.

Medical Adhesives

K. Kim, M. Shin, M.-Y. Koh, J. H. Ryu,
M. S. Lee, S. Hong,*
H. Lee* 2402–2410

TAPE: A Medical Adhesive Inspired by a Ubiquitous Compound in Plants

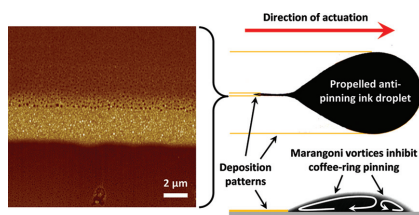


TAPE is a medical glue inspired by the adhesive properties of polyphenols and is found ubiquitously in plant species. The adhesion strength of TAPE exhibits a 250% increase relative to that of fibrin glue, and TAPE exhibits wet-resistant adhesion. TAPE can be an effective hemostatic material and a pH-sensitive patch for detecting gastroesophageal reflux disease in vivo.

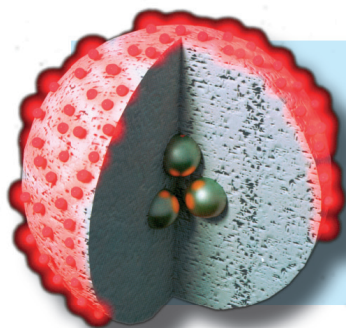
Nanoprinting

G. Konvalina, A. Leshansky,
H. Haick* 2411–2419

Printing Nanostructures with a Propelled Anti-Pinning Ink Droplet



Lateral actuation of propelled anti-pinning ink droplets is presented and explored as a new approach for patterning nanomaterials. This approach achieves continuous patterns that can be formed on rigid or flexible substrates, even within 3D concave closed shapes, and offers the ability to produce a controlled thickness gradient along the patterns.



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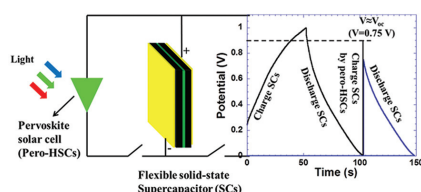
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FULL PAPERS

Self-powered electronics is demonstrated by integration of high-performance perovskite hybrid solar cells with flexible solid-state supercapacitors, which is based on self-stacked solvated graphene films and possess high capacitance and excellent mechanical properties. The self-powered electronics is further demonstrated to have great potential applications in storage of solar energy.

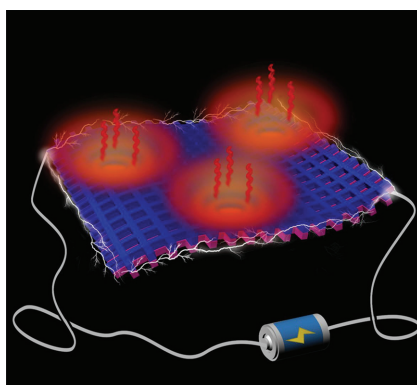


Supercapacitance

P. C. Du, X. Hu, C. Yi, H. C. Liu, P. Liu, H.-L. Zhang,* X. Gong*2420–2427

Self-Powered Electronics by Integration of Flexible Solid-State Graphene-Based Supercapacitors with High Performance Perovskite Hybrid Solar Cells

A polymeric electrical carpet of 2D Janus hybrid thin film, with grafted polymer layer as insulative carpet and supported carbon materials as conductive element, has the potential application in heating micro-/nano devices locally.

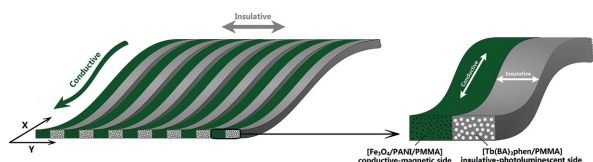


Thin Films

P. Xiao, C. Wan, J. Gu, Z. Liu, Y. Men, Y. Huang,* J. Zhang,* L. Zhu, T. Chen*2428–2435

2D Janus Hybrid Materials of Polymer-Grafted Carbon Nanotube/Graphene Oxide Thin Film as Flexible, Miniature Electric Carpet

Novel Janus nanoribbons arrays with excellent electrically conductive anisotropy, magnetism, and photoluminescence are prepared via electrospinning technology. Based on the unique nanostructure, conductance in the direction parallel to the Janus nanoribbons is almost eight orders of magnitude higher than that in the perpendicular direction, which is by far the most excellent conductive anisotropy for anisotropic conductive materials.

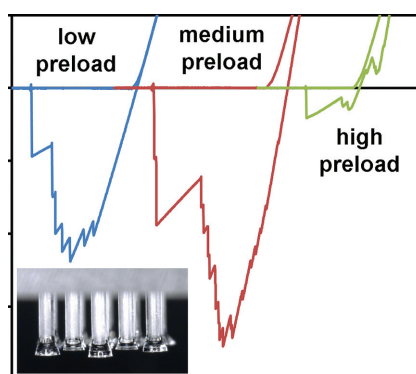


Janus Nanoribbons

Q. Ma, J. Wang, X. Dong,* W. Yu, G. Liu2436–2443

Flexible Janus Nanoribbons Array: A New Strategy to Achieve Excellent Electrically Conductive Anisotropy, Magnetism, and Photoluminescence

Novel bioinspired, switchable adhesives with pillars of different length are successfully prepared, and allow control of the pull-off force by means of preloading. Three distinct adhesive states are accessible. Adhesive properties are characterized by force–distance experiments and in situ observation of the deformation. Various applications, for example, in transportation, handling, and robotics, may benefit from the new bioinspired adhesive.



Bioinspired Adhesives

P. Y. Isla, E. Kroner*2444–2450

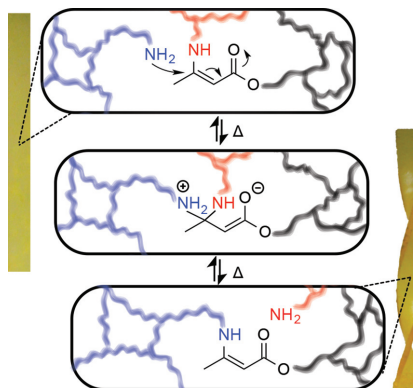
A Novel Bioinspired Switchable Adhesive with Three Distinct Adhesive States

FULL PAPERS

Vitrimers

W. Denissen, G. Rivero, R. Nicolaÿ,
L. Leibler, J. M. Winne,*
F. E. Du Prez* 2451–2457

Vinylogous Urethane Vitrimers

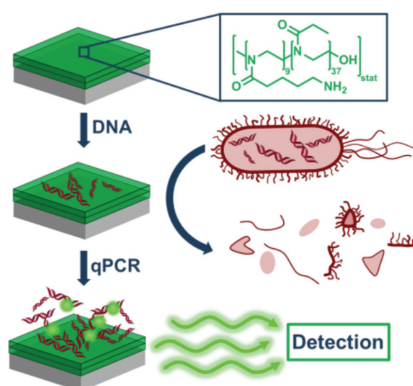


Catalyst-free vitrimers based on the transamination of vinylogous urethanes are prepared from readily accessible chemicals. These high T_g , cross-linked materials exhibit excellent mechanical properties, while the exchangeable bonds enable full stress-relaxation on short time scales and recycling over many cycles.

Bioanalytics

M. N. Leiske, M. Hartlieb, C. Paulenz,
D. Pretzel, M. Hentschel,
C. Englert, M. Gottschaldt,
U. S. Schubert* 2458–2466

Lab in a Tube: Purification, Amplification, and Detection of DNA Using Poly(2-oxazoline) Multilayers



Detection of DNA directly from biological material is performed by the use of covalently bound poly(2-oxazoline) multilayers on polypropylene. Layer-by-layer assembly and interaction with genetic material is investigated in detail, and the amplification and detection of surface adsorbed DNA is performed by quantitative real-time polymerase chain reaction using coated reaction vessels.

Dielectric Elastomers

S. J. Düнки, Y. S. Ko, F. A. Nüesch,
D. M. Opris* 2467–2475

Self-Repairable, High Permittivity Dielectric Elastomers with Large Actuation Strains at Low Electric Fields

A one-step process is presented for the synthesis of dielectric elastomers with permittivity of up to 10.1 at 10 kHz, $Y(10\%) = 154$ kPa, and strain at break of 260%. Actuators made with them are able to self-repair after a breakdown and show lateral strains of up to 20.5% at an electric field as low as 10.8 V μm^{-1} .

