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Aqueous Cathodic Deposition
In article number 1907089, Zhiping Lai and co-workers develop an aqueous cathodic deposition method to fabricate ZIF-8 membranes. The membrane grows under a current, which provides a self-healing mechanism, leading to an ultrathin and defect-free membrane that shows excellent performance in propylene/propane separation.

Chemiresistors
In article number 1907087, Timothy M. Swager and co-workers describe a real-time wireless anion sensing platform consisting of carbon nanotubes functionalized by a squaramide-based anion selector. The chemical interaction between the selector and anion is efficiently transduced into an electrical signal. The sensing platform has the ability to communicate with a smartphone, enabling wireless data transmission of anion sensing signals in real time.

Photothermal Janus Anodes
In article number 1909432, Wei Wang, Xiaodong Chen, and co-workers achieve solar-activated low-temperature biological wastewater treatment (BWT) via a photothermal Janus anode composed of a unique photothermal waterproof nonporous layer and a conductive porous layer. The photothermal Janus anode successfully prevents anodic electrochemical microorganism poisoning by shielding photosynthesis and enables the BWT system to achieve appreciable removal of organic pollutants and stable electricity generation.

δ-CsPbI3 Intermediate Phase Growth
In article number 1908343, Yumin Liu, Xing-Zhong Zhao, and co-workers develop a δ-CsPbI3 intermediate phase growth (IPG) strategy for achieving high and controllable Cs⁺ incorporation and fabricating large-grain perovskite thin films. The δ-CsPbI3 phase in the PbI₂ film, which serves as the cesium source, facilitates the growth of perovskite grains. This CsPbI3-IPG is a facile and effective strategy to produce large-grain Cs⁺ incorporated perovskite films via sequential deposition.
Recently, plenty of noble metal nanocrystals combined with semiconductors/metalloid materials have been developed that can produce strong surface plasmon resonance (SPR) properties. Herein, the latest progress in the design, synthesis, and features of SPR-assisted photocatalysis, and optoelectronic devices are summarized. Their structure-related properties and applications in water splitting, green energy storage, and fuel cells are also discussed in detail.

Carbon counter electrode materials for dye-sensitized and perovskite solar cells are summarized extensively. The specific morphology and structure design of the carbon counter electrode in dye-sensitized solar cells and the intrinsic features, energy level alignment, and interface engineering of the perovskite/carbon interface in perovskite solar cells are emphasized.

Yttrium-doped cadmium oxide films grown on fused silica exhibit Fabry–Perot resonance. Interband-pumping shifts the resonance, leading to broadband transmission/reflection modulation. Up to 135% reflection-modulation is demonstrated in the mid-infrared region, with picosecond response times. The relaxation times and the epsilon-near-zero wavelengths can be tailored by controlling the doping level. This has applications in tunable optical/plasmonic devices spanning the ultraviolet to the mid-infrared region.

An electrical transduction platform using single-walled carbon nanotubes non-covalently functionalized with squaramide-based anion binding selectors is developed for real-time wireless anion detection. Improved anion sensitivity is achieved by an internal charge transfer after deprotonation of the squaramide selector upon the addition of acetate.
An ultrathin ZIF-8 membrane with ≈500 nm thickness is fabricated via a novel aqueous cathodic deposition method. The membrane shows superior C3H6/C3H8 separation performance with the permeance of C3H6 up to 182 GPU and a selectivity of C3H6 over C3H8 up to 142, which surpasses all the reported membrane performances prepared by conventional methods.

Solar-activated low-temperature biological wastewater treatment (BWT) is achieved by the design of a photothermal Janus anode composed of a unique photothermal waterproof nonporous layer and a conductive porous layer. The photothermal Janus anode successfully prevents anodic electrochemical microorganism poisoning by shielding photosynthesis and enables the BWT system to achieve appreciable removal of organic pollutants and stable electricity generation.

A δ-CsPbI3 intermediate phase growth (IPG)-assisted sequential deposition strategy is developed in this work, which not only achieves controllable Cs+ incorporation and enlarged perovskite grains, but also manipulates the crystallization, modulates the bandgap, and improves the stability of the final perovskite film. This CsPbI3-IPG is a facile and effective strategy to obtain large-grain Cs+ incorporated perovskite film via sequential deposition.
Bulky cation addition to perovskite solar cells is demonstrated as an effective means of significantly improving device performance. Detailed structural characterization reveal additives are located at surfaces and grain boundaries, resulting in suppression of nonradiative recombination. Judicious cation selection results in MAPI-based perovskite cells with a power conversion efficiency $>20\%$ and MAPBrI cells with a $V_{oc}$ of 1.22 V.

High-performance on-chip thermionic electron micro-emitter arrays on a 1 cm $\times$ 1 cm chip are realized by exploiting suspended super-aligned carbon nanotube films as thermionic filaments. Compared with field electron micro-emitter arrays, the thermionic micro-emitter arrays show much better stability, reproducibility, and uniformity, which are believed to make them promising in on-chip integrated electron sources.

Thin and rigid covalent organic framework films as an artificial solid electrolyte interphase for Li metal anodes not only redistributes the Li-ion flux, reduces the side reactions between Li metal and electrolytes, and leads to the homogeneous plating/stripping process, but also strongly represses dendrite formation on the Li anode and exposure to ensure battery safety.

The universal Al-Li alloy-based layer is demonstrated to be highly effective for stabilizing the lithium metal anode at an ultrahigh current density. The high strength layer not only inhibits the growth of lithium dendrites but also prevents the parasitic reactions of Li with the liquid electrolyte and polysulfides.
Zwitterionic osmolytes (betaine or proline) are first reported to endow NH₄Cl-containing Ca-alginate/polyacrylamide hydrogels with excellent freeze tolerance. Due to the capacity to inhibit ice formation of zwitterionic osmolytes, the resulting hydrogels can achieve outstanding ionic conductivity (up to 2.7 S m⁻¹) together with stable mechanical flexibility even at a low temperature of −40 °C.

Ultrafast melting of 3D metal–organic frameworks comprising flexible ligands by femtosecond laser pulses allows producing a new kind of derivative as well-organized spheres with a metal oxide dendrite core and an amorphous organic shell, which are suitable for non-linear nanophotonics due to enhanced second harmonic generation and three-photon luminescence.

Lead-free inorganic high-k dielectric BaxSr1−xTiO3 oxides are successfully introduced to support MoS₂ channels in field effect transistors, targeting both extremely low voltage operation and ferroelectric nonvolatile memory function by simply adjusting the composition ratio of Ba and Sr.

Substrate-free and shapeless planar micro-supercapacitors are fabricated by encapsulating ultrathin microelectrodes made from 2D materials in different geometries with graphene-oxide-incorporated hydrogel electrolyte, showing high-performance tenability and arbitrary form factors, in particular, unprecedented mechanical flexibility even under extreme crumpling, rolling, or spiral deformation while still maintaining the initial performance.
O3-Na_{0.73}Li_{0.36}Ti_{0.73}O_2 is first achieved as an anode for sodium-ion batteries (SIBs). It delivers a reversible capacity of 108 mAh g\(^{-1}\) with near-zero strain and no phase transitions, ensuring excellent cycle stability over 6000 cycles. More surprisingly, in contrast to the 32\% capacity drop of the P2-type material, this O3-type material shows excellent water stability among layered transition metal oxides in SIBs.

A Water Stable, Near-Zero-Strain O3-Layered Titanium-Based Anode for Long Cycle Sodium-Ion Battery

S. Ma, Y. Zhang, Y. Liang,* L. Ren,* W. Tian, L. Ren .........................1908508

High-Performance Ionic-Polymer–Metal Composite: Toward Large-Deformation Fast-Response Artificial Muscles

M.-J. Dong, X. Wang, C.-D. Wu* .................................1908519

Creation of Redox-Active PdS\(_x\) Nanoparticles Inside the Defect Pores of MOF UiO-66 with Unique Semihydrogenation Catalytic Properties

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Salt-Assisted Growth of P-type Cu\(_9\)S\(_5\) Nanoflakes for P-N Heterojunction Photodetectors with High Responsivity

An effective strategy is developed for the synthesis of highly efficient semihydrogenation catalysts, consisting of in situ created PdS\(_x\) nanoparticles as the redox-active sites inside the defect pores of metal–organic frameworks, which demonstrate very high alkene selectivity (up to 99.5\%) in semihydrogenation of easily over-hydrogenated terminal alkynes.

High-quality, single-crystalline p-type Cu\(_9\)S\(_5\) nanoflakes are synthesized via a salt-assisted chemical vapor deposition method and have good conductivity. The resulting p-n heterojunction, Cu\(_9\)S\(_5\)/MoS\(_2\), shows a strong coupling at the interface and exhibits good optoelectronic performance with a high responsivity and response rate due to the strong built-in electric field in the depletion layer.
The rational design and facile synthesis of O-incorporated CoP (denoted as O-CoP) nanosheets, which synergistically integrate favorable thermodynamics through modification of electronic structures with accelerated kinetics through nanostructuring, is demonstrated. Benefiting from the structural and compositional advantages, the optimal O-CoP nanosheets with moderate O incorporation display outstanding catalytic activities for both hydrogen evolution reaction and oxygen evolution reaction.

On the basis of the molecular design philosophy for aggregation-induced emission (AIE), here, a constitutional isomerization strategy involving the combination of backbone distortion and rotor twisting is demonstrated. The resultant AIEgen displays a high quantum yield of 11% with an emission peak of 1030 nm. Further, neutrophils are creatively used as carriers to detect brain inflammation with a high signal-to-background ratio of 30.6.

Hybrid living materials (HLMs) are a class of multifunctional materials that harness the responsive capabilities of engineered bacteria in combination with established digital fabrication processes (e.g., computer-aided design and additive manufacturing) for structural materials. The programmable biological control enabled by the multimaterial HLM framework creates new possibilities for large-scale, structurally complex, and diversely functional hybrid living devices.

Deep neural networks, device simulation, and experiment are coupled to demonstrate a general method for the extraction of material parameters from thin-film solar cells. Mobilities, trap densities, and recombination constants are extracted from transient and steady state data. The method is applicable to all classes of thin-film devices, and has considerable advantages over previous approaches.
Lateral magnetic anisotropy energy in La$_{2/3}$Sr$_{1/3}$MnO$_3$ layers is tunable via three different interface-engineering approaches. The interface-engineered samples show a uniform Mn–O–Mn bond angle and Mn–O bond length across the entire layer. The direct correlation between 3d$_{x^2-y^2}$ orbital symmetry breaking and lateral magnetic anisotropy energy is unveiled, where the dominant role of the crystal field is highlighted.

Double-sided 2D surface passivation of 3D perovskite film contributes to a remarkable device $V_{OC}$ of 1.2 V, which is one of the highest open-circuit voltages reported for perovskite cells with an optical bandgap of $\approx 1.6$ eV. Discontinuous 2D perovskite films provide conductive pathways through these resistive layers, allowing for efficient charge transport between the 3D perovskite and charge transport layers.

Facilitating intercellular electrical communication in tissue engineering is challenging. Here, electroconductive fibrous scaffolds with tailorable mechanical and electrical properties are presented. Cardiomyocytes show improved contractile amplitude, intercellular junctions, and higher beating rates.

A new aluminate-based solid-state electrolyte is fabricated via a chemical reaction between LiOH and triethylaluminum in the presence of LiTFSI-containing electrolyte. The aluminate-based solid-state electrolyte exhibits high ionic conductivity and good capability to stabilize Li anode in both inert and oxidizing conditions.
An unprecedented anchoring-based coassembly strategy is proposed to acquire highly scalable and wettable hole-extraction monolayers (HELs) for p-i-n structured perovskite solar cells. It enables ultrathin HELs with high uniformity, facilitates the fabrication of large-area perovskite films, and guarantees a high quality of interfacial contact. For the first time, a monolayer HEL-based 36 cm² module achieves 12.67% efficiency.

An in situ structure–property characterization method is reported by monitoring the color change in a photonic elastomeric material. By a two-step polymerization process, the coatings are first linearly chain-extended and subsequently crosslinked, for which the color redshifts during chain extension, and is “frozen in” during network formation. Additionally, patterned coatings are made responsive toward specific solvents and temperature.

Inspired by the gas storage mechanism of the water spider, a strategy to collect and store underwater gas bubbles is demonstrated based on a single-layer underwater superaerophobic mesh (USM) assembled with a quartz tube. Moreover, a device with an asymmetrical U-shaped quartz tube fitted to the USM is designed to realize continuous gas collection and transportation.

An engineered drug delivery scaffold based on fibrin gel is used to codeliver cyclophosphamide (CTX) and anti-PD-L1 for the prevention of cancer recurrence postsurgery. This sequential local delivery system restrains suppressive regulatory immune cells and meanwhile enhances effector cells robustly. Finally, it inhibits tumor recurrence to improve the prognosis. This strategy has potential applications in clinical practice.
High-strain Peano hydraulically amplified self-healing electrostatic (HASEL) actuators are electrohydraulically driven artificial muscles that feature high-speed linear contraction of \( \approx 24\% \), matching average values for skeletal muscles. The materials and geometry are optimized, and the application as a soft pump is demonstrated; other potential uses include bioinspired robots, robotic faces, and artificial organs.

A facile preparation strategy based on anisotropic deswelling is developed to achieve uniformly colored large-area cholesteric liquid crystal (CLCE) films. The CLCE exhibits rapid and reversible color changes to any mechanical deformation locally or globally. This easily scalable approach for fabricating CLCE films opens up possibilities for numerous applications.

A new strategy, by incorporating sliding crosslinks and hydrogen bonds into a polymer to achieve a highly stretchable and self-healable elastomer with good mechanical strength, is reported in this work.

Three diketopyrrolopyrrole (DPP) based copolymers are applied in organic transistors. \( p \)-Type behavior is observed for all the materials in air. However, charge-carrier-polarity change occurs by changing the measurement atmosphere and the electron affinity of the flanking groups of the DPP core.
Underwater adhesion is achieved through a self-hydrophobization process on a dynamic hydrogel surface. The adhesion mechanism ensures ready, strong, nonspecific, repeatable, and long-term stable underwater adhesion without requiring extra processes or reagents, which enables convenient application underwater/or in wet conditions.

A dual metal–organic frameworks (MOFs) pyrolysis strategy is developed to regulate the intrinsic activity and porous structure of the derived catalysts. The as-prepared FeNiCo-based porous carbon material in zinc–air batteries displays a low voltage gap and long-term durability. This work affords a competitive bifunctional oxygen electrocatalyst for zinc–air battery and paves a new way to fabricate MOF-derived materials.

Efficient charge separation and enriched reductive reactive sites are synchronously achieved by coupling piezocatalysis and photocatalysis of layered piezoelectric semiconductor Bi$_4$NbO$_8$X (X = Cl, Br) single crystalline nanoplates, which results in the efficient production of reactive oxygen species (•O$_2$$, \text{H}_2\text{O}_2$, and •OH) and hydrogen.

Benzene-bridged polypyrrole films with controllable thickness and ultralarge area are prepared by a conventional interfacial polymerization method. Such a semiconductive polypyrrole film, which possesses a bandgap of 2.0 eV and a carrier mobility of $\approx$1.5 cm$^2$ V$^{-1}$ s$^{-1}$, can be used as electrode material for micro-supercapacitors and exhibits ultrahigh energy (50.7 mWh cm$^{-3}$) and power (9.6 kW cm$^{-3}$) densities.