Microfluidic Devices

ESCARGOT (Embedded SCAfold RemovinG Open Technology) is a novel and simple methodology for the manufacturing of complex microfluidic devices in a single block of polydimethylsiloxane, developed by V. Saggiomo and A. H. Velders in article number 1500125. Dissolvable scaffolds are used for the creation of microfluidic channels without the use of clean rooms, and integration of external elements directly in the microfluidic device is shown to be easy.

Contact Transfer Printing

A scalable contact-transfer printing of an ultra-sensitive, flexible nanoplasmonic biosensing platform for miRNA-21 is presented by J.-S. Yeo and co-workers in article number 1500121. The greatly increased sensitivity and suppressed noise result from selective pre-functionalization on the side-walls of the nanostructures to enhance the electric field. Arrays of the nanostructures form hetero assemblies, which are contact-transfer printed onto flexible substrates.

Photoluminescence

Radiative recombination in thin films of the arche-typical, high-performing perovskites is investigated through spatially resolved photoluminescence by H. Sirringhaus, F. Deschler and co-workers in article number 1500136. Localized regions with dimensions ≈500 nm show increased emission with narrower emission lines, attributed to increased order. Excited states do not diffuse out of high emission regions, but are decoupled from nearby regions. Cover design by Bojan Galic.
The bacterial flagellar motor (BFM) is a molecular complex ca. 45 nm in diameter that rotates the propeller that makes nearly all bacteria swim. This self-assembling motor has high rotational speeds and can quickly switch direction to navigate its environment. The BFM is thus a pinnacle of evolution that informs and inspires novel nanotechnology in the new era of synthetic biology.

**Molecular Motor**

R. Xue, Q. Ma, M. A. B. Baker, F. Bai

A Delicate Nanoscale Motor Made by Nature—The Bacterial Flagellar Motor

**Photoluminescence**

H. Huang, A. S. Susha, S. V. Kershaw, T. F. Hung, A. L. Rogach

Control of Emission Color of High Quantum Yield CH$_3$NH$_3$PbBr$_3$ Perovskite Quantum Dots by Precipitation Temperature

Emission color controlled, high quantum yield CH$_3$NH$_3$PbBr$_3$ perovskite quantum dots are obtained by changing the temperature of a bad solvent during synthesis. The products for temperatures between 0 and 60 °C have good spectral purity with narrow emission line widths of 28–36 nm, high absolute emission quantum yields of 74% to 93%, and short radiative lifetimes of 13–27 ns.

**Photoluminescence**

M. Vrućinić, C. Matthiesen, A. Sadhana, G. Dvitini, S. Cacovich, S. E. Dutton, C. Ducati, M. Atature, H. Snaith, R. H. Friend, H. Sirringhaus, F. Deschler

Local Versus Long-Range Diffusion Effects of Photoexcited States on Radiative Recombination in Organic–Inorganic Lead Halide Perovskites

Radiative recombination in thin films of the archetypical, high-performing perovskites CH$_3$NH$_3$PbBr$_3$ and CH$_3$NH$_3$PbI$_3$ shows localized regions of increased emission with dimensions ≈500 nm. Maps of the spectral emission line shape show narrower emission lines in high emission regions, which can be attributed to increased order. Excited states do not diffuse out of high emission regions before they decay, but are decoupled from nearby regions, either by slow diffusion rates or energetic barriers.

**Polymers**

A. R. Gentle, G. B. Smith

A Subambient Open Roof Surface under the Mid-Summer Sun

A novel material open to warm air stays below ambient temperature under maximum solar intensities of mid-summer. It is found to be 11 °C cooler than a commercial white cool roof nearby. A combination of specially chosen polymers and a silver thin film yields values near 100% for both solar reflectance, and thermal emittance at infrared wavelengths from 7.9 to 13 µm.
Surface amorphization provides unprecedented opportunities for altering and tuning material properties. Surface-amorphized TiO$_2$@graphene synthesized using a designed low temperature-phase transformation technique exhibits significantly improved rate capability compared to well-crystallized TiO$_2$@graphene and bare TiO$_2$ electrodes. These improvements facilitate lithium-ion transport in both insertion and extraction processes and enhance electrolyte absorption capability.

An easy and cheap fabrication method for intricate polydimethylsiloxane microfluidic devices is presented. The acrylonitrile butadiene styrene scaffold-removal method uses cheap, off-the-shelf materials and equipment for the fabrication of intricate microfluidic devices. The versatility of the method is proven by the fabrication of 3D multi-layer, ship-in-a-bottle, selective heating, sensing, and NMR microfluidic devices. The methodology is coined ESCARGOT: Embedded SCAffold RemovinG Open Technology.

Surface-amorphous and oxygen-deficient Li$_3$VO$_4$-$\delta$ synthesized by simple annealing of Li$_3$VO$_4$ powders in a vacuum shows great enhancements in both reversible capacity and coulombic efficiency for the first discharge/charge without delicate size control and carbon coating. The results are associated with the improved charge-transfer kinetics caused by the amorphous surface of Li$_3$VO$_4$-$\delta$.
COMMUNICATIONS

Batteries

X. Lu,* J. Deng, W. Si, X. Sun, X. Liu, B. Liu, L. Liu, S. Oswald, S. Baunack, H. J. Grafe, C. Yan,* O. G. Schmidt .................1500113

High-Performance Li-O₂ Batteries with Trilayered Pd/MnOₓ/Pd Nanomembranes

Trilayered Pd/MnOₓ/Pd nanomembranes are fabricated as the cathode catalysts for Li-O₂ batteries. The combination of Pd and MnOₓ facilitates the transport of electrons, lithium ions, and oxygen-containing intermediates, thus effectively decomposing the discharge product Li₂O₂ and significantly lowering the charge overpotential and enhancing the power efficiency. This is promising for future environmentally friendly applications.

Charge Transport

X. Chen, S. Yang, Y. C. Zheng, Y. Chen, Y. Hou, X. H. Yang,* H. G. Yang* ......................1500105

Multifunctional Inverse Opal-Like TiO₂ Electron Transport Layer for Efficient Hybrid Perovskite Solar Cells

A novel multifunctional inverse opal-like TiO₂ electron transport layer (IOT-ETL) is designed to replace the traditional compact layer and mesoporous scaffold layer in perovskite solar cells (PSCs). Improved light harvesting efficiency and charge transporting performance in IOT-ETL based PSCs yield high power conversion efficiency of 13.11%.

FULL PAPERS

Contact Transfer Printing

J. Lee, J. Park, J.-Y. Lee, J.-S. Yeo* .....................................1500121

Contact Transfer Printing of Side Edge Prefunctionalized Nanoplasmonic Arrays for Flexible microRNA Biosensor

Ultrasensitive flexible nanoplasmonic biosensor for microRNA-21 is demonstrated using a scalable contact transfer printing process. The greatly increased sensitivity and suppressed noise are enabled by selective prefunctionalization on the field-enhanced side edge of the nanostructure arrays forming hetero assemblies.

Supramolecular Materials

N. Sun, X. Xiao,* W. Li, J. Jiang* .....................................1500082

Multistimuli Sensitive Behavior of Novel Bodipy-Involved Pillar[5]arene-Based Fluorescent [2]Rotaxane and Its Supramolecular Gel

The first Bodipy-involved fluorescent pillar[5]arene-based rotaxane acts as solvent polarity-, thermo-, and pH-driven molecular shuttle, while its self-assembled supramolecular gel also shows multiple external stimuli-induced reversible gel--sol phase transitions upon heating/cooling, shaking/resting, or the addition of different anions.
A technique for creating freestanding 3D electronics by using shape memory polymers is presented. The 3D shape-formation process allows controlled curvature, programmable (step-wise) folding, and can be operated in enclosed environments. Furthermore, this method allows self-wrapping of carbon nanotube transistors, sensors, and memory devices onto any irregularly shaped-objects without degradations in device performance.

A polymer cathode with dense benzoquinone units, poly(benzoquinonyl sulfide), is developed for both Li-organic and Na-organic batteries. It demonstrates superior comprehensive electrochemical performance including high energy density (734 W h kg$^{-1}$ for Li battery, or 557 W h kg$^{-1}$ for Na battery) exceeding those of most inorganic Li or Na intercalation cathodes.