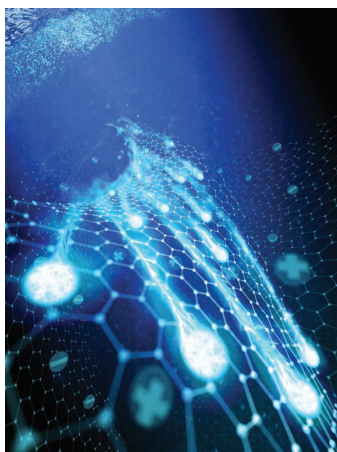


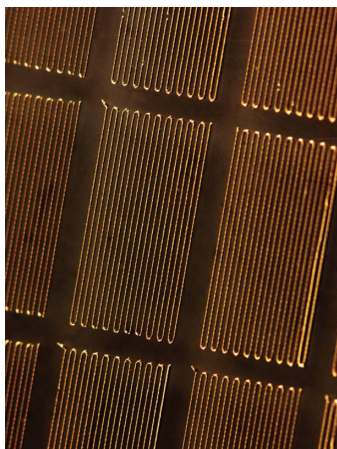
ADVANCED FUNCTIONAL MATERIALS

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Charge Transport

Dynamic control is demonstrated by S. Dasgupta, J. Biener, and co-workers over electronic transport in high surface-area graphene-based bulk materials with a 3D open porous network structure. The structure, described on page 3494, consists of single- and double-layer graphene nanoplatelets. The large macroscopic conductance of the nanographene monoliths can be varied up to several hundred percent using electrolyte gating-induced charge-carrier accumulation or depletion, thereby paving the way towards carbon-based bulk transistors.

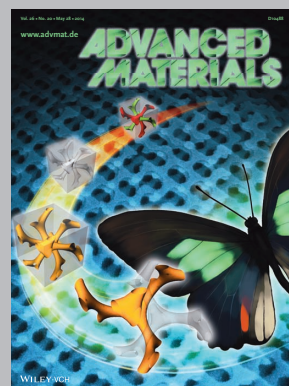
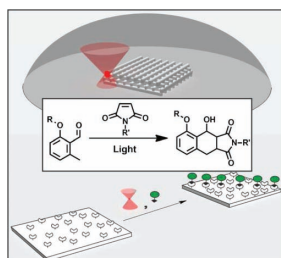


Stretchable Electronics

R. K. Kramer and co-authors report a direct writing method for Ga-In alloys based on an extrusion process. Liquid Ga-In exposed to ambient conditions forms a Ga-oxide skin, which governs the wetting dynamics and printability of Ga-In alloys on silicone-based substrates. The direct writing method and corresponding design algorithm developed on page 3501 lead to free-standing liquid structures, which are applied to create stretchable and conformable electronic devices.

3D Photolithography

The fabrication and spatially resolved surface patterning of woodpile photonic crystals is achieved via a light-induced Diels–Alder reaction by M. Wegener, C. Barner-Kowollik, and co-workers. On page 3571, direct laser writing combined with a non-radical step polymerization to fabricate crystals with five axial periods and a rod spacing of down to 500 nm. The surface patterning is demonstrated by additionally employing a bromine containing maleimide.



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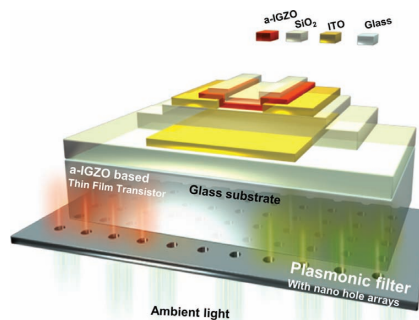
www.small-journal.com

HIGHLIGHTS

Transparent Electronics

S. Chang, Y. S. Do, J.-W. Kim,
B. Y. Hwang, J. Choi, B.-H. Choi,
Y.-H. Lee, K. C. Choi,*
B.-K. Ju* 3482–3487

Photo-Insensitive Amorphous Oxide Thin-Film Transistor Integrated with a Plasmonic Filter for Transparent Electronics



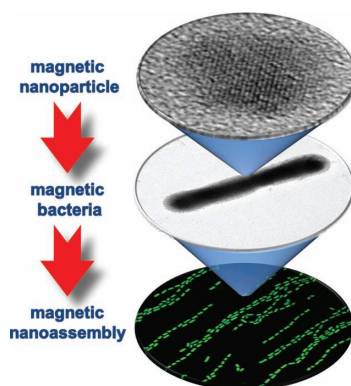
A novel amorphous-indium-gallium-zinc-oxide-based application with stable switching characteristics under negative bias illumination is shown. Metallic nanohole-based plasmonic filters are used for tuning the spectrum of the ambient light source, and the photosensitivity of the a-IGZO-TFT is investigated within a selectively controlled spectral range. The suggested thin-film transistors show greatly improved stability even in a negative bias illumination stress environment.

FULL PAPERS

Magnets

M. Martín, F. Carmona, R. Cuesta,
D. Rondón, N. Gálvez,*
J. M. Domínguez-Vera* 3489–3493

Artificial Magnetic Bacteria: Living Magnets at Room Temperature

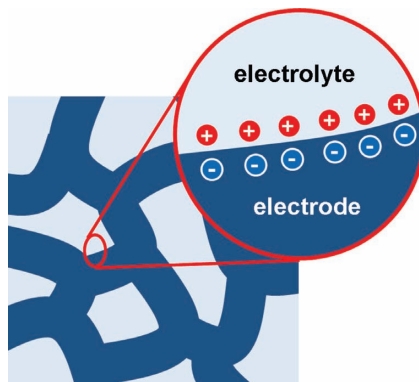


Living magnets from probiotic (non-magnetic) bacteria are created by assembling superparamagnetic maghemite nanoparticles at their surface. The artificial magnetic bacteria present a ferromagnetic phase at room temperature. This means that the blocking temperature of the maghemite nanoparticles increases more than 100 K when assembled.

Charge Transport

S. Dasgupta,* D. Wang, C. Kübel,
H. Hahn, T. F. Baumann,
J. Biener* 3494–3500

Dynamic Control Over Electronic Transport in 3D Bulk Nanographene via Interfacial Charging

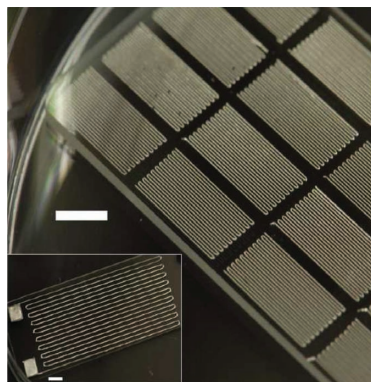


The electron transport properties of centimeter-sized 3D bulk nano graphene monoliths can be dynamically controlled via electrolyte gating-induced interfacial charge density. A fully reversible change in the macroscopic conductance is observed despite the high conductivity of the material. The exceptionally large yet tunable current through such metallic and bulk channel paves the way towards high-power bulk transistors.

Stretchable Electronics

J. W. Boley, E. L. White, G.-C. Chiu,
R. K. Kramer* 3501–3507

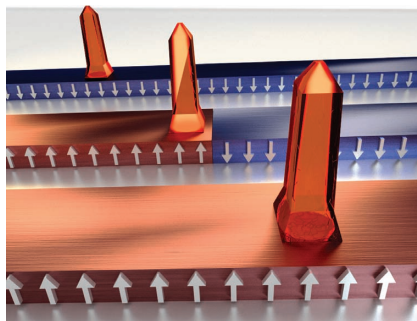
Direct Writing of Gallium-Indium Alloy for Stretchable Electronics



A novel method for directly writing liquid gallium-indium alloy is presented. In addition to the basic characterization of the direct writing process, a design algorithm for process stability is also developed. The method is employed to fabricate a strain gauge exhibiting an approximately linear behavior through strains of 50% with a gauge factor of 1.5.

FULL PAPERS

Vertical magnetic nanopillars grown by electron-beam induced deposition are used to control pinning of magnetic domain walls, moving through an underlying conduit. The pinning strength depends on the height and magnetic state of the pillars, and this is used to determine the switching field of the pillars themselves.

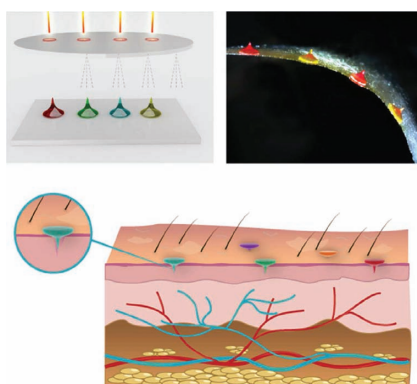


Magnetic Nanostructures

J. H. Franken, M. A. J. van der Heijden, T. H. Ellis, R. Lavrijsen, C. Daniels, D. McGrouther, H. J. M. Swagten,* B. Koopmans3508–3514

Beam-Induced Fe Nanopillars as Tunable Domain-Wall Pinning Sites

Biodegradable polymer microneedles represent a promising tool in transdermal drug delivery field. Here, a new fabrication approach based on polymer solution electro-drawing is presented. Microneedles produced with this technique can be obtained directly onto flexible substrate with controlled shape and can indent epithelium layer of animal skin. Furthermore, microneedles can be loaded with both hydrophobic and hydrophilic active compounds.

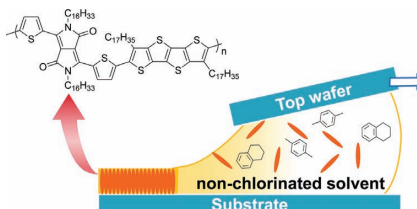


Drug Delivery

R. Vecchione, S. Coppola, E. Esposito, C. Casale, V. Vespini, S. Grilli,* P. Ferraro, P. A. Netti*3515–3523

Electro-Drawn Drug-Loaded Biodegradable Polymer Microneedles as a Viable Route to Hypodermic Injection

A non-chlorinated mixed solvent system, composed by tetrahydronaphthalene and *p*-xylene, is demonstrated for high mobility thin film transistors. By optimizing the ratio of the two solvents, charge transport characteristics are significantly improved for polymer devices deposited by spin coating and solution shearing. The non-chlorinated mixed solvents provide a practical and environmentally-friendly approach to achieve high performance polymer transistor devices.

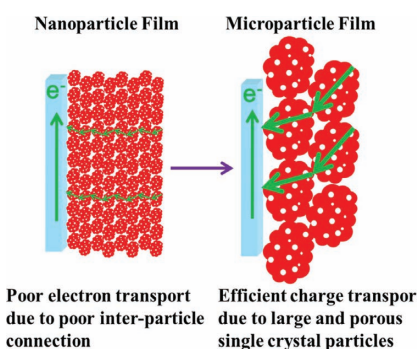


Organic Electronics

W.-Y. Lee, G. Giri, Y. Diao, C. J. Tassone, J. R. Matthews, M. L. Sorensen, S. C. B. Mannsfeld, W.-C. Chen, H. H. Fong, J. B.-H. Tok, M. F. Toney, M. He,* Z. Bao*3524–3534

Effect of Non-Chlorinated Mixed Solvents on Charge Transport and Morphology of Solution-Processed Polymer Field-Effect Transistors

Poor electron transport associated with insufficient inter-particle connection is revealed to contribute to suppressed photoelectrochemical activities of LaTiO_2N photoanodes. By establishing highly crystalline porous LaTiO_2N particles and superior inter-particle connectivity with reduced grain boundary density among the film particles, a record plateau photocurrent of 6.5 mA cm^{-2} is demonstrated for Co_3O_4 modified LaTiO_2N photoanodes under simulated sunlight.



Charge Transport

J. Y. Feng, W. J. Luo, T. Fang, H. Lv, Z. Q. Wang, J. Gao, W. M. Liu, T. Yu, Z. S. Li,* Z. G. Zou3535–3542

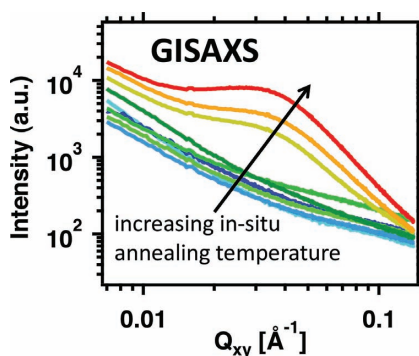
Highly Photo-Responsive LaTiO_2N Photoanodes by Improvement of Charge Carrier Transport among Film Particles

FULL PAPERS

Organic Photovoltaics

A. Sharenko, M. Kuik, M. F. Toney,
T.-Q. Nguyen* 3543–3550

**Crystallization-Induced Phase Separation
in Solution-Processed Small Molecule
Bulk Heterojunction Organic Solar Cells**

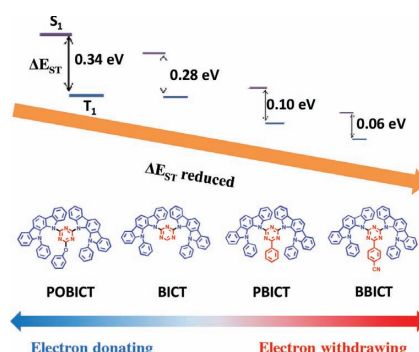


The relationship between donor crystallization and blend phase separation is investigated in solution-processed bulk heterojunction organic solar cells using in-situ thermal annealing grazing incidence X-ray scattering. Based on these data as well as blend electrical properties measured as a function of annealing temperature, it is hypothesized that donor crystallization is the driving force for the development of blend phase separation.

Organic Electronics

D. Zhang, L. Duan,* Y. Li, H. Li, Z. Bin,
D. Zhang, J. Qiao, G. Dong, L. Wang,
Y. Qiu 3551–3561

**Towards High Efficiency and Low
Roll-Off Orange Electrophosphorescent
Devices by Fine Tuning Singlet and
Triplet Energies of Bipolar Hosts Based
on Indolocarbazole/1, 3, 5-Triazine
Hybrids**

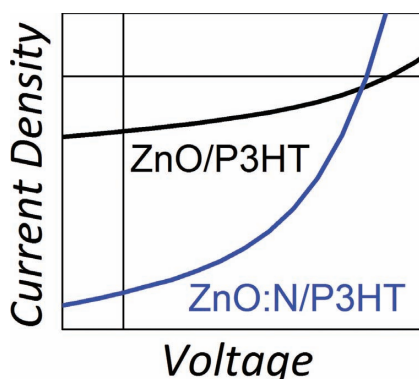


A series of indolocarbazole/1, 3, 5-triazine hybrids are designed and prepared as hosts for phosphorescent orange-emitting diodes. Singlet-triplet splitting and carrier injection/transporting are adjusted by introducing moieties with different electronegativity. By harmonizing the optical and electrical properties, high efficiency with ultra-low roll-off is realized in the device.

Hybrid Photovoltaics

K. P. Musselman,* S. Albert-Seifried,
R. L. Z. Hoye, A. Sadhanala,
D. Muñoz-Rojas,
J. L. MacManus-Driscoll,
R. H. Friend 3562–3570

**Improved Exciton Dissociation
at Semiconducting Polymer:ZnO
Donor:Acceptor Interfaces via Nitrogen
Doping of ZnO**

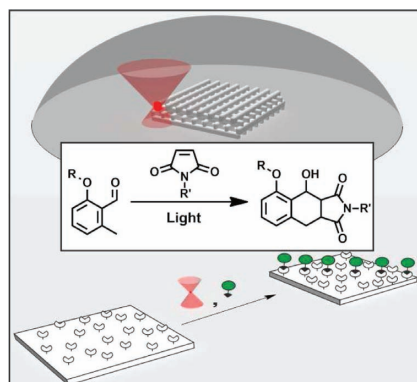


Nitrogen doping of ZnO is shown to dramatically improve exciton dissociation at the interface between ZnO and a conjugated polymer. The improvements in exciton dissociation and device photocurrent follow from a reduction in the ZnO electron concentration and enhanced light-induced de-trapping of electrons from the surface of the nitrogen-doped ZnO.

3D Photolithography

A. S. Quick, H. Rothfuss, A. Welle,
B. Richter, J. Fischer, M. Wegener,*
C. Barner-Kowollik* 3571–3580

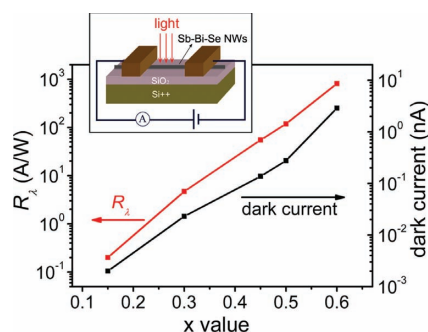
**Fabrication and Spatially Resolved
Functionalization of 3D Microstructures
via Multiphoton-Induced Diels–Alder
Chemistry**



A light-induced Diels–Alder reaction is employed for the fabrication and the spatially resolved surface patterning of 3D microstructures using a direct laser writing setup. Woodpile photonic crystals with a lateral rod spacing of 700–500 nm are fabricated and characterized via SEM, FIB milling, and transmission/reflection spectroscopy. Covalent surface patterning of the KIT-logo is verified using ToF-SIMS.

FULL PAPERS

The remarkable responsivity of an **Sb–Bi–Se nanowire-based photodetector** is reported. The spectra responsivity and external quantum efficiency of an $(\text{Sb}_{0.44}\text{Bi}_{0.56})_2\text{Se}_3$ nanowire photodetector reaches as high as $\approx 1.6 \times 10^6\%$, ≈ 1000 -times faster than that of a binary Sb_2Se_3 nanowire. Meanwhile, an underlying mechanism of surface Se vacancies and augmented oxygen chemisorptions is proposed to interpret these phenomena.

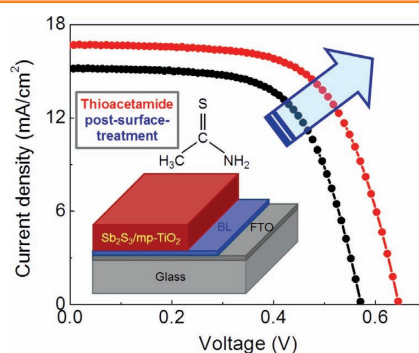


Photoconductivity

R. Huang, J. Zhang, F. Wei, L. Shi, T. Kong,* G. Cheng*3581–3586

Ultrahigh Responsivity of Ternary Sb–Bi–Se Nanowire Photodetectors

The light-harvesting Sb_2S_3 surface on mesoporous- TiO_2 in inorganic–organic heterojunction solar cells is sulfurized with thioacetamide. Through such a simple treatment, the cell records an overall power conversion efficiency of 7.5% under simulated illumination (AM 1.5G, 100 mW cm^{-2}) and the performance enhancement is mainly attributed to the extinction of trap sites by deep-level transient spectroscopy analysis.

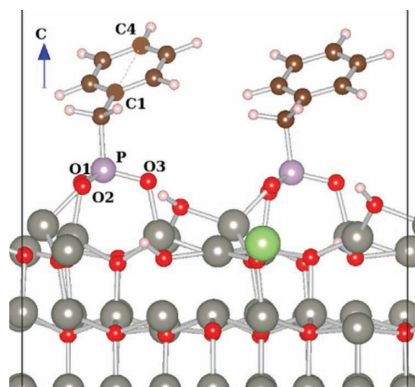


Solar Technology

Y. C. Choi, D. U. Lee, J. H. Noh, E. K. Kim,* S. I. Seok*3587–3592

Highly Improved Sb_2S_3 Sensitized-Inorganic–Organic Heterojunction Solar Cells and Quantification of Traps by Deep-Level Transient Spectroscopy

The surface modifications of gallium-doped zinc oxide with a series of self-assembled phosphonic acid monolayers are investigated. Excellent agreement is obtained between theoretical and experimental results regarding the surface work-function modification, the O 1s core-level binding energy shifts, and the energy level alignment between the highest occupied molecular orbitals of the modifiers and the valence band maximum of the surface.

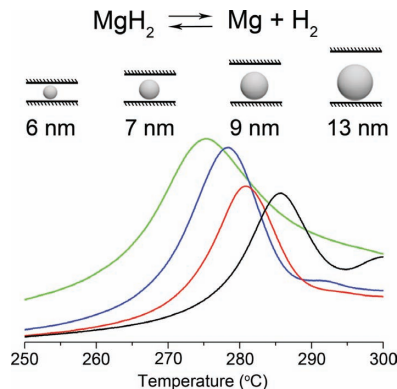


Surface Modifications

H. Li, E. L. Ratcliff,* A. K. Sigdel, A. J. Giordano, S. R. Marder, J. J. Berry, J.-L. Brédas*3593–3603

Modification of the Gallium-Doped Zinc Oxide Surface with Self-Assembled Monolayers of Phosphonic Acids: A Joint Theoretical and Experimental Study

Supported MgH_2 nanoparticles on carbon with different sizes are synthesized and show faster hydrogen mobility and sorption kinetics. Nanoparticles with sizes below 20 nm have a significant lower hydrogen release temperature and the mobility is three orders of magnitude faster compared to micrometer sized MgH_2 . The smaller the MgH_2 particles, the lower the hydrogen release temperatures become.



Hydrogen Storage

Y. S. Au, M. K. Obbink, S. Srinivasan, P. C. M. M. Magusin, K. P. de Jong, P. E. de Jongh*3604–3611

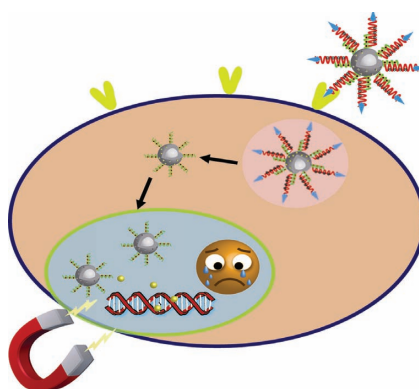
The Size Dependence of Hydrogen Mobility and Sorption Kinetics for Carbon-Supported MgH_2 Particles

FULL PAPERS

Cancer Theranostics

Z. Li, K. Dong, S. Huang, E. Ju, Z. Liu,
M. Yin, J. Ren,* X. Qu* 3612–3620

A Smart Nanoassembly for Multistage Targeted Drug Delivery and Magnetic Resonance Imaging

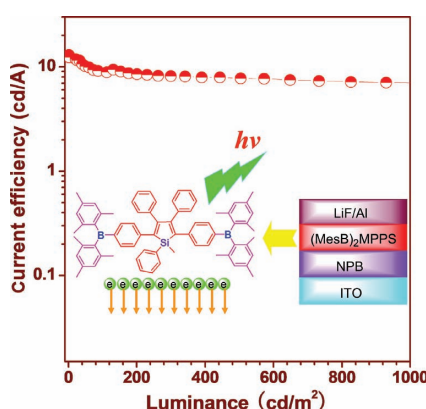


A multistage continuous targeting strategy (targeting from tumor tissue, cancer cell to organelle) based on magnetic mesoporous silica nanoparticles, to achieve nucleus-targeted drug delivery and cancer therapy while simultaneously minimizing the side effects to normal tissue, is demonstrated. In addition, this smart nanoassembly can be used as predominant contrast agents for magnetic resonance imaging.

Luminescent Materials

L. Chen, Y. Jiang, H. Nie, P. Lu,
H. H. Y. Sung, I. D. Williams,
H. S. Kwok, F. Huang, A. Qin, Z. Zhao,*
B. Z. Tang* 3621–3630

Creation of Bifunctional Materials: Improve Electron-Transporting Ability of Light Emitters Based on AIE-Active 2,3,4,5-Tetraphenylsiloles



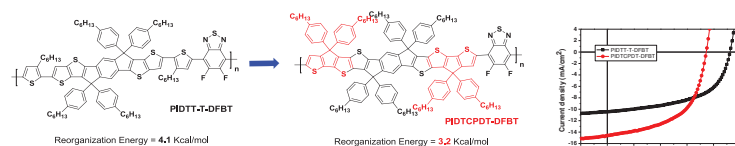
Grafting dimesitylboryl groups onto 2,3,4,5-tetraphenylsiloles generates efficient bifunctional materials that can simultaneously serve as light emitters and electron transporters in OLEDs. Remarkably high electroluminescence efficiencies up to 13.9 cd A^{-1} , 4.35% and 11.6 lm W^{-1} are attained from the double-layer OLEDs based on them.

Conjugated Polymers

Y. X. Li, K. Yao, H.-L. Yip, F.-Z. Ding,
Y.-X. Xu, X. Li, Y. Chen,*
A. K.-Y. Jen* 3631–3638

Eleven-Membered Fused-Ring Low Band-Gap Polymer with Enhanced Charge Carrier Mobility and Photovoltaic Performance

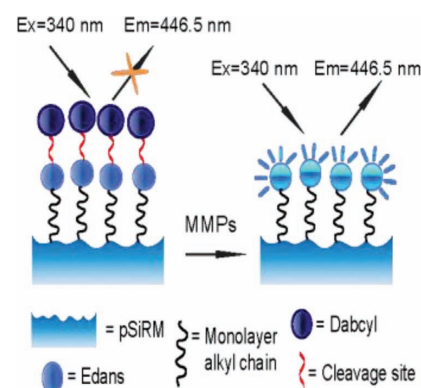
A multi-ring, ladder-type low band-gap polymer (PIDTCPDT-DFBT) is developed to show enhanced light harvesting, charge transport, and photovoltaic performance. The rigidified polymer provides lower reorganizational energy, resulting in one order higher hole mobility than the reference polymer. The device made from PIDTCPDT-DFBT also shows a quite promising power conversion efficiency of 6.46%.



Optical Biosensors

F. S. H. Krismastuti, S. Pace,
N. H. Voelcker* 3639–3650

Porous Silicon Resonant Microcavity Biosensor for Matrix Metalloproteinase Detection



An optical biosensor based on functionalized porous silicon resonance microcavity (pSiRM) using matrix metalloproteinase (MMP) substrate containing a fluorophore and a quencher is demonstrated. The presence of MMP cleaves the substrate leaving the fluorophore on the pSiRM matrix which is now emitting the fluorescence. This biosensor sensitively and selectively detects the MMP in buffer solution and human wound fluid.