Materials Views

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Gecko Know–How!

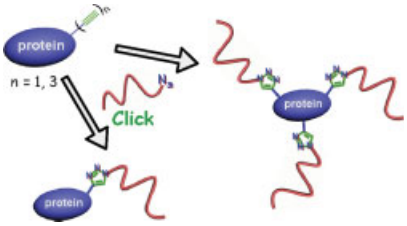
The fabrication of hairy films, inspired by the keratinous hairs found on the soles of Gecko feet, is described by Woo K. Cho and Insung S. Choi in a paper published in *Advanced Functional Materials* this month. Such hairs afford the Gecko the ability to stick to and climb up many different surfaces.

In this work, a facile, efficient replica-molding technique is used to form the films, which demonstrate very strong adhesion properties coupled with a very high contact angle that leads to superhydrophobicity. /lms

I. S. Choi et al., *Adv. Funct. Mater.* **2008**, *18*, 1089

Polymer-Protein Bioconjugates by RAFT and Click Chemistry

Modification of biomacromolecules with synthetic polymers is a viable means to increase efficacy for *in vivo* and *in vitro* applications. Bioconjugates with stimuli-susceptibility are particularly interesting because of the ability of the attached polymer to impart responsiveness to the protein to which it is attached. Recently



Sumerlin et al. have reported a novel synthesis route of responsive polymer-protein conjugates by a combination of RAFT polymerization and click chemistry. A model protein, bovine serum albumin (BSA), was functionalized with an alkyne moiety by reaction of its free cysteine residue with propargyl maleimide. Azido-terminated poly(*N*-isopropylacrylamide) (PNIPAM-N3) was prepared via RAFT, and polymer-protein coupling was accomplished by copper-catalyzed azide-alkyne cycloaddition. /ct

B. S. Sumerlin et al., *Macromol. Rapid Commun.*, DOI: 10.1002/marc.200800073

Precious Acoustics

Among its many exceptional qualities, the mechanical properties of diamond make the material especially interesting for acoustic applications. While electronic device development is still struggling with large-area substrate growth and the intricate art of diamond doping, surface acoustic wave filters based on diamond have reached the market. The appealing combination of diamond's bio-inertness with the high sensitivity of acoustic sensors motivates the ongoing search for improvement and alternative device concepts. In their Feature Article, the authors summarize the state-of-the-art of diamond films in composite acoustic applications and review different types of acoustic devices and sensors. /sb

V. Mortet et al., *phys. status solidi a*, DOI 10.1002/pssa.200777502

In Brief

Super-Tough Nanocomposites

A dramatic increase in the toughness (elongation before failure from 7% to 210%) of the biocompatible and biodegradable poly(lactide-*co*-glycolide) is achieved by the addition of small amounts of surface modified clay nanoparticles, which introduce physical crosslinks. /ks

E. P. Giannelis et al., *Small*, DOI: 10.1002/smll.200701231

Transparent 8Y Ceramics

The high transparency of Y_2O_3–ZrO_2 (8Y) ceramics produced by the hot isotactic pressing method is sensitive to the microstructural features of fine grains and small intergranular pores of the pre-sintered material, with a porosity less than 100 ppm required for high transparency. /df

I. Yamashita et al., *J. Am. Ceram. Soc.* **2008**, *91*, 813.

Green Polymer Chemistry

Commercial available PEGs can be quantitatively functionalized to α-ω telechelic PEG-methacrylates and PEG-acetates by transesterification using Candida antarctica lipase B (Novozyme 435) as the catalyst. /ct

J. E. Puskas et al. *J. Polym. Sci. A: Polym. Chem.*, DOI: 10.1002/pola.22640

Alloy Rain: Watching Falling Droplets Solidify

Free falling and electromagnetically levitated alloy droplets allow direct measurement of undercooling and crystallization front velocity towards microstructure engineering from the melt. /mo

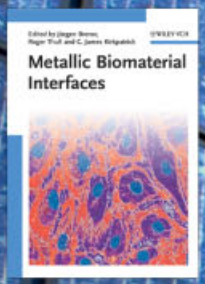
D. M. Herlach et al., *Adv. Eng. Mater.*, DOI: 10.1002/adem.200800022

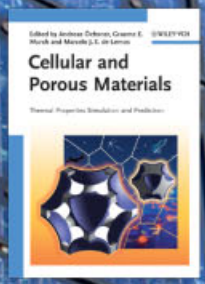
Hydrogenation of Poly(phenylethylnorbornene)s

Hydrogenation of norbornene polymers, used in electronics applications, produces two different derivatives, with the phenyl groups either preserved or saturated, that exhibit very different glass-transition properties. /gk

R. A. Register et al., *Macromol. Rapid Commun.*, DOI: 10.1002/marc.200800019

The many facets of Materials Science





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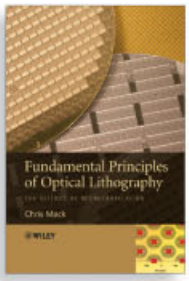

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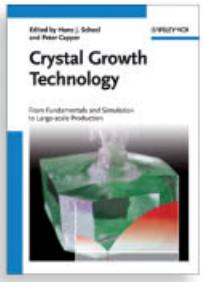

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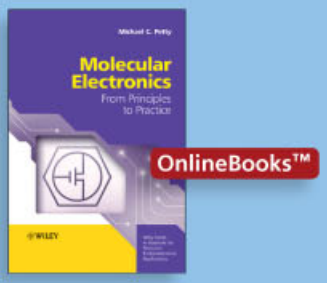

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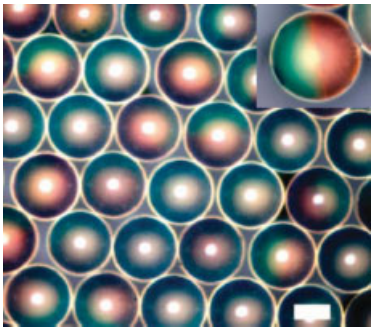
A Facile Way to Colloid Photonic Crystals

A major obstacle to the practical use of colloidal crystals is a lack of simple and reliable methods for consolidating the colloidal particles into crystals with well controlled shapes, sizes, and structures over fast time scales. S.-M. Yang et al. report a novel and simple method for creating various structural motifs of colloidal crystals by using silica particles dispersed in ethoxylated trimethylolpropane triacrylate (ETPTA) resin and photoinduced consolidation. Various colloidal suprastructures can be fabricated in that way.



The strong polarity of the ETPTA matrix induces long-range repulsions and enables the silica particles to self-assemble into periodic non-close-packed structures dispersed in the matrix. These self-organized structures can then be rapidly solidified by UV exposure to produce colloidal crystals without cracks. The high chemical resistivity and physical rigidity of crosslinked ETPTA open a wide range of applications. /ks

S.-M. Yang et al., *Adv. Mater.*, DOI: 10.1002/adma.200703022

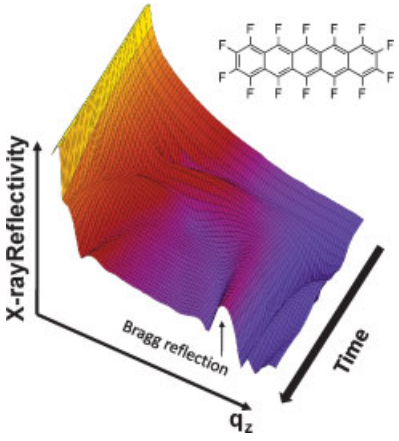
Silver Bullet Slays Bacteria!

Self-sterilizing surfaces that automatically release antimicrobial silver nanoparticles in the presence of micro-organisms have recently been demonstrated by Wendelin Stark and his co-workers. Their paper, published in *Small* this month, describes how the uptake of nutrients by a growing population of bacteria creates an ionic flux that can be used to trigger the dissolution of carrier particles and release of antimicrobial silver. Films containing the smart particles have been shown to work effectively in the presence of various human pathogens, highlighting their potential for use in clinical environments. /lms

W. J. Stark et al., *Small,* DOI: 10.1002/smll.200800047

High-Quality Perfluoro-Pentacene Films Grown

In this Rapid Research Letter, Stefan Kowarik et al. present an in-situ and real-time study of the growth of perfluoro-pentacene (PFP). The pentacene derivative PFP is a promising n-type organic semiconductor with high electron mobility and is used in complementary circuits with pentacene. High structural order is found in



thin films as evidenced by Bragg reflections up to the eighth order. No contamination with a second phase is present. The first order reflection is seen to increase with time. From a detailed analysis of the time-resolved X-ray scattering the growth mode is determined to be Stranski-Krastanov growth with one wetting layer, and the evolution of the surface roughness is extracted. /sh

S. Kowarik et al., *phys. status solidi RRL* **2008**, *2, 120*

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M. H. Zeng et al.
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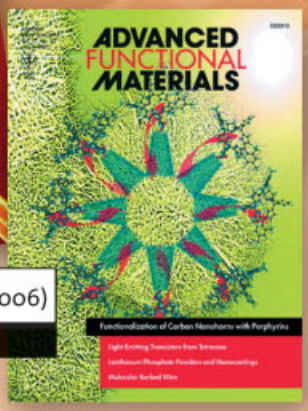

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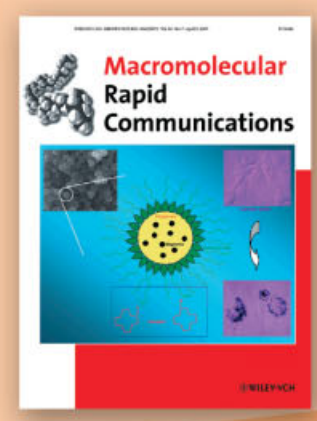

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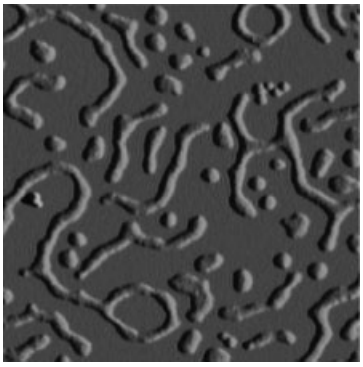
Tailor-Made Superstructures

Much attention has been devoted to the self-assembly of dendritic molecules to superstructures of controllable topologies. Amphiphilic arborescent (or dendrigraft) copolymers are dendritic molecules synthesized from polymeric building blocks according to a generation-based scheme. This article in *Macromolecular Chemistry and Physics* presents the first investigation of the self-assembly behavior of PS-*g*-PEO arborescent copolymers of high branching functionalities at the air/



water interface using the Langmuir balance technique. It could be shown that arborescent PS-g-PEO copolymers form stable monolayers and tend to associate spontaneously at the air/water interface even without compression. By varying the composition and the structure of the arborescent PS-*g*-PEO copolymers, the association behavior of the amphiphiles could be tailored to favor the formation of either ribbon-like superstructures of uniform width, large island-like clusters with a wide size distribution, or non-associated micelles of uniform sizes. /ks

M. Gauthier et al., *Macromol. Chem. Phys.*, DOI: 10.1002/macp.200700619

The Click. . . and How to Use it

Click chemistry is now a well-known and widely used organic synthesis technique. The specific chemistry imparted by the 1,2,3-triazole unit, however, has remained relatively unexplored. Craig Hawker and coworkers describe an elegant method for the synthesis of 4-vinyl-1,2,3-triazoles that avoids the use of a costly and difficult protection step. After Huisgen reaction, a wide range of vinyl monomers with different functional groups can be obtained by either Wittig or elimination chemistry. Since 1-H-triazole-based materials have shown promise as catalytic supports and proton exchange membranes, this report provides a basis for further investigations by allowing access to a range of new materials. /gk

C. J. Hawker et al., *J. Polym. Sci., Part A: Polym. Chem.* **2008**, *46*, 2897.

Nanoworms for Tumor Targeting

Cancer bionanotechnology is aiming for two main goals: ultrasensitive imaging for the early detection of cancers and efficient delivery of therapeutics to tumors. Dextran-coated magnetic iron oxide (IO) nanoparticles are of particular interest because they show relatively low toxicity and long circulation, and dramatically enhance hydrogen T_2 relaxation in magnetic resonance imaging (MRI). In this contribution in *Advanced Materials* M. J. Sailor et al. hypothesize that a nanostructure with an elongated assembly of IO cores (called nanoworms NWs) would improve the ability of the nanoparticles to circulate, target, and

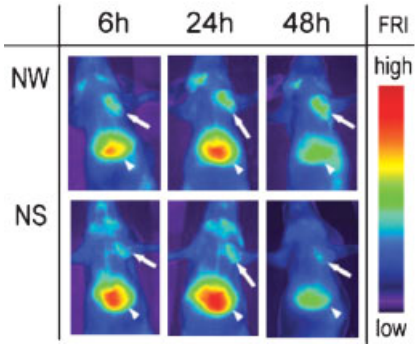


image tumors. Indeed, they find that the elongation of the nanoparticles improves their magnetic relaxivity in MRI, increases their ability to attach to tumor cells *in vitro*, and amplifies their passive accumulation *in vivo* as compared to spherical ones. These results are important for the design of *in vivo* multifunctional nanoprobes applicable to the diagnosis and treatment of human diseases. /ks

M. J. Sailor et al., *Adv. Mater.*, DOI: 10.1002/adma.200800004

In Brief

Novel "One-Step" Method for Graft Copolymers

The simultaneous ring-opening polymerization of ε-caprolactone and 2-hydroxyethyl methacrylate polymerization via reversible addition fragmentation chain transfer chemistry lead to the respective graft-copolymer in one step. /ct

C. Barner-Kowollik et al., *J. Polym. Sci. A: Polym. Chem.*, **2008**, *46*, 3058

Photocrosslinkable, Biodegradable Scaffolds

Optically transparent and biodegradable macromers based on poly(ethylene glycol) and fumaric acid copolymers can be photochemically crosslinked into biocompatible scaffolds, with potential application in injectable, photocrosslinkable carriers for drug and cell delivery. /df

M. Imami et al. *Polym. Adv. Technol.*, DOI: 10.1002/pat.1112

Diamond - Four Years after T_c

Read on where a new model system for electronic phase transitions stands in terms of control and understanding after boron-doping successfully turned diamond into a superconductor. /sb

E. Bustarret, *phys. status solidi a*, DOI: 10.1002/pssa.200777501

New Insights into Biodegradation of PLA

Molecular ecological techniques were successfully used to detect and identify new PLA-degrading microorganisms directly from the compost and may provide a new tool for the investigation of biodegradation mechanisms and for recycling processes of PLA and other biodegradable polymers. /ks

D. Y. Wu et al., *Macromol. Biosci.* **2008**, *8*, 304

Responsive Gold Nanoparticles

Via a two-step procedure surfactant-stabilized gold nanoparticles are encapsulated by a polymer, leading to core/shell materials that exhibit a temperature-driven, reversible swelling-deswelling transition. /gk

J. Pérez-Juste et al., *Adv. Mater.* **2008**, *20*, 1666

Crosslinking Electrospun Nanofibers

Thorough mechanical characterization of crosslinked, electrospun chitosan-poly(ethylene oxide) nanofiber mats demonstrate that the mats become more brittle and less ductile after glutaraldehyde vapor deposition crosslinking, and that mechanical properties can be tuned by adjusting the crosslinking time. /df

C. L. Schauer et al., *J. Appl. Polym. Sci.*, DOI: 10.1002/app.28107

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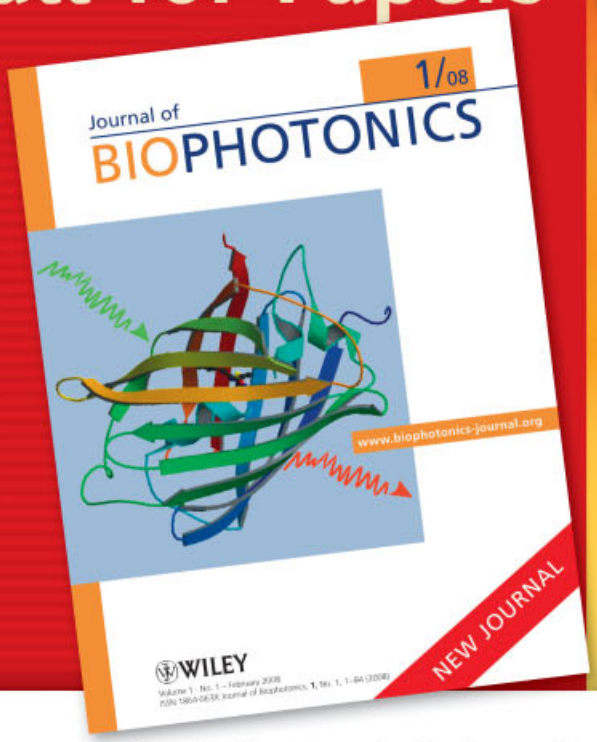

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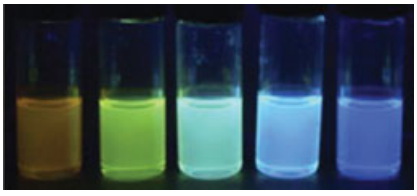
A Colorful Response

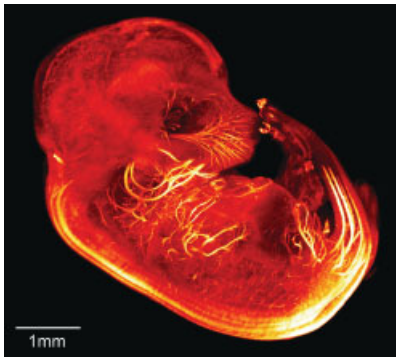
Light-emitting organic polymers, with their attractive luminescence efficiencies, response times and full-color displays, have been investigated as alternatives to their inorganic counterparts in a variety of devices such as diodes, photodetectors or image sensors. The color of the light emitted can be tuned by altering the electron environment - either during the preparation process of the polymer or as post-functionalization. Liu and co-workers have for the first time exploited radical addition reactions for this purpose. The addition of free radicals to double bonds of a poly(phenylene vinylene) backbone led to the formation of single bonds, shortening the π-conjugated length of the polymer chains and resulting in a blue shift of the luminescence peak. By regulating the reaction extent, the researchers could control the conjugation length of the polymer and therefore its wavelength of fluorescence. /ap



F.-Q. Liu et al., *Polym. Int.*, DOI: 10.1002/pi.2428

Ultramicroscopy for a Detailed Anatomic Insight

Confocal and 2-photon microscopy both allow excellent spatial resolution. Yet, they suffer from limited fields of view and a penetration depths of less than 1 mm. To obtain 3D reconstructions from large specimens, histological sections are still standard. A team led by H.-D. Dodt developed a new technique based on the 100-years-old idea of light sheet illumination, termed ultramicroscopy. The sample is laterally illuminated by a blue laser forming a thin sheet of light. Fluorescence is emitted only from a thin optical section and collected by the objective lens. To clear opaque biological samples, they are imbued with a medium of the same refractive index as protein. The team presents ultramicroscopic 3D-reconstructions of whole immunolabeled mouse embryos and Drosophila giving detailed insight into their anatomy. /kmh



K. Becker et al., *J. Biophot.*, DOI: 10.1002/jbio.200710011

Just Add Sugar: Microcapsule Content Release

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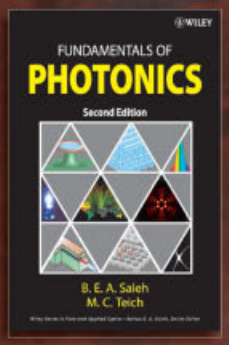

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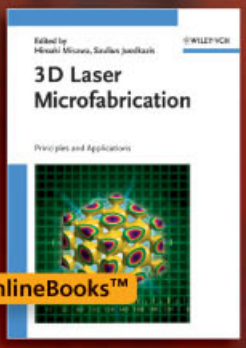

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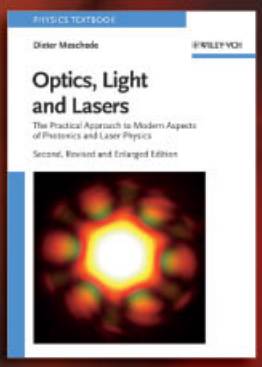

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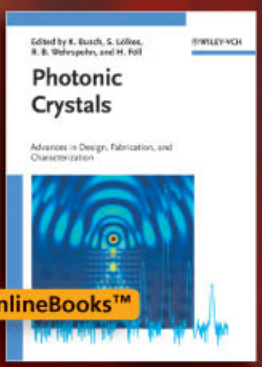

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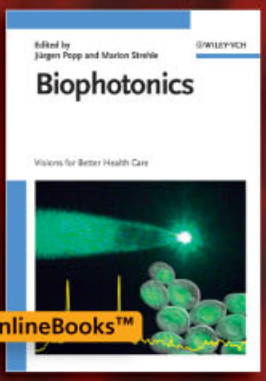

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