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See Felix N. Castellano *et al.*, page 814.
Solvent polarity alters the configuration of the lowest excited triplet state in a Pt(II) charge transfer complex.
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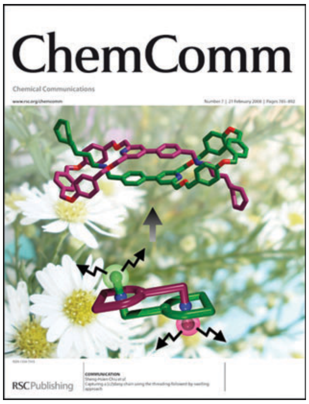

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Using an efficient "threading-followed-by-swelling" approach to capture a [c2]daisy chain in solution.
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C9

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Chemical Science

February 2008/Volume 5/Issue 2

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FEATURE ARTICLE

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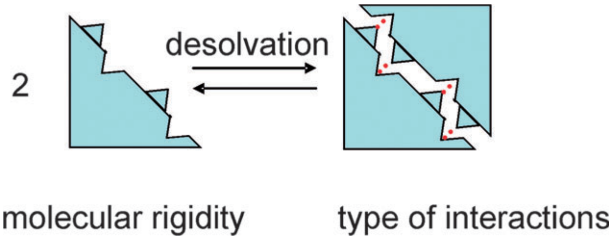
How to achieve self-assembly in polar solvents based on specific interactions? Some general guidelines

Thomas Rehm and Carsten Schmuck*

Self-assembly in polar solutions in general requires a combination of several non-covalent interactions within one binding motif. Besides the combination of H-bonds and hydrophobic or aromatic stacking interactions, in the last few years H-bonded ion pairs have been proven useful in this context. We present some representative examples and discuss some general principles and guidelines that determine the stability of self-assembling molecules in solution.



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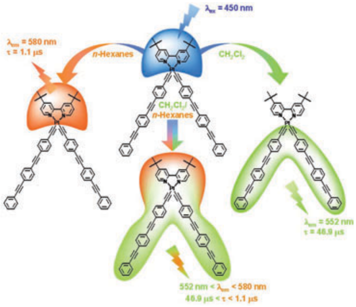
Solvent-induced configuration mixing and triplet excited state inversion exemplified in a Pt(II) complex

Sébastien Goeb, Aaron A. Rachford and
Felix N. Castellano*

Solvent-induced triplet excited state configuration mixing and inversion has been realized in a Pt(II) charge transfer chromophore bearing two pendant phenyleneethynylene subunits.



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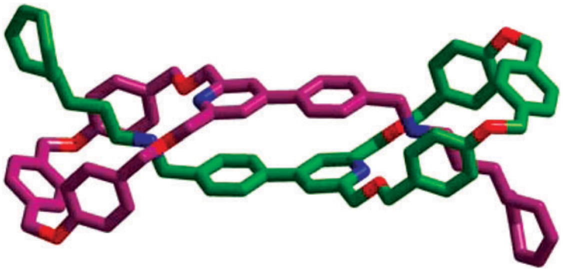
Capturing a [*c*2]daisy chain using the threading-followed-by-swelling approach

Shau-Hua Ueng, Sheng-Yao Hsueh, Chien-Chen Lai,
Yi-Hung Liu, Shie-Ming Peng and Sheng-Hsien Chiu*

We have used the ''threading-followed-by-swelling'' approach to fix a daisy chain structure in solution, leading to the isolation of a captured [*c*2]daisy chain in 77% yield.



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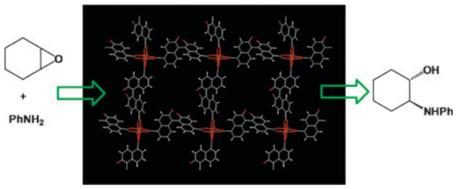
A novel chiral porous metal–organic framework: asymmetric ring opening reaction of epoxide with amine in the chiral open space

Koichi Tanaka,* Shinji Oda and Motoo Shiro

A novel chiral metal–organic framework was constructed from C_2-symmetric 2,2′-dihydroxy-1,1′-binaphthalene-5,5′-dicarboxylic acid, in which the asymmetric ring-opening reaction of an epoxide with amine proceeded efficiently.



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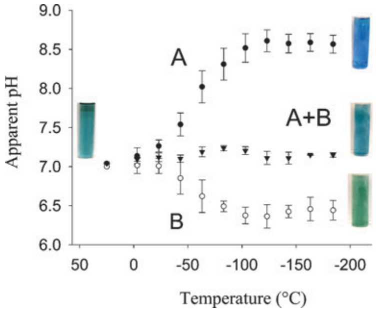
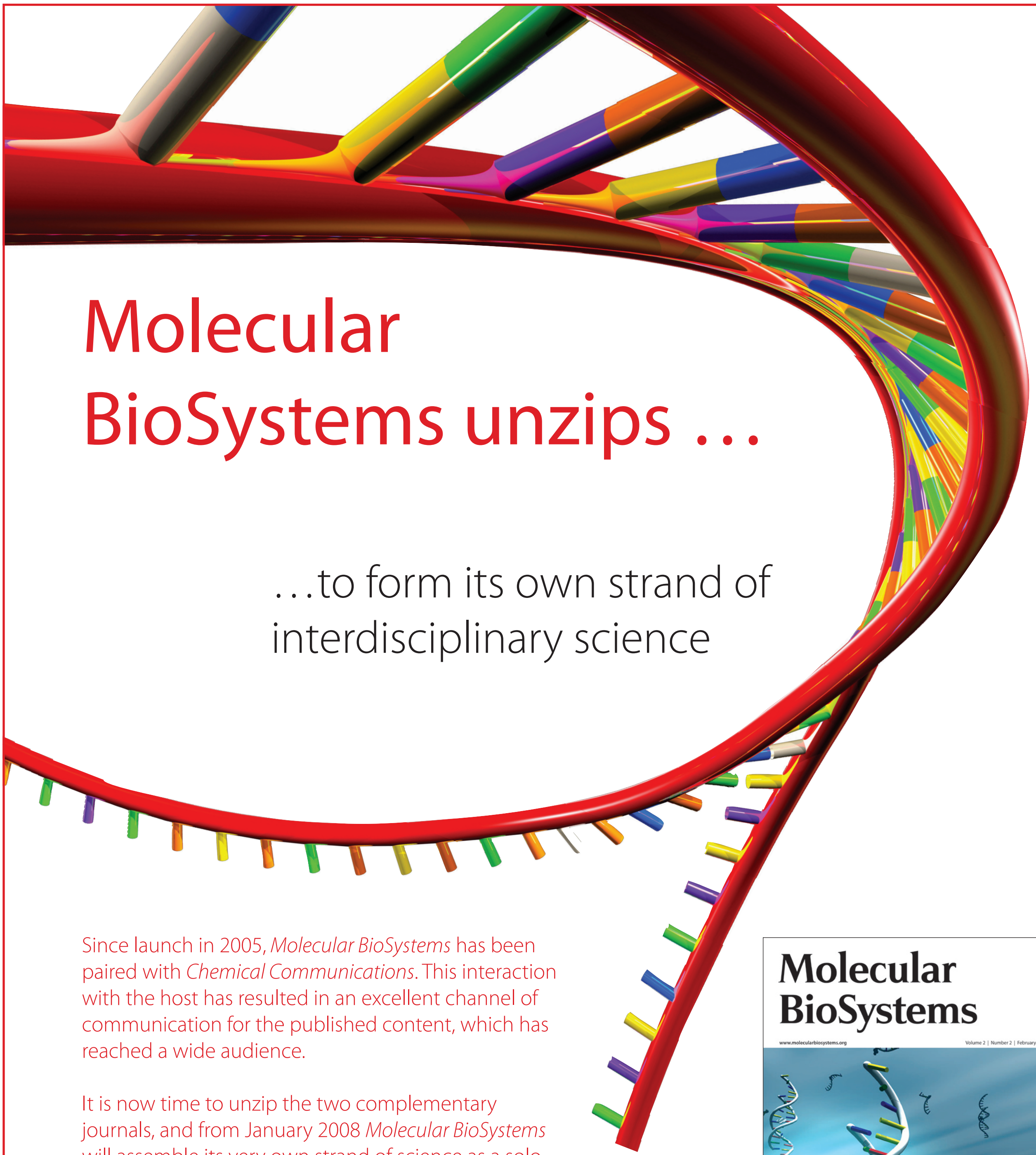
A temperature independent pH (TIP) buffer for biomedical biophysical applications at low temperatures

Nathan A. Sieracki, Hee Jung Hwang, Michelle K. Lee,
Dewain K. Garner and Yi Lu*

Through a combination of buffers with opposite temperature coefficients, a buffer system resistant to low temperature effects has been developed for low temperature applications including drug storage and molecular spectroscopy.



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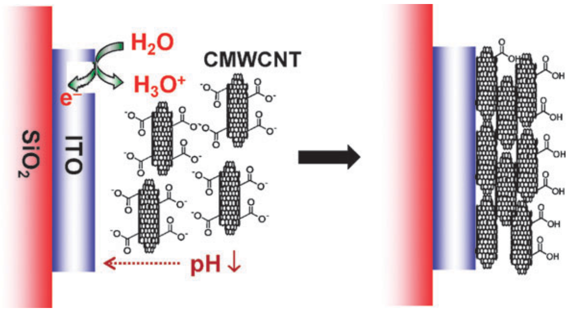
Surfactant and polymer-free electrochemical micropatterning of carboxylated multi-walled carbon nanotubes on indium tin oxide electrodes

Md. Abdul Aziz and Haesik Yang*

We present a facile micropatterning method that is based on the electrochemically induced deposition of carboxylated multi-walled carbon nanotubes on an indium tin oxide electrode without using surfactants or polymers.



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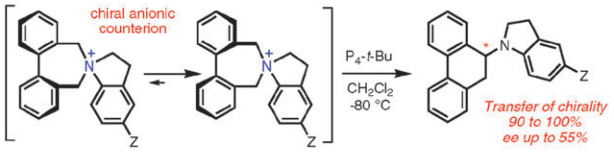
Enantioselective [1,2]-Stevens rearrangement of quaternary ammonium salts. A mechanistic evaluation

Maria-Héléna Gonçalves-Farbos, Laurent Vial and Jérôme Lacour*

Using a supramolecular asymmetric ion pairing strategy, the enantioselective [1,2]-Stevens rearrangement of *tropos* quaternary ammonium ions is feasible. Excellent transfer of chirality and decent enantioselectivity levels are afforded.



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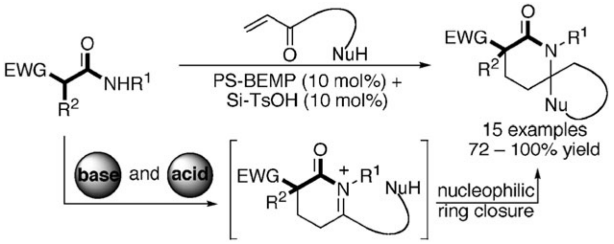
Site isolated base and acid catalyzed azaspirocyclization cascades

Adam W. Pilling, Jutta Böhmer and Darren J. Dixon*

A one-pot, site isolated base (PS-BEMP) and acid (Si-TsOH) catalyzed cyclization cascade to azaspirocyclic molecules is reported.



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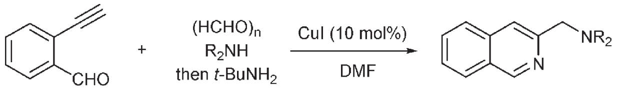
Facile synthesis of 3-(aminomethyl)isoquinolines by copper-catalysed domino four-component coupling and cyclisation

Yusuke Ohta, Shinya Oishi, Nobutaka Fujii* and Hiroaki Ohno*

Copper(I)-catalysed domino coupling–cyclisation using 2-ethynylbenzaldehydes, paraformaldehyde, secondary amine, and t-BuNH$_2$ leads to 3-(aminomethyl)isoquinolines in good to high yields.



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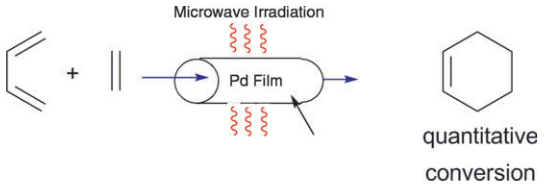
Diels–Alder cycloadditions by microwave-assisted, continuous flow organic synthesis (MACOS): the role of metal films in the flow tube

Gjergji Shore and Michael G. Organ*

Pd thin films on the capillary wall have been demonstrated to couple effectively with microwave irradiation to promote Diels–Alder reactions in flow. Reactions that take days in batch mode at reflux in toluene have been reduced to mere minutes in flow while being irradiated.



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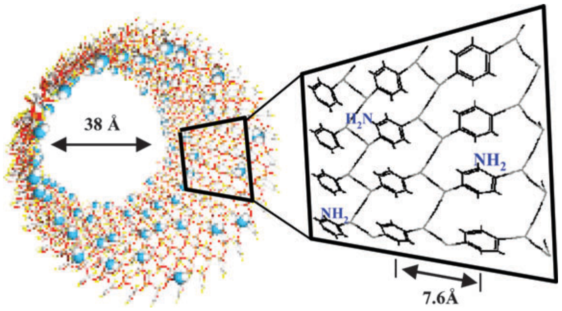
Chemical modification of crystal-like mesoporous phenylene-silica with amino group

Masataka Ohashi, Mahendra P. Kapoor and Shinji Inagaki*

Amination of phenylene moieties in crystal-like mesoporous phenylene-silica material is achieved by a two-step chemical transformation process while preserving both the ordered mesostructure and crystal-like molecular scale periodicity of the parent material.



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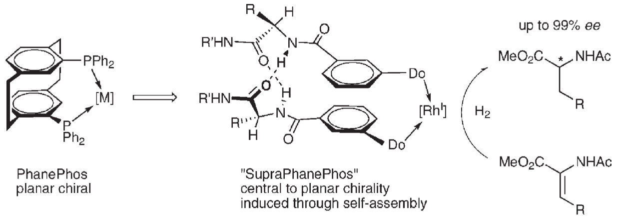
Supramolecular PhanePhos-analogous ligands through hydrogen-bonding for asymmetric hydrogenation

Andy Ch. Laungani and Bernhard Breit*

PhanePhos-analogous phosphorous ligands have been generated *via* self-assembly of monodentate peptidyl ligands through interstrand hydrogen-bonding, and studied in rhodium(I)-catalyzed asymmetric hydrogenation (up to 99% ee).



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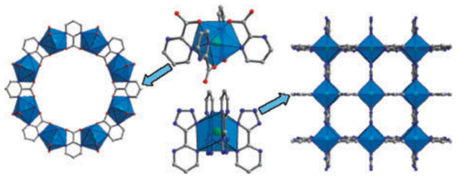
Eight coordination with bis(bidentate) bridging ligands: zeolitic topology *versus* square grid networks

Jian-Yong Zhang, Ai-Ling Cheng, Qi Yue, Wei-Wei Sun and En-Qing Gao*

The assembly of the asymmetric bis(bidentate) 2-pyrimidinecarboxylate ligand with Cd^{II} produces a metal–organic framework with the RHO zeolitic topology, while 5-(2′-pyrimidyl)tetrazolate with Cd^{II} leads to square grid networks.



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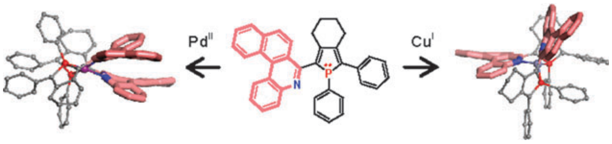
Stereoselective coordination of ditopic phospholyl-azahelicenes: a novel approach towards structural diversity in chiral π-conjugated assemblies

Wenting Shen, Sébastien Graule, Jeanne Crassous,* Christophe Lescop, Heinz Gornitzka and Régis Réau*

Phosphole-modified aza[4]helicenes having a 1,4-P,N moiety have been prepared. These compounds act as heteroditopic chelates toward metal ions having different coordination geometries (Pd^{II}, Cu^{I}). The coordination is highly stereoselective.



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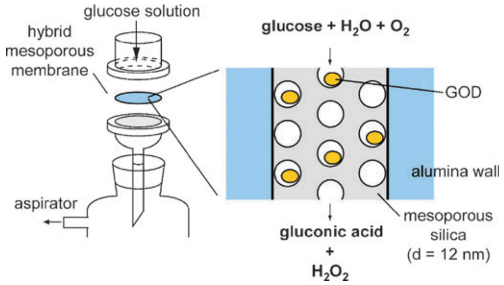
Enzyme catalytic membrane based on a hybrid mesoporous membrane

Wensheng Fu, Akira Yamaguchi, Hideaki Kaneda and Norio Teramae*

Immobilization of glucose oxidase (GOD) within a hybrid mesoporous membrane with 12 nm pore diameter was successfully achieved, resulting in catalytically high efficiency during flow of a glucose solution across the membrane.



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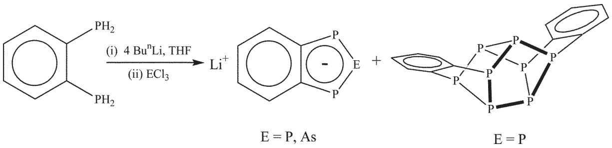
1,2-Diphosphinobenzene as a synthon for the 1,2,3-triphospha- and 2-arsa-1,3-diphosphaindenyl anions and a stable organo derivative of the P_8 unit of Hittorf's phosphorus

Craig P. Butts, Michael Green,* Thomas N. Hooper, Richard J. Kilby, John E. McGrady, Dimitrios A. Pantazis and Christopher A. Russell*

1,2-Diphosphinobenzene provides an excellent template for the synthesis of tri-pnictogen derivatives of the indenyl anion and an octaphosphorus cage.



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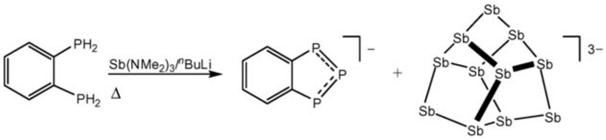
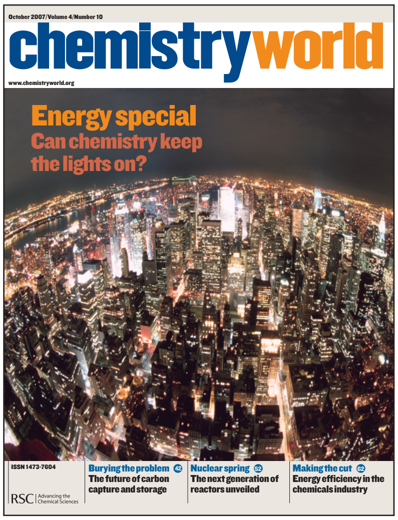
Direct synthesis of the 1,2,3-$[\overline{C_6H_4P{\cdots}P{\cdots}P}]^-$ anion, isoelectronic with the indenyl anion $[\overline{C_6H_4CH{\cdots}CH{\cdots}CH}]^-$

Felipe García, Robert J. Less, Vesal Naseri,
Mary McPartlin, Jeremy M. Rawson,*
Maria Sancho Tomas and Dominic S. Wright*

The reaction of 1,2-$(PH_2)_2C_6H_4$ with the mixed-metal base ${}^nBuLi–Sb(NMe_2)_3$ in the presence of 12-crown-4 gives $[Li(12\text{-crown-}4)_2]^+[C_6H_4P_3]^-$ (**1**) as the major product.

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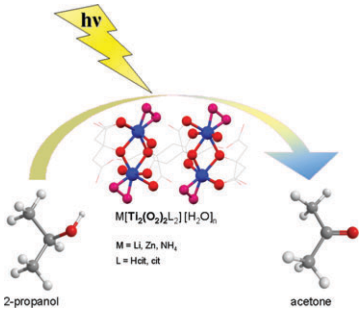
Active peroxo titanium complexes: syntheses, characterization and their potential in the photooxidation of 2-propanol

Markus Rohe and Klaus Merz*

The novel metal peroxo titanium complexes $Li_2(NH_4)_4[Ti_2(O_2)_2(cit)(Hcit)]_2 \cdot 5H_2O$ and $Zn(NH_4)_4[Ti_2(O_2)_2(Hcit)_2(cit)_2]_2 \cdot 12H_2O$ (cit = citrate) show significant activity in the photochemical oxidation of 2-propanol.



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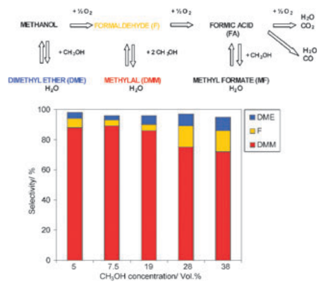
Amorphous oxide as a novel efficient catalyst for direct selective oxidation of methanol to dimethoxymethane

Sébastien Royer, Xavier Sécordel, Markus Brandhorst, Franck Dumeignil,* Sylvain Cristol, Christophe Dujardin, Mickaël Capron, Edmond Payen and Jean-Luc Dubois*

We report for the first time the use of an amorphous oxide catalyst for the selective oxidation of methanol in the gas phase, leading at 553 K to the production of dimethoxymethane with a selectivity as high as 90% at high methanol conversion (68%).



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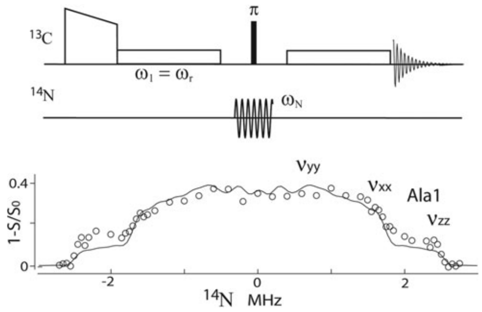
Measuring nitrogen quadrupolar coupling with ^{13}C detected wide-line ^{14}N NMR under magic-angle spinning

Zhehong Gan*

A ^{13}C-detected ^{14}N wide-line NMR experiment is described for measuring nitrogen quadrupolar coupling under magic-angle spinning.



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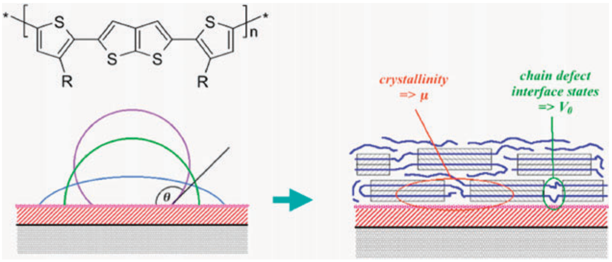
Organic field-effect transistors of poly(2,5-bis(3-dodecylthiophen-2-yl)thieno[2,3-*b*]thiophene) deposited on five different silane self-assembled monolayers

Ruth Rawcliffe, Maxim Shkunov, Martin Heeney, Steven Tierney, Iain McCulloch and Alasdair Campbell*

Depositing poly(2,5-bis(3-dodecylthiophen-2-yl)thieno[2,3-*b*]thiophene) on five different self-assembled monolayers indicates that varying the SAM surface energy changes the FET mobility and turn-on voltage by varying polymer crystallinity at the buried interface.



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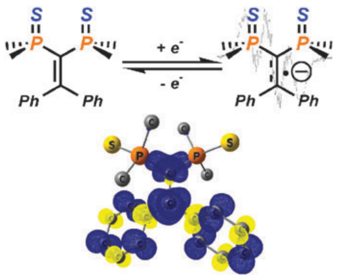

Synthesis of a stable radical anion *via* the one electron reduction of a 1,1-bis-phosphinosulfide alkene derivative

Thibault Cantat, Frédéric Biaso, Aurélien Momin, Louis Ricard, Michel Geoffroy,* Nicolas Mézailles* and Pascal Le Floch*

The chemical reduction of a 1,1-bis(phosphinosulfide)alkene derivative led to the formation of a new type of radical ligand, characterized by X-ray crystallography, EPR spectroscopy and its electronic structure by DFT calculations.

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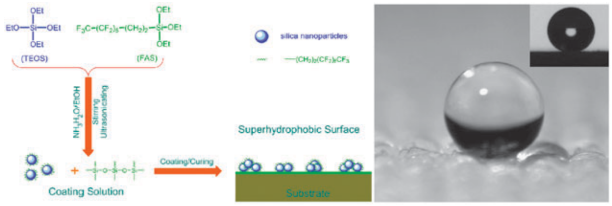
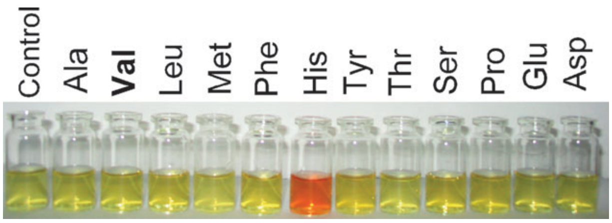


One-step coating of fluoro-containing silica nanoparticles for universal generation of surface superhydrophobicity

Hongxia Wang, Jian Fang, Tong Cheng, Jie Ding, Liangti Qu, Liming Dai, Xungai Wang and Tong Lin*

Stable superhydrophobic surfaces with water contact angles over 170 degrees and sliding angles below 7 degrees were produced by simply coating a particulate silica sol solution on various substrates.

880

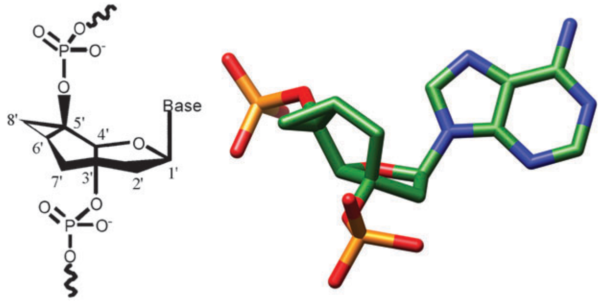


Synthesis of *para*-sulfonatocalix[4]arene-modified silver nanoparticles as colorimetric histidine probes

Dejun Xiong, Mingliang Chen and Haibing Li*

para-Sulfonatocalix[4]arene-modified silver nanoparticles were utilized as a novel colorimetric sensor to probe histidine in aqueous solution.

883



Crystal structure of tricyclo-DNA: an unusual compensatory change of two adjacent backbone torsion angles

Pradeep S. Pallan, Damian Ittig, Annie Héroux, Zdzislaw Wawrzak, Christian J. Leumann and Martin Egli*

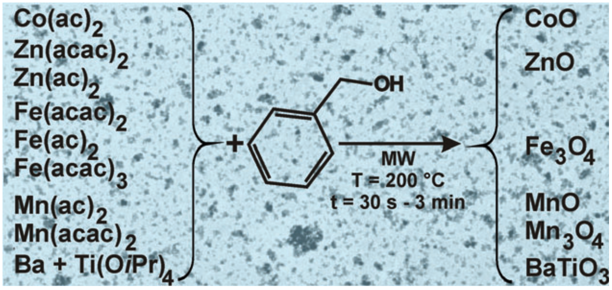
The crystal structure of a DNA duplex with tricyclo-DNA (tc-DNA) residues provides insight into the increased RNA affinity of tc-DNA relative to DNA and tc-DNA's superior resistance to nucleases.

886

One-minute synthesis of crystalline binary and ternary metal oxide nanoparticles

Idalia Bilecka, Igor Djerdj and Markus Niederberger*

Highly crystalline binary and ternary metal oxide nanoparticles (CoO, ZnO, Fe_3O_4, MnO, Mn_3O_4, $BaTiO_3$) were synthesized in just a few minutes by reacting metal alkoxides, acetates or acetylacetonates with benzyl alcohol under microwave heating.



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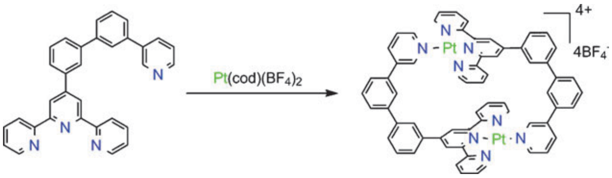
Synthesis, characterization and molecular recognition of a bis-platinum terpyridine dimer

Robert Trokowski, Shigehisa Akine and Tatsuya Nabeshima*

A novel bis-platinum(II) terpyridine-based macrocycle has been quantitatively obtained by self-assembly; the Pt(II) host binds neutral planar and electron-rich aromatic guests with good selectivity in DMSO.



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Chemical Science

New technology could lead to widely available antibacterial coatings

Bacteria drop dead on killer surfaces

Surfaces that kill bacteria on contact could soon be a reality in our homes and hospitals, thanks to researchers from the Curie Institute in Paris. The French group has developed a method for making surfaces bactericidal that it says is straightforward and versatile enough to be widely used.

Vincent Semetey and colleagues have devised a simple way to attach polymers containing quaternary ammonium groups to surfaces. Surfaces modified in this way kill any bacteria that come into contact with them.

'The strategies developed so far for attaching the polymers use organic solvents and require multiple steps, limiting their implementation in industry,' said Semetey. 'Our method requires just a single reaction step in water.' He added that because the polymer is bound covalently, the antibacterial activity is permanent, which is an advantage over techniques with surfaces impregnated with biocides such as silver ions.

Past experiments with similar surfaces have shown that the ammonium groups do not induce resistance in bacteria, said Semetey, a great advantage in these days of multiresistant superbugs.

Any surfaces with free hydroxyl groups can be made permanently bactericidal

The researchers say that their method can be used to modify any surfaces that have free hydroxyl groups, including glass, ceramics and some plastics. According to Semetey the technology is particularly suited to treating textiles, for example bandages.

'There is an urgent need for easy-to-apply coatings to make materials permanently bactericidal,' said Alexander Klibanov of the Massachusetts Institute of Technology, USA. Himself a pioneer in the field, he said Semetey's work was timely and that the method was straightforward and could help control the spread of infections.

Semetey said that his group are considering several applications of their method in hospitals, and are working together on this with colleagues based at the hospital run by the Curie Institute. Furthermore, the technology has received interest from several companies.

Danièle Gibney

Reference

O Bouloussa, F Rondelez and V Semetey, *Chem. Commun.*, 2008, DOI: 10.1039/b716026g

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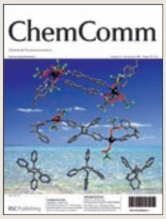
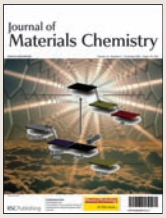




A snapshot of the latest developments from across the chemical sciences

Research highlights

Rotaxane molecules that link together could be used in molecular electronics

Molecular daisy chains

A molecular daisy chain that threads itself together could have future uses in molecular electronic devices, say scientists in Taiwan.

Sheng-Hsien Chiu and his colleagues at the National Taiwan University, Taipei, and National Chung Hsing University, Taichung, have found a way to interlock pseudorotaxanes and rotaxanes, creating chains that could prove useful as molecular actuators and switches for molecular electronic devices.

Daisy chains are typically made by making a hole in the stalk and passing another daisy stalk through this hole, where the flower head acts as a stopper. Chiu's method is akin to passing the flower head through the hole in the stalk. Here the flower head is a dialkenyl cyclopropane unit that rearranges to a cycloheptadiene unit at elevated temperatures, which then acts as a stopper.

The daisy monomer used in this study is a hydrogen-bond-donating thread-like unit (a stalk), a hydrogen-bond-accepting macrocycle (the hole in stalk) and a dialkenyl cyclopropane terminal group (a flower head). These components are allowed to self-assemble in solution into daisy-chain-like complexes, before heating the system to rearrange the terminal groups and trap the units in place.

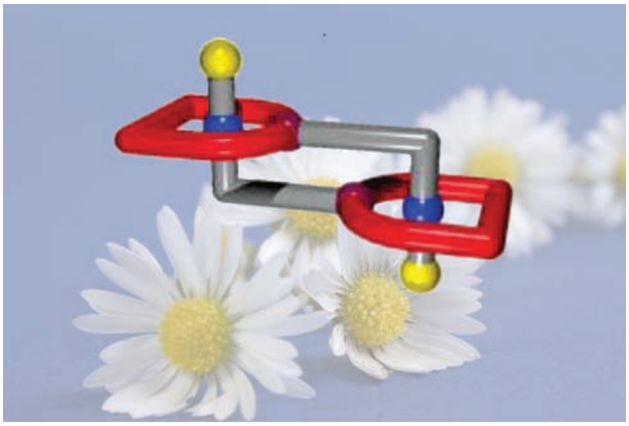
Chiu and co-workers isolated the daisy chain by chromatography and confirmed its structure using X-ray crystallography. They found a cyclic dimeric daisy chain was formed. This two-daisy ring is the entropically favoured product, Chiu explained.

'The challenge remains to overcome entropy and assemble larger cyclic and acyclic molecular daisy chains,' Chiu said.

He believes the solution to this problem is to use a more structurally rigid monomer that would disfavour dimerisation and form longer chains.

In the future Chiu hopes to use this approach to isolate other types of molecular daisy chains and functional interlocked polymers.

Emma Shiells



The interlocked rotaxane molecules resemble daisy chains

Reference

Shau-Hua Ueng *et al*, *Chem. Commun.*, 2007, DOI:10.1039/b716331b

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Enclosing nutraceuticals in silica particles enables their use as oral drugs

East meets west

Curcumin is a major component of the spice turmeric, which has been used in Eastern medicine for thousands of years. Curcumin and β-carotene, another bioactive compound, both have limited use in Western medicine due to poor bioavailability, but all this could change thanks to mesoporous silica particles.

Curcumin and β-carotene are nutraceuticals – dietary supplements with a medicinal effect on human health – that show anti-inflammatory, anti-carcinogenic, anti-tumour and anti-cancer capabilities. Tests have found that neither compound remains in the bloodstream long after consumption, because of poor water solubility. This means they are unsuitable as oral drugs.

To overcome this hurdle, Colin Raston and colleagues, from the University of Western Australia, Perth, have encapsulated both curcumin and β-carotene, respectively inside mesoporous silica capsules. These capsules can be used for the delivery and controlled release of the compounds.

The silica capsules have well-defined nanochannels that ensure the drugs controlled release. They are also highly fluorescent, so can act as trackers for monitoring drug dose.

The nanosized capsules are made in a continuous flow reactor called a spinning disc processor. This rapid approach uniquely makes nanoparticles of a uniform size. Raston said he believes the reactor can be used to make a wide range of other nanomaterials. 'The technology is not only scalable but also offers precise control over the particle size, shape and surface properties,' he said.

An advantage of spinning disc processing is that nanotoxicology issues, scalability, effluent treatment and hazardous work environments are dealt with at the conception stage rather than attempting to make a new process or product scalable and non-toxic after its development, explained Raston.

Challenges facing the future of this system are, according to Raston, adapting the technology to a wide range of therapeutics and turning it into a commercial product.

Elinor Richards

Curcumin and β-carotene could now be used in Western medicine

Reference

N W Clifford, K Swaminathan-Iyer and C L Raston, *J. Mater. Chem.*, 2008, **18**, 162 (DOI: 10.1039/b715100d)

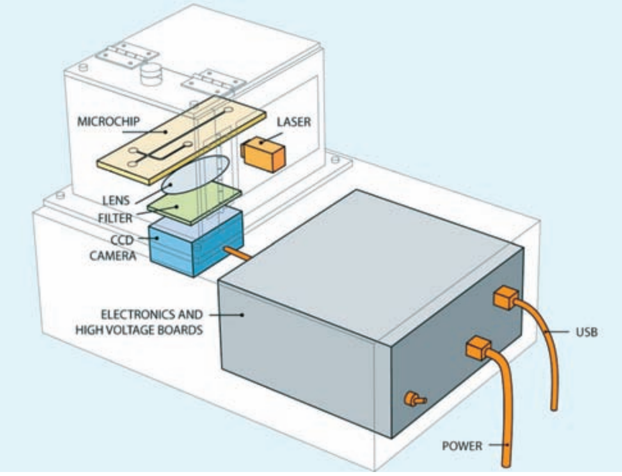
Cost of on-the-spot genetic tests slashed

Genetic testing in a shoe-box

Canadian scientists have lowered the cost of portable devices for rapid genetic testing.

The cost of carrying out a single genetic test currently varies from hundreds to thousands of pounds, and the wait for results can be weeks. Now a group led by Christopher Backhouse, University of Alberta, Edmonton, have developed a reusable microchip-based system that is small enough to be portable, can be used for point-of-care medical testing and costs just £500 to build. This is the least expensive device made so far.

The well-known techniques reverse transcription, polymerase chain reaction and capillary electrophoresis have been developed over recent decades to take tiny amounts of genetic material, grow and amplify them. These handling techniques make detecting genes possible, and have previously been miniaturised so they fit on a microchip that uses small channels, valves and reaction chambers.



The team have redesigned the gene handling microchip, and used a different detection method, to develop a system that is 'comparable in performance to much bigger and more expensive machines', explained Backhouse. The size of the device is reduced to that of a shoe-box with optics instrumentation and supporting electronics filling the space around the microchip.

The £500 device could be used to test a person's predisposition to cancer

Reference
G V Kaigala *et al*, *Analyst*, 2008, DOI: 10.1039/b714308g

To keep costs down, 'instead of using the very expensive confocal optics systems currently used in these types of devices we used a consumer-grade digital camera', Backhouse explained.

The device can be adapted for use in many different genetic tests. 'By making small changes to the system you could test for a person's predisposition to cancer, carry out pharmacogenetic tests for adverse drug reactions or even test for pathogens in a water supply,' said Backhouse.

The group strives to make genetic testing accessible to everyone in the same way computers are now. 'It's not long ago that computers were inaccessible to most people but now we all carry more than one on our person. This was made possible by integration and cost reductions,' said Backhouse. He said he plans to cut the manufacturing costs of this device to £50 in the very near future by integrating more of the electronics and further miniaturising the microfluidics.

Gavin Armstrong

Moving towards using viruses to transport therapeutics to target cells

Viral cargo delivery

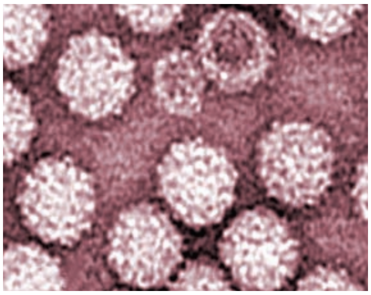
US chemists have used a virus capsule to package and release molecules, which could lead to targeted delivery of therapeutic compounds.

Stefan Franzen and his colleagues at North Carolina State University in Raleigh used the red clover necrotic mosaic virus as a vehicle for dye molecules that can be loaded and unloaded on demand.

Red clover necrotic mosaic virus is a plant virus with a protein shell, or capsid, of multiple subunits that self-assemble to form a cage. Franzen explained that, 'these protein cages offer a rigid structure with an interior cavity that can function as an ideal container for cargo encapsulation'.

To explore its versatility for nanopackaging and delivery, Franzen first worked on capturing dye molecules into the capsid. As divalent ions are integral to the virus structure, Ca^{2+} and Mg^{2+} depletion in the solution induces significant conformational changes. This leads to surface pores forming, allowing dye molecules to infuse into the interior cavity. Restoring the ion balance closes the pores, trapping the dye inside the virus. When Franzen lowered the ion concentration, the pores reopened and the dye molecules were released.

Microscopic image of red clover necrotic mosaic viruses carrying dye molecules



Reference
L Loo *et al*, *Chem. Commun.*, 2008, 88 (DOI: 10.1039/b714748a)

Franzen's final aim is to use the capsids for intracellular drug delivery – the next stage is to study their ability to package and deliver cargo into a target cell, he explained. The idea is that loaded viruses should be triggered to open their surface pores and release their package inside a cell where the divalent ion concentrations are low. This concept is 'advantageous because the virus capsid will be able to act as container to protect a cargo until it reaches the targeted cell to be released', explained Franzen.

Michael Spencelayh

Natural enantiomer of a grape vine pest's sex pheromone has been identified

Mealybugs look in the mirror

US researchers have used spectroscopy to identify the absolute configuration of the mealybug sex pheromone, with potential uses in pest control.

An interdisciplinary team worked together to determine the 3D arrangements of the atoms in this molecule. Entomologist Jocelyn Millar and organic chemist Bruno Figadère at the University of California, Riverside, teamed up with an expert in vibrational circular dichroism (VCD) spectroscopy, Philip Stephens from the University of Southern California, Los Angeles.

Millar explained the importance of the finding: 'This insect is a worldwide pest of grape vines and numerous other plants. To determine whether the pheromone can be incorporated into pest management, full identification was required.'

The chiral pheromone of the mealybug *Pseudococcus viburni* had been made diastereoselectively by Millar before, and its relative configuration established using NMR. The absolute configuration could not be confirmed as only a few micrograms of the natural compound are available, preventing measurement of its optical rotation. In the absence of one enantiomer of known configuration, Millar had no way of determining which enantiomer was the natural pheromone.

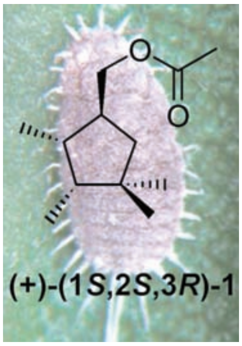
'To break this impasse we reasoned that if at least one enantiomer could be resolved from the synthetic racemate, it might be possible to determine its absolute configuration by comparing its experimentally-determined VCD spectrum to the theoretical VCD spectra of the two enantiomers, calculated using density functional theory,' explained Figadère. This proved to be the case and enabled unambiguous assignment of the absolute configuration of the pheromone.

'Comparison of experimental and theoretical VCD spectra has again been shown to be a valuable method for determining the absolute configuration of chiral compounds without enantioselective synthesis of one or both enantiomers,' remarked Stephens. 'This method should be particularly useful for newly-identified natural products where the very small amounts of sample may eliminate the use of other methods for determining absolute configuration.'

'There are a number of chemical and enzymatic methods for resolving racemates, and the ability to determine the absolute configurations of the resulting enantiomers without having to do a chiral synthesis will save a lot of time and effort,' Millar added.

Hans-Erik Högberg, a Professor of Organic Chemistry at the Mid Sweden University, Sundsvall, agreed 'Millar presents an elegant solution to this problem and provides researchers in chemical ecology with a powerful new tool for determining absolute stereochemistry. I expect this to greatly impact future research in chemical ecology.'

Michael Spencelayh



Knowledge of the absolute stereochemistry of the bug's sex pheromone could be used to stop crop infestations

Reference
B Figadère *et al, Chem. Commun.*, 2008, DOI: 10.1039/b717440c

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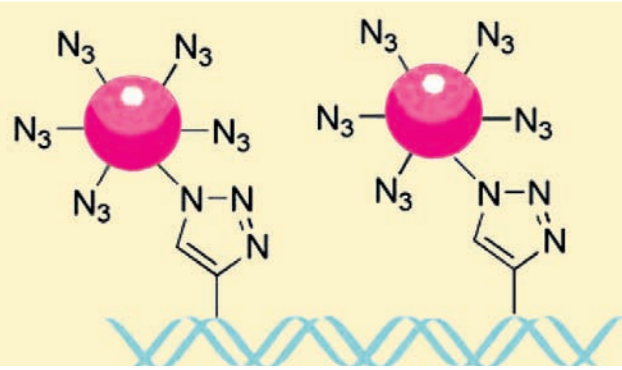
DNA proves a useful template for nanosized electronic devices

DNA nanowires

Fastening azide-functionalised gold nanoparticles onto modified DNA holds great promise for nanoscale electrical circuits, say German researchers.

The trend for miniaturisation in electronics, and size and cost limitations of conventional lithographic techniques, has led researchers to develop alternative routes to nanoelectronic components. DNA is a useful template for nanoscale electronic devices, explained Simon from the Institute for Inorganic Chemistry, Aachen, Germany, due to its well-defined structure and many electrostatic and chemical binding sites which can be modified.

Simon and colleagues have made a new type of gold nanoparticle containing an azide ($-N_3$) functional group. They have coupled the nanoparticles to artificial DNA, where thymine bases are replaced by alkyne-modified derivatives, using a copper catalysed cycloaddition reaction. This densely covers the DNA with nanoparticles at highly regular intervals. As the nanoparticles can conduct electricity, the nanoparticle-modified DNA can potentially be used as a nanowire.



Gold nanoparticles are attached to modified DNA making nanowires

Reference
M Fischler *et al, Chem. Commun.*, 2008, 169 (DOI: 10.1039/b715602b)

Monika Fischler, who also worked on the project, said that the 'major advantages [of this route] are the programmability of the DNA template through incorporating artificial bases, as well as the high selectivity and yield of the copper catalysed reaction'.

Duncan Graham of the University of Strathclyde, UK, praised the work. He said that the 'formation of chains of nanoparticles is very challenging and this is a good approach to producing nanowires that potentially conduct electricity better'.

Vikki Chapman

A time for transition

Peter Kündig discusses his chemistry career and new editorial role with Joanne Thomson

Peter Kündig

Peter Kündig is Professor of Organic Chemistry at the University of Geneva. His research focuses on the use of transition metals for organic synthesis. He is the new chairman of the *Chemical Communications* editorial board.

What early influences steered you towards a career as a chemist?

As a child, I was fascinated by science and technology. Shortwave radios, watching planes, homemade explosives and fireworks were all part of my youth. It was much easier to make explosives at home back then because the ingredients – fuses, weed-killer, sulfur – were more readily available.

What are you working on at the moment?

New and more efficient ways to make chiral organic molecules using transition metals is my main concern. We develop new efficient ways to make new and existing catalysts and we carry out mechanistic studies. We have made new chiral bulky ligands, such as *N*-heterocyclic carbenes, phosphoramidates, and perfluoroarylphosphinites.

These modify the reactivity of metals and catalyse highly asymmetric reactions including the arylation of amides, hydrogenolysis, cycloadditions and coupling reactions under mild conditions. These and the application of chromium-mediated dearomatisation reactions to natural product synthesis are all areas where I have current interests and research projects.

Transition metal catalysed reactions are already recognised as a significant component of the organic chemist's arsenal. How do you see the field progressing?

Catalysis will continue to see tremendous growth and asymmetric reactions will take a lead in future developments. With the impressive array of reported reactions, it is surprising to see that less than thirty of these processes are used in industrial production. Almost all of them are asymmetric hydrogenations and oxidations. This is bound to change.

Carbon–heteroatom and carbon–carbon bond forming reactions will come to the fore but catalyst access, stability, efficiency and selectivity will need to be improved. New reactions and cascade processes will keep us busy. There are a lot of things still to do.

What scientific discovery would you like to have been responsible for?

Alkene metathesis as applied to organic synthesis. It is a reaction that has been around for many years. It has been used widely in polymer science and the petroleum industry but its application to fine chemistry needed the selective catalysts developed by Dick Schrock and Bob Grubbs. For this they received the Nobel Prize, along with Yves Chauvin who provided the mechanism. It was something that was waiting to be discovered and it has had a huge impact on organic chemistry.

You are the new chairman of the *ChemComm* editorial board. What are your aspirations for the journal?

I am looking forward to working with an editorial staff that has been doing an outstanding job over the years. I would like to help to further increase the visibility of the journal in all areas of frontier chemistry and strengthen its position as one of the leading communication journals in which everyone wants to publish their best and newest research.

You won the EuCheMS award for service in recognition of your work for European cooperation in science. Why is cooperation between European chemical societies so important?

With more than 50 societies, European chemistry is too fragmented. More and more decisions, and a growing part of our research funding, will come from Brussels. There has to be a rallying point for chemists in Europe otherwise chemistry will be neglected by European politicians. EuCheMS provides this umbrella structure and it will be far more effective than the individual societies on their own.

What do you do in your spare time?

My wife would tell you that I have no spare time, and that chemistry is my life. However, I like carpentry and motorcycle riding and repairing. I like skiing and mountain walks and travelling to out-of-the-way places in Asia or South America. I have a passion for wines, and keeping the cellar well-stocked is a challenge. Time is, of course, the missing ingredient and chemistry takes up most of it.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Instant insight

The light touch

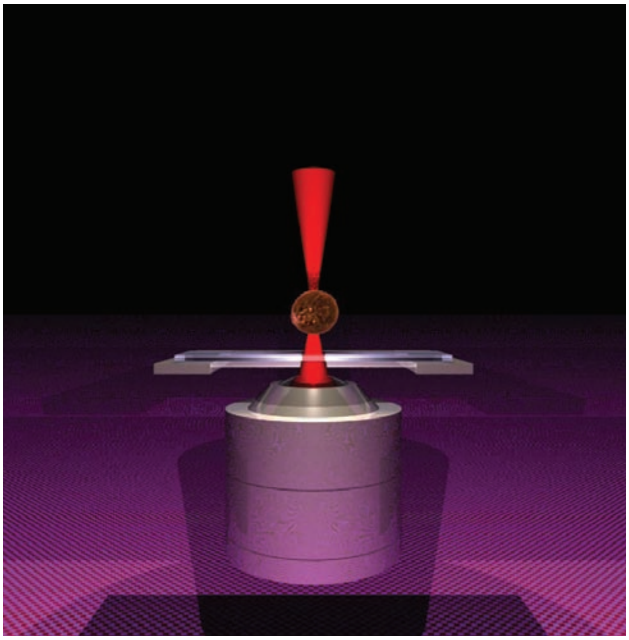
Kishan Dholakia, Peter Reece and Min Gu from the University of St Andrews, UK, examine how light can move and sort biological objects, and be used for studying physics and chemistry at the microscopic scale

Holding and moving objects using light might seem like science fiction, but it is actually science fact – at the microscopic scale. The characteristics of light and light–matter interactions on a small scale have allowed some astounding scientific advances in the last forty years. The invention of the laser opened up many new research fields including optical micromanipulation – where light exerts a force, to hold (trap) and move objects. This force comes from transferring momentum possessed by light to objects. For example if an object refracts the light, the light's momentum will change as it bends. Naturally the momentum of a single quantum of light, the photon, is very small, meaning these forces are barely a million millionth of a Newton.

Such forces cannot hope to move macroscopic objects, but are perfect for holding and moving objects the size of single cells or smaller. A tightly focused beam of light can move objects this size without damage, as carefully choosing the light wavelength avoids absorption and ensures the force transfer is non-invasive.

In the biological world, this technique can measure exceptionally precise and miniscule forces where macromolecules are tethered to microscopic beads. Here we are in the realm of molecular motors that convert chemical energy to mechanical work. Examples include the actin-myosin system which operates using energy from chemical reactions, typically the hydrolysis of adenosine triphosphate (ATP) to adenosine diphosphate (ADP) and phosphate. Trapping allows this process to be observed in real time. The exact positions of trapped particles are observed to much higher accuracies than the wavelength of light, as detectors can take in to account an objects centre of gravity, meaning the movement of biological molecules can be observed with amazing sensitivity. Transcriptional elongation of *Escherichia coli* RNA polymerase motion can even be monitored on a DNA template with its motion recorded at the Ångström level.

Light can do much more than just make accurate force measurements. It can move single or multiple droplets for subsequent mixing and study chemical reactions – opening up new chemistry including combinatorial chemistry using only picolitres of reagents, studying coagulation dynamics and micro-reactions. Optical forces combined with fluidic forces are also used in the area of microfluidics for lab-on-a-chip research.



Light passing through a microscope objective can grab and hold objects in the bright part of the beam

Novel photonics in the form of arrays of traps or the implementation of new light patterns (rather than the standard circular mode pattern from most lasers) is core to many recent advances. If extended light patterns are created instead of one single beam, an array of light spots (akin to a set of egg-boxes) are generated. These arrays of traps are known as a potential energy landscape. The motion of a particle across this optical array is like a small ball moving along a slanted corrugated roof, where gravity causes the object to move across the roof, but the exact trajectory followed is dependent upon the slant of the corrugation in the roof. Extending this analogy, arrays of traps can be created so that when particles flow over them they deflect objects to a degree based on their affinity to the light. This method allows the separation (sorting) of cells and colloidal particles without adding fluorescent markers. This is just one example of what these landscapes may achieve: their impact should reach a wide range of colloidal and soft matter research, and may even help us better understand superconductivity.

Optical micromanipulation has been around for over 35 years, with its impact significantly expanding recently. These new applications and insights make the field more dynamic and exciting than ever – light has 'caught' more than the imaginations of scientists.

Reference

K Dholakia, P Reece and M Gu, *Chem. Soc. Rev.*, 2008, **37**, 42 (DOI: 10.1039/b512471a)

Read Kishan Dholakia et al's tutorial review on 'Optical micromanipulation' in issue 1, 2008 of Chemical Society Reviews.

Essential elements

Celebrating a decade of success

2008 is a big year for RSC Publishing as four titles from its successful journal portfolio celebrate their tenth year of publication. *CrystEngComm*, *Green Chemistry*, *Journal of Environmental Monitoring* (*JEM*), and *Physical Chemistry Chemical Physics* (*PCCP*) have all made huge advances in their first decade.

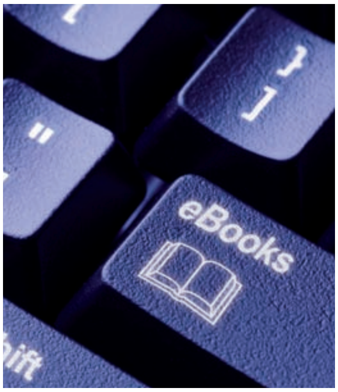
PCCP boasts the highest ISI immediacy index of any general physical chemistry journal and *CrystEngComm*, with an impact factor of 3.729, is *the* journal in which to publish crystal engineering research. *JEM* is packed full of cutting-edge work on environmental processes and impacts and *Green Chemistry*, the most highly cited journal in its field, has an impact factor of 4.192.

A number of celebratory activities are planned this year to mark the anniversaries, including receptions, sponsored lectures, poster prizes and commissioned articles. Look out for specially selected reviews representing the many areas of *Green Chemistry*, and *JEM* sponsored lectures at Airmon 2008 (Albert Gilmutdinov) and DIOXIN 2008 (Kevin Jones). *PCCP* and *CrystEngComm* will also be maintaining a high profile at key conferences across their fields, including sponsoring ten poster prizes.

For further information on these and other anniversary events visit the website (www.rsc.org/journals) or speak to us at one of the many conferences RSC Publishing staff will be attending throughout 2008. Watch out for celebrations at the Spring ACS meeting in New Orleans in April...

RSC Books 2008

2007 witnessed the launch of the RSC eBook Collection, an innovative online product for scientists across the globe. A further highlight was *Elegant Solutions* by Philip Ball being awarded the 2007 Dingle Prize for the best recent book to communicate the history of science, technology and/or medicine to a wide audience of non-specialists. As we begin 2008, RSC Publishing is confident that our exciting 2008 book list will achieve further success, reinforcing our position at the forefront of international chemistry research publishing.



ISTOCKPHOTOS

Looking forward to the year ahead, RSC Books plans to continue providing a first class online publishing service and is aiming to achieve simultaneous eBook and print publication. Our eBook project saw 44 new eBooks go live in 2007 with a further 52 forecast to go live during 2008. Expect to see groundbreaking titles from our exclusive RSC Nanoscience & Nanotechnology, RSC Biomolecular Sciences series and the new RSC Green Chemistry and RSC Energy Series which join the RSC eBook Collection during 2008.

For more information on our prestigious international best sellers visit www.rsc.org/books

And finally...

This month sees the publication of an exciting theme issue of *Molecular BioSystems* on the subject of metabolomic analysis of microorganisms. The issue is introduced by Hirotada Mori and Tadhg Begley of the *Molecular BioSystems* editorial board and features a good mix of review and primary research material.

The investigation of cellular metabolic pathway networks is a remarkably varied field, requiring a wide range of knowledge and theoretical and experimental tools taken from a diversity of scientific disciplines.

Approaches involving time-of-flight mass spectrometry, TOCSY NMR, informatics and computational strategies are described, along with the modelling and reconstruction of metabolic networks. A review of flux analysis, dynamic changes in metabolite profiles, new techniques to identify extracellular components and dynamic changes in gene regulation are all to be found in this issue. Enjoy!

See www.molecularbiosystems.org

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