Chem Soc Rev

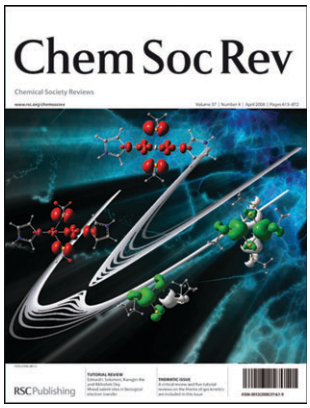
Chemical Society Reviews

www.rsc.org/chemsocrev

RSC Publishing is a not-for-profit publisher and a division of the Royal Society of Chemistry. Any surplus made is used to support charitable activities aimed at advancing the chemical sciences. Full details are available from www.rsc.org

IN THIS ISSUE

ISSN 0306–0012 CODEN CSRVBR 37(4) 613–872 (2008)



Cover
See Edward I. Solomon, Xiangjin Xie and Abhishek Dey, page 623.
Mixed valent multinuclear Cu and Fe sites in biology are increasingly delocalized as the spectroscopically determined metal–metal and bridging ligand interactions increase, tuning electron transfer.
Image reproduced by permission of Edward I. Solomon, Xiangjin Xie and Abhishek Dey from *Chem. Soc. Rev.*, 2008, **37**, 623.

Inside Cover
See Marta Mas-Torrent and Concepció Rovira, page 827.
p-Type, n-type and ambipolar OFETs based on soluble small molecules.
Image reproduced by permission of Marta Mas-Torrent and Concepció Rovira from *Chem. Soc. Rev.*, 2008, **37**, 827.

CHEMICAL SCIENCE

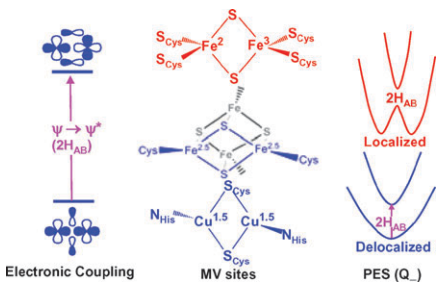
Drawing together the research highlights and news from all RSC publications, *Chemical Science* provides a 'snapshot' of the latest developments in chemical science, showcasing newsworthy articles and significant scientific advances.

Chemical Science

April 2008/Volume 5/Issue 4

www.rsc.org/chemicalscience

TUTORIAL REVIEWS



Chem Soc Rev

Chemical Society Reviews

www.rsc.org/chemsocrev

Chemical Society Reviews publishes accessible, succinct and reader-friendly articles on topics of current interest in the chemical sciences. The promotion of international and multidisciplinary awareness and cooperation is particularly encouraged. Chemical Society Reviews publishes two article types: tutorial reviews, which present an accessible introduction to the topic, and critical reviews, which provide a deeper evaluation of the current literature.

Chemical Society Reviews (print: ISSN 0306-0012; electronic: ISSN 1460-4744) is published 12 times a year by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, UK CB4 0WF.

All orders, with cheques made payable to the Royal Society of Chemistry, should be sent to RSC Distribution Services, c/o Portland Customer Services, Commerce Way, Colchester, Essex, UK CO2 8HP. Tel +44 (0) 1206 226050; Email sales@rscdistribution.org

2008 Annual (print + electronic) subscription price: £514; US$995. 2008 Annual (electronic) subscription price: £463; US$896. Customers in Canada will be subject to a surcharge to cover GST. Customers in the EU subscribing to the electronic version only will be charged VAT.

If you take an institutional subscription to any RSC journal you are entitled to free, site-wide web access to that journal. You can arrange access via Internet Protocol (IP) address at www.rsc.org/ip. Customers should make payments by cheque in sterling payable on a UK clearing bank or in US dollars payable on a US clearing bank. Periodicals postage paid at Rahway, NJ, USA and at additional mailing offices. Airfreight and mailing in the USA by Mercury Airfreight International Ltd., 365 Blair Road, Avenel, NJ 07001, USA.

US Postmaster: send address changes to: Chemical Society Reviews, c/o Mercury Airfreight International Ltd., 365 Blair Road, Avenel, NJ 07001. All dispatches outside the UK by Consolidated Airfreight.

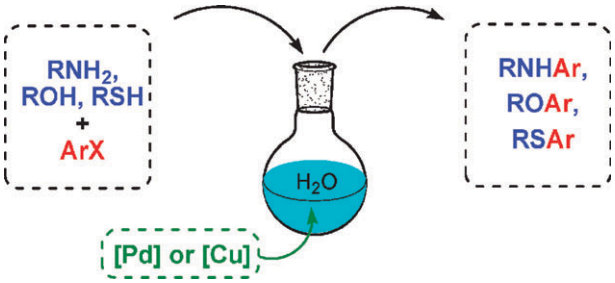
PRINTED IN THE UK

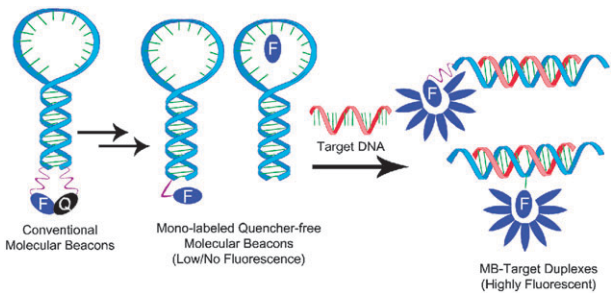
Advertisement sales: Tel +44 (0) 1223 432243; Fax +44 (0) 1223 426017; E-mail advertising@rsc.org

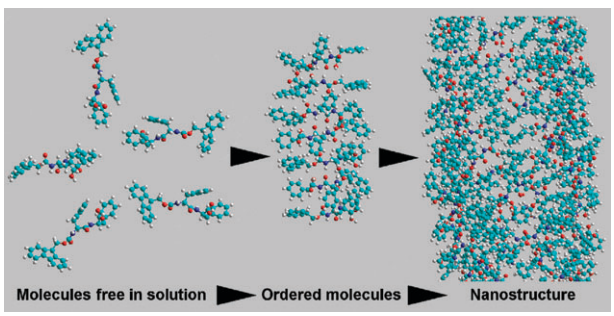
INFORMATION FOR AUTHORS

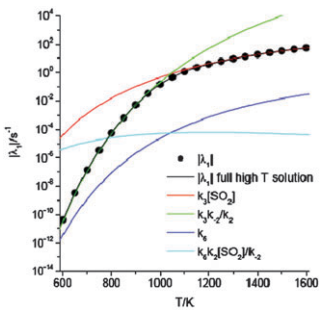
The Editorial Board commissions articles that encourage international, interdisciplinary progress in chemical research. The Board welcomes proposals for new tutorial reviews or critical reviews and the appropriate synopsis pro forma should be requested from the Editorial Office (csr@rsc.org). Full details of how to submit material for publication in Chemical Society Reviews are given in the Instructions for Authors (available from http://www.rsc.org/authors). Submissions should be sent *via* ReSourCe: http//www.rsc.org/resource

Authors may reproduce/republish portions of their published contribution without seeking permission from the RSC, provided that any such republication is accompanied by an acknowledgement in the form: (Original Citation) – Reproduced by permission of The Royal Society of Chemistry.









Physically demanding

PCCP is acknowledged as the journal of choice for fast publication of cutting-edge research in physical chemistry, chemical physics and biophysical chemistry. Committed to publishing research of the highest quality, at **0.866**, *PCCP* has the highest official ISI immediacy index of any general physical chemistry journal and an impressive impact factor of **2.892**.* Our times to first publication in a citable form are impressively rapid and unparalleled by our closest competitors.

PCCP publishes its tenth volume in 2008. A challenging decade has seen the journal successfully establish its place on the physical chemistry leaderboard; a reflection of its speed of publication, enduring quality, broad scope, and high impact.

And at *PCCP* we're always raising the bar. Striving to beat our personal best. So things can only go from strength to strength. Make *PCCP* your first choice.

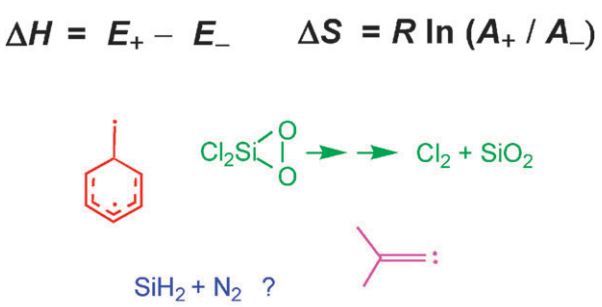
Aiming higher

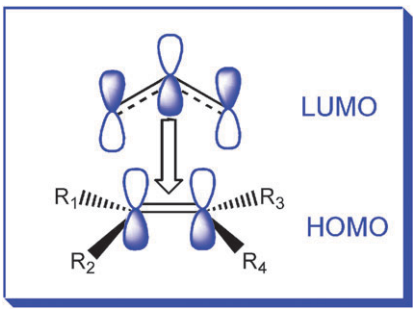
* 2006 Thomson Scientific (ISI) Journal Citation Reports ®

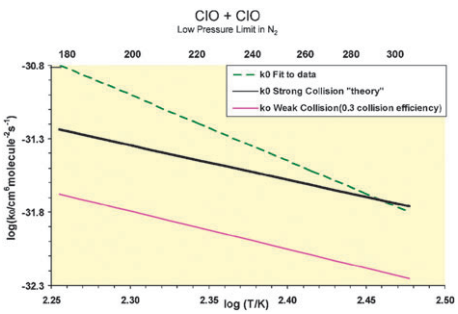
RSC Publishing

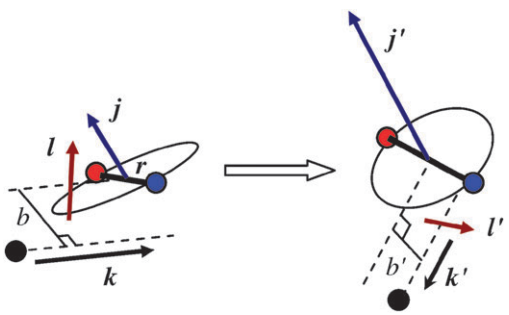
www.rsc.org/pccp

Registered Charity Number 207890









Call for Papers

Energy & Environmental Science

'Energy is the most important scientific and technological challenge facing humanity in the twenty-first century. Energy security and environmental security have come to the forefront of both global and national priorities. This journal aims to bridge the various disciplines involved with energy and the environment, providing a forum for disclosing research results and discourse on this critical field.' **Professor Nathan Lewis**

Launching Summer 2008

Energy & Environmental Science will publish high quality research from aspects of the chemical sciences relating to energy conversion and storage, alternative fuel technologies and environmental science. It will contain a full mix of primary articles, communications and reviews.

The current issue in 2008/9 will be free online. Institutional access to all 2008/9 content will be available following registration at **www.rsc.org/ees_registration**

Contact the Editor, Philip Earis, at **ees@rsc.org** or visit the website for more details.

International Editorial Board members include:

Professor Nathan Lewis, Caltech, USA *(Editorial Board Chair)*
Professor Michael R Wasielewski, Northwestern, IL, USA
Professor Arthur Nozik, National Renewable Energy Laboratory, USA
Professor Jefferson W Tester, MIT, MA, USA
Professor Steven E Koonin, BP, London, UK

Submit your work today!

RSC Publishing

www.rsc.org/ees

Registered Charity Number 207890

FREE E-MAIL ALERTS AND RSS FEEDS

Contents lists in advance of publication are available on the web *via* www.rsc.org/csr – or take advantage of our free e-mail alerting service (www.rsc.org/ej_alert) to receive notification each time a new list becomes available.

Try our RSS feeds for up-to-the-minute news of the latest research. By setting up RSS feeds, preferably using feed reader software, you can be alerted to the latest Advance Articles published on the RSC web site. Visit www.rsc.org/publishing/technology/rss.asp for details.

ADVANCE ARTICLES AND ELECTRONIC JOURNAL

Free site-wide access to Advance Articles and the electronic form of this journal is provided with a full-rate institutional subscription. See www.rsc.org/ejs for more information.

* Indicates the author for correspondence: see article for details.

Electronic supplementary information (ESI) is available *via* the online article (see http://www.rsc.org/esi for general information about ESI).

April 2008 / Volume 5 / Issue 4 / ISSN 1478-6524 / CSHCBM / www.rsc.org/chemicalscience

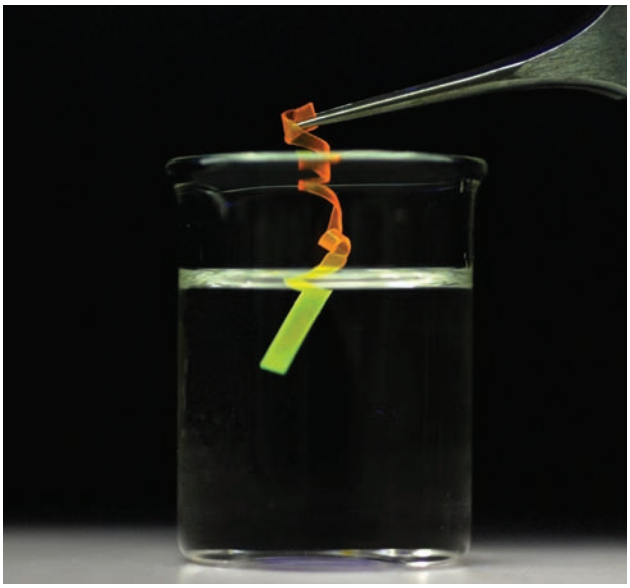
Chemical Science

Colour assists with finding transition temperature of shape-memory materials

Shapely polymers get the green light

Shape-memory materials spontaneously change shape when exposed to an external stimulus, such as heat. Materials chemists have now made a shape-memory polymer that reversibly changes colour as it changes shape, enabling repeated transitions to be easily monitored even when the shape change is small.

Shape-memory materials have been well studied since the discovery of their unusual properties in the 1960s. Recent work has included the incorporation of dyes into the polymers, allowing accurate monitoring of the transition. These systems used to rely on the dye undergoing a permanent chemical change, meaning that they only worked once. Patrick Mather, Christoph Weder and colleagues at the Case Western Reserve University, Cleveland, US, have now adapted this approach to make a shape-memory polymer that reversibly changes colour when it reaches its transition temperature, allowing it to be used for repeated transitions.



CHRISTOPH WEDER

The polymer is an orange spiral when cool, and changes to a green rod when dipped in hot oil

As a demonstration, Mather and Weder took a known shape-memory polymer, crosslinked poly(cyclooctene), and treated it with solutions of a phenylene-vinylene dye. They heated the rod-shaped polymer to 75 °C, twisted it into a spiral, and cooled it to 5 °C to set the shape. The polymer spiral, which at this point was fluorescing orange, was then dipped into silicone oil at 8 °C, causing it to revert to its original shape and green colour.

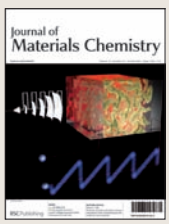
The dye's colour change is caused by a reversible aggregation–deaggregation of the dye molecules that occurs at the transition temperature. This reversibility, says Mather, is 'a requirement for any application requiring multiple cycling, whether the cycle time is a day, as in architectural applications, or minutes, as for medical applications'.

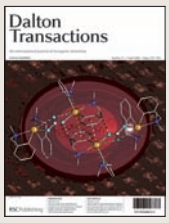
Andreas Lendlein, of the Institute of Polymer Research, Teltow, Germany, says that this approach is 'an important strategy to optimise materials towards the needs of specific applications'. Future work might involve developing dyes able to visualise multiple transitions in the same polymer, says Weder.

David Barden

Reference
J Kunzelman *et al.*, *J. Mater. Chem.*, 2008, **18**, 1082 (DOI: 10.1039/b718445j)

In this issue





A snapshot of the latest developments from across the chemical sciences

Research highlights

Natural atmospheric processes cause formation of megacryometeors

Getting to the truth of falling ice chunks

A massive lump of ice falling from the sky and landing at your feet is not what you would expect on a lovely sunny day, but unusual events like these have been known to happen. People have often speculated whether they could be giant hailstones or maybe ice from aircraft, but a team of Spanish scientists has found that the answer actually lies within complex natural processes in the atmosphere.

Jesus Martinez-Frias at the Centre for Astrobiology, Madrid, and a multidisciplinary team of scientists have looked at the formation of large ice conglomerations, known as megacryometeors, in our atmosphere. There have been more than 100 recorded events of ice chunks falling from the sky, explains Martinez-Frias, but up to now their formation has not been fully understood.

The team focussed on a ten kilogram ice chunk which fell from a clear sky in a town close to Madrid in 2007 - the Mejorada del Campo megacryometeor. Using a multianalytical approach the team found that the chunks have the texture, hydrochemical features and isotopic values that prove they come from atmospheric processes. The water in the megacryometeor is clearly tropospheric, explains Martinez-Frias.

The 2007 Mejorada del Campo megacryometeor crashed through the roof of an industrial storage unit

Martinez-Frias uses the analogy of an atmospheric 'symptom' to say that the real cause of these ice chunks will only be 'diagnosed' with an interdisciplinary approach. 'Megacryometeors do fall. This is an indisputable fact and we encourage other scientists to study these events all around the world to ascertain whether they obtain similar results and reach similar conclusions about their formation.'

Bernd Michael Rode, professor of theoretical and inorganic chemistry at the University of Innsbruck, Austria, says, 'the team's work shows that our atmosphere still provides surprising and unresolved problems'. He echoes the words of Martinez-Frias, saying that this field of research 'requires interdisciplinary co-operation on a very wide scale'.

Katherine Davies

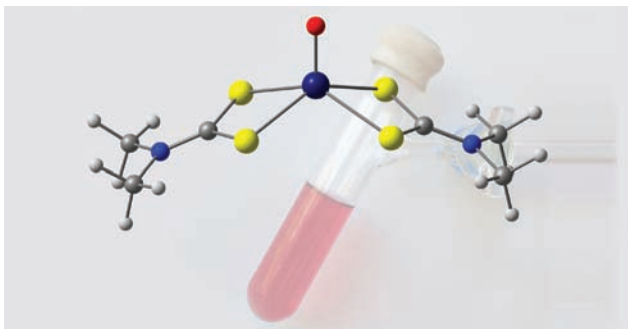
Reference
F Alamilla Orellana *et al, J. Environ. Monit.*, 2008, DOI: 10.1039/b718785h

High-valent metal oxides for the hydrogenation of alkynes and sulfoxides

From oxidation to reduction

Researchers in Portugal have developed high-valent metal oxides for hydrogenating alkynes and sulfoxides, using inexpensive hydrogen.

Beatriz Royo and co-workers at the University of Lisbon exploited catalysts normally used for oxidations, such as olefin epoxidation and oxygen transfer. An earlier unconventional hydrosilylation of carbonyl groups with a high-valent rhenium oxide catalyst prompted us to further investigate these catalysts, says Royo. The team has extended the role of this and a similar molybdenum catalyst to reductive processes using hydrogen, a cheaper and more convenient reducing agent than silane. The catalysts are even capable of catalysing the selective hydrogenation of alkynes to alkanes - a challenging task in organic synthesis, says Royo.



Oxidation catalysts have been utilised in reductive processes

The molybdenum catalyst, MoO_2Cl_2, also possesses high catalytic activity in the deoxygenation of sulfoxides using hydrogen, which may have important advantages in terms of green chemistry, explains Royo. The procedure replaces phosphines, expensive metals and environmentally hazardous reducing agents, and has the added advantage of producing only water as a by-product.

Werner Thiel, professor of inorganic chemistry at the University of Kaiserslautern in Germany, is impressed by the work. He says that the researchers have exceeded the expectations for these types of catalysts, and that they have 'opened the door for other researchers to find further applications of high-valent transition metal compounds in reductions'.

Royo says that the team is now studying the mechanism of these processes, and an important goal for the future is to develop systems for enantioselective reductions.

Roxane Owen

Reference
P M Reis *et al, Dalton Trans*, 2008, 1727 (DOI: 10.1039/b719375k)

Hydrogels make light work of releasing their chemical cargo

Laser triggers microcapsule mixing

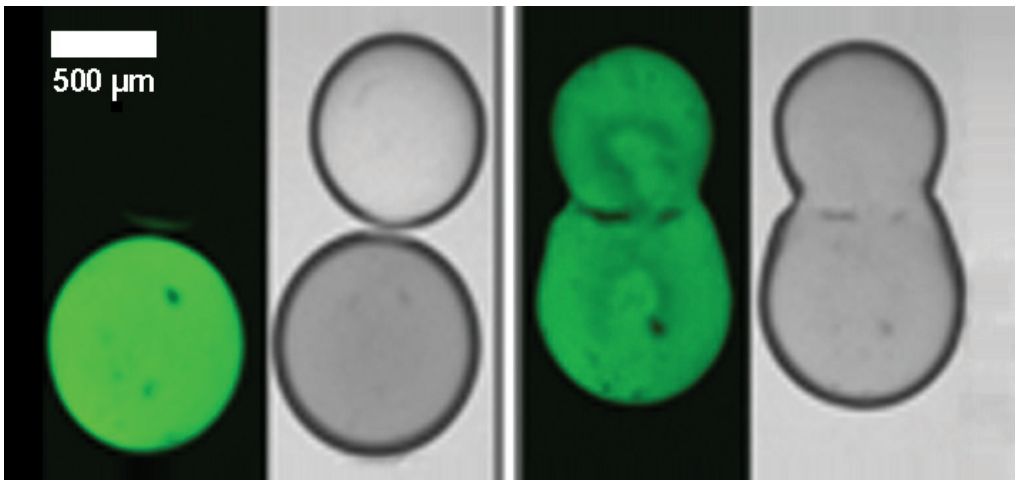
Gel-based capsules that can be individually opened with a precisely aimed blast from a laser could provide a new way to control reactions or deliver drugs.

The hydrogel consists of a self-assembled, supramolecular network of small organic molecules which each incorporate a carbon-carbon double bond. UV light triggers this alkene group to isomerise, converting a linear molecule into a bent one. This disrupts the supramolecular structure and turns the gel into a sol.

Itaru Hamachi and colleagues at Kyoto University, Japan, used this effect to selectively join two adjacent gel capsules, one carrying an enzyme and the other a fluorogenic substrate.

Using a carefully focused laser beam to partially fuse the two gel capsules, a readily detectable fluorescent dye was produced as the enzyme and substrate mixed.

'This is a very interesting, elegant concept,' says Jan van Esch, who researches hydrogels at Delft University of Technology in the Netherlands. 'This approach could bridge the gap between reactions done in test tubes and by microfluidics, both in terms of scale and the surface effects you get with small volumes. And a nice thing about the technique is it can be readily adopted by other researchers; you don't need any special equipment to apply it,' he adds.



A laser beam fuses two microcapsules (left; one with fluorescent dye) into one droplet (right)

According to the Kyoto team, the potential applications of the process range from microfluidics to drug delivery. 'In the future of nanotechnologies, biomolecules such as DNA, RNA, proteins and cells are undoubtedly key players,' says Hamachi. 'So the development of materials which can encapsulate, isolate and manipulate biomolecules at the single molecule level will become increasingly important.'

James Mitchell Crow

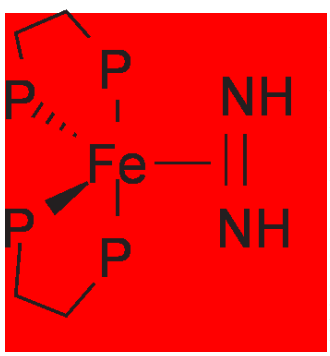
Reference
S Matsumoto *et al*, *Chem. Commun.*, 2008, 1545 (DOI: 10.1039/b719004b)

Unusual iron complex may lead to better ways of producing ammonia

Diazene takes a side-on stance

Scientists from Australia and the UK have made an iron complex in which a diazene ligand is bound to the metal side-on.

'This is the first ever member of this class of compounds,' says Leslie Field of the University of New South Wales in Sydney, Australia. His synthesis of the iron–diazene complex – formed by reacting an iron complex with hydrazine – was a lucky break. 'We had been trying to make diazene complexes for some time by a number of routes, but without success,' says Field. Ironically, in this reaction diazene complexes weren't the intended target. 'We were expecting hydrazine-containing copounds,' says Field.



Diazene (HN=NH) is an unstable and very reactive molecule at room temperature, and Field hopes that the new complex may provide a surrogate source of the compound for studying its chemistry. Interestingly, the side-on stance of diazene is a previously unknown binding mode for this molecule.

Field adds that the complex may represent a possible intermediate in the reduction of nitrogen to ammonia. Studying the chemistry of the complex may shed light on the role of iron as a catalyst in this process. According to Field, better understanding of the mechanisms of nitrogen reduction could lead to improved strategies for the reaction.

Ammonia is one of the world's most highly produced chemicals, with worldwide production in 2006 totalling 122 million tonnes, according to the US Geological Survey. The industrial process of reducing nitrogen to ammonia requires high temperatures and pressures. 'If we get a better handle on understanding the reduction of dinitrogen and the key intermediates involved, this may lead to development of better catalysts and milder reaction conditions than are currently used,' Field says.

Danièle Gibney

Reference
L D Field *et al*, *Chem. Commun.*, 2008, 1680 (DOI: 10.1039/b802039f)

News in brief

Complex medicines
New ruthenium complexes that possess better antibacterial properties than commercially available treatments have been made

Safer stent surfaces
Understanding how a blood plasma protein changes structure at a stainless steel surface offers hope for new medical implants

See **www.rsc.org/chemicalscience** *for full versions of these articles*

This month in *Chemical Technology*

Watching paint die
The decline of decaying paintings could be reversed thanks to a new technique from German scientists

Metals without the meltdown
Scientists have found a practical, cheap and environmentally friendly way of producing the industrially important metal niobium

Detecting a microbe among millions
A sensor that can discriminate between closely related bacteria has been developed by material scientists in the US

Miniature mixing inspired by nature
Dutch scientists have copied nature to develop a faster and more efficient method for mixing small volumes of liquid

See **www.rsc.org/chemicaltechnology** *for full versions of these articles*

This month in *Chemical Biology*

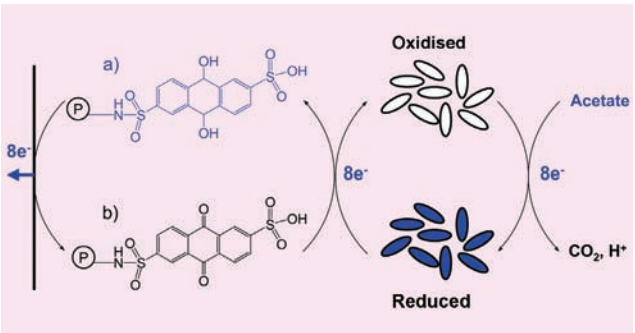
Is Raman spectroscopy the way to nail criminals
Fingernail fragments collected from a crime scene could be used to predict the sex of the suspect, say scientists in Singapore

Protein activity tied in knots
UK scientists have engineered a molecular knot that inhibits an enzyme crucial to foot-and-mouth disease, an infectious disease amongst cloven-hoofed animals

See **www.rsc.org/chembiology** *for full versions of these articles*

Bacteria turn biowaste into energy

Edible electricity



The polymeric surface is reduced by electrons released as bacteria break down acetate

Bacteria-powered fuel cells are a promising way to produce energy from biowaste, provided you can efficiently capture the microbes' electrical potential.

Chemists in Singapore and Japan have examined two different approaches to improving the interface between bacteria and electrode in microbial fuel cells. These devices employ microorganisms to oxidatively break down organic molecules, a process which produces electrons. Capturing these electrons at the fuel cell's anode is the key to harnessing this energy source.

Masanori Adachi and co-workers at Ebara Research in Fujisawa-shi, Japan, have improved the anode interface by incorporating a polymer mediator onto the anode surface.[1] This polymeric anthraquinone-based surface is electrochemically reduced by electrons released as the bacteria break down an acetate 'fuel'. The polymer layer passes these electrons on to the anode itself, and is then ready to be reduced again by the next electron wave.

The Ebara team tested the coated anode system over four months, finding no loss in performance over that time. Such stable performance suggests commercialised microbial fuel cells for practical use may soon become reality, says Adachi.

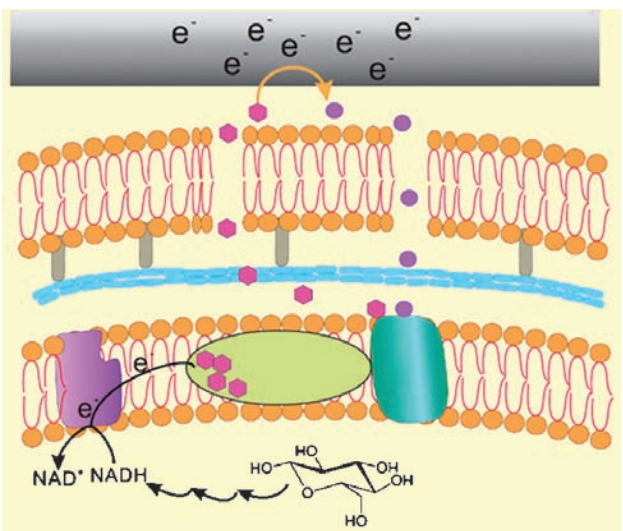
In a separate study,[2] Chang Ming Li and colleagues at Nanyang Technological University in Singapore have developed a fuel cell in which the bacteria themselves transfer electrons to the anode. Following studies showing that Escherichia coli grown under electrochemical conditions evolve the ability to directly pass electrons to an electrode, Li found that the cells were excreting their own mediator, a hydroquinone-based structure essentially performing the same role as Adachi's polymer.

The Li team suggests that the bacteria may be evolving by developing pores in their outer membrane, which allows the hydroquinone to leave the cell and reach the anode. 'The mediatorless microbial fuel cell is very attractive because of its advantages of high energy conversion efficiency and low manufacturing costs,' says Li. The next challenge will be to genetically engineer bacterial strains that produce more of the mediator compounds, he adds.

'Both these studies show good progress towards developing practical microbial fuel cells,' says Xiao Guo, who researches biofuel cells at University College London, UK. 'However, we still need to improve the power density by two to three orders of magnitude to be close to a practical fuel cell. The biological interface is key – if we can engineer a system directly linking electron transfer sites to the electrode, we can greatly enhance the power density,' he says.

James Mitchell Crow

References
1 M Adachi *et al*, *Chem. Commun.*, 2008, DOI: 10.1039/b717773a
2 Y Qiao *et al*, *Chem. Commun.*, 2008, 1290 (DOI: 10.1039/b719955d)



Bacteria release a hydroquinone mediator (pink) which is oxidised at an electrode to give a quinone (purple)

Instant insight

Smart dental implants

Henning Schliephake from the George-Augusta University, Göttingen, Germany, discusses the state-of-the-art dental implants making their way to a dentist's surgery near you

ISTOCKPHOTOS / CARMEN MARTÍNEZ BANÚS

Dental implants are screws or cylinders, commonly made of titanium, which are inserted into the jaw bone in a surgical procedure. They act as artificial roots and can provide anchorage to crowns and bridges after the original root has been lost. Close contact between the adjacent bone and the implant surface is important for the artificial roots to remain fixed for the long-term. This bone-to-implant contact is accomplished by the growth of new bone on the titanium surface. The adsorption of biomolecules and blood components onto the titanium from the body fluids surrounding the implant is a crucial step in this process. This allows bone cells and their precursors to approach the surface and start growing bone tissue. Bone healing may be compromised by previous infection, radiotherapy or osteoporosis, and this can jeopardise the process and lead to implant failure.

In recent years, material scientists and clinicians have developed a number of approaches to improving the regenerative capacity of adjacent bone. One strategy is to create surface conditions that encourage quicker and more intense adsorption of biomolecules onto the implant surface, by altering the implants surface morphology and surface chemistry. Increasing the surface roughness using acid etching and sandblasting combined with integration of fluoride ions or calcium phosphate nanocrystals considerably increases the speed and strength of the bone-implant contact.

An alternative way of enhancing bone formation on the implant surface is using biological signals to attract bone cells to the surface and increase the speed they grow. Some of these signals are based on a short sequence of amino acids - the so called RGD motifs - that bind to specific receptors on the cell surface initiating cell migration and/or increasing cellular activity. The signals are held in place by various types of linker molecules that are anchored to the titanium surface.

Dental implants are inserted surgically and act as artificial roots providing anchorage to crowns and bridges

Another way to accelerate bone growth is using signalling molecules or growth factors to accelerate cellular specialisation. As bone forming cells originate from so called precursor cells, using osteogenic signalling molecules such as bone morphogenic proteins on the implant surface could considerably increase the number of bone forming cells and therefore the amount and strength of the bone grown.

In native bone, many of these osteogenic signalling molecules are encased in the bone matrix, a highly structured assembly of minerals and proteins, which provides three-dimensional stability to the bone tissue. This reservoir of growth factors aids the healing process of bone, for example after a fracture. The most complex approaches among recent surface modifications of titanium implants have tapped into this source to produce matrix-engineered surfaces. Here bone matrix proteins such as collagen are arranged on the implant surface, together with molecules that bind growth factors in native bone, to provide a reservoir for osteogenic signals that are slowly released from the surface in a nature-like fashion after implant placement.

Many of these biological approaches have yet to work their way from the bench to the bedside. However, the huge potential of this research and improved biotechnological capabilities will eventually prove useful for the incorporation of many types of artificial materials into the human body - extending far beyond the integration of dental implants.

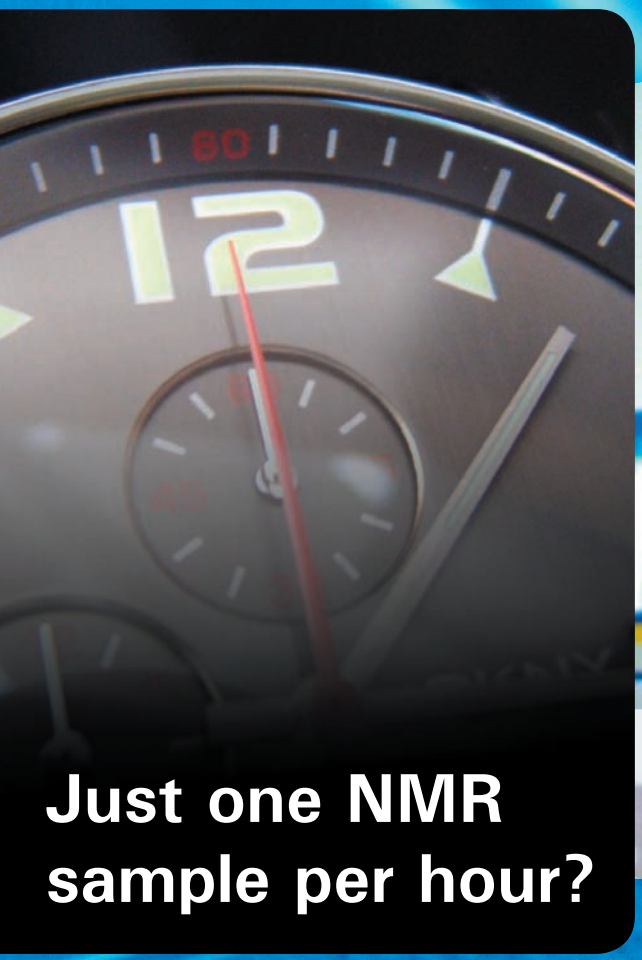
Read Henning Schliephake and Dieter Scharnweber's feature article 'Chemical and biological functionalization of titanium for dental implants' in issue 20, 2008 of Journal of Materials Chemistry

Reference
H Schliephake and D Scharnweber, *J. Mater. Chem.*, 2008, DOI: 10.1039/b715355b

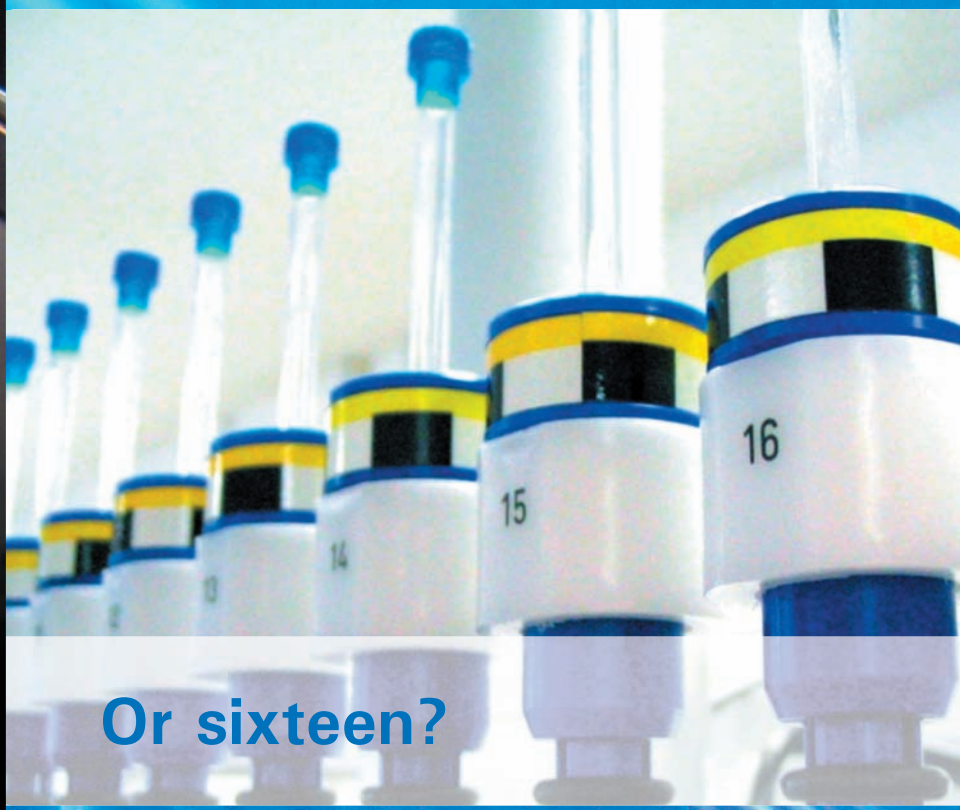
Bruker BioSpin

BRUKER

CryoProbe™



Just one NMR sample per hour?



Or sixteen?

The Bruker CryoProbe™ cools the NMR coils and preamplifiers to improve sensitivity by a factor of 4 and throughput by a factor of 16!

Only From Bruker...

- Over 600 cryoprobes installed in laboratories world-wide, including over 400 inverse triple resonance ^{1}H (^{13}C, ^{15}N) z-gradient Cryoprobes, used extensively for protein studies
- Sensitivity-optimised Cryoprobes for a range of nuclei (^{1}H, ^{19}F, ^{3}H, ^{13}C, ^{2}H, ^{15}N, ^{31}P, etc.)
- Available for a range of tube diameter sizes and types including 1.7mm (for small quantities), 5mm (for standard-sized samples), 10mm (for polymer applications), and shaped tubes (for high dielectric samples)
- Convertible to flow cell applications such as LC-NMR, and use with liquid handling robots
- Winner of four R&D Awards

Contact us for more details: 075 – 6285251 bruker@bruker.nl www.bruker-biospin.com

think forward

NMR Solutions

Instant insight

Beyond the catastrophe

Angus Cook and Phil Weinstein at the University of Western Australia, Crawley, consider the long term care needed by communities struck by earthquakes and other natural disasters

We often only think of natural disasters as sudden and short-lived upheavals in normal life. After dramatic events such as earthquakes, floods and hurricanes, it is often the immediate needs that capture most of the attention and resources. The long-term health needs of communities in this situation are normally overlooked. Recovery from natural disasters may in fact be a drawn-out, unpredictable process. Human health problems after major disasters range from psychological disorders - including depression, anxiety and substance use - to physical injury and illness. These illnesses may appear across the community, including those who have lost property, belongings or the capacity to sustain a livelihood - or even the more general population living outside the disaster zone who may be affected in indirect ways. One obvious delayed impact is malnutrition from the disaster event either compromising the quality of food available - such as crop yields and fish stocks - or impeding ready access to supplies. Populations already vulnerable to poverty and food insecurity, such as those living in sub-Saharan Africa, are particularly likely to succumb to a superimposed crisis. After the 2005 Pakistan earthquake, 2.3 million people experienced problems with food supplies for many months because of logistical difficulties in providing relief and the inaccessibility of affected areas.

Natural disasters are often linked to outbreaks of infectious disease, and most occur around the time of the emergency. However, people who are displaced for longer times after the disaster are at risk from poor sanitation, overcrowding and contaminated food and water. Large scale destruction of homes may force populations to remain in camp accommodation for years.

Large scale destruction of homes may force populations into camp accommodation for years

After the Mount Pinatubo eruption in the Philippines, 18 000 cases of measles struck those living in camps. Disruptions of water systems provides ideal conditions for breeding mosquitoes and the eventual spread of the diseases they carry. Heavy rains and flooding appeared to be responsible for increased dengue rates in Thailand, Indonesia, Venezuela and Brazil, and for the re-emergence of West Nile Fever in Romania in 1996, the Czech Republic in 1997 and Italy in 1998.

The increased strain on existing medical facilities after emergencies may destabilise normal patterns of care. This leads to illness for those who require medications, ongoing procedures (such as dialysis), or a high level of care (including the elderly, and those with long-term illnesses or disabilities). Many disasters spread toxic agents - including biological and chemical wastes - into the environment, and diseases from such hazards may not be apparent until years after the event. Considerable concern has been expressed about the potential toxicity of the floodwaters in post-Katrina New Orleans, which left sediments rich in heavy metals, petrochemicals and asbestos.

Mental health issues following natural disasters are well documented, and it is common for victims to experience distress after such overwhelming events. Many people experience ongoing mental illness, including post-traumatic stress disorders. Research suggests that this is not necessarily short-lived, and may persist for a decade or more in a third of the initial cases. Depression, suicide and child abuse are other delayed consequences of disasters. The social and economic impacts of disasters in shaping long-term health should not be underestimated, and post-event unemployment is strongly associated with mental illness. Many families suffer considerable financial hardship and may become temporarily or permanently relocated, thereby interrupting established community, cultural and social ties.

Disaster relief remains largely crisis dominated. Many emergency organisations do not have adequate processes or the authority structure to assess risks and health needs in the weeks, months and years following a disaster. As we may be moving into an era of climate change and extreme weather events, it is timely to note that recovery from disasters is protracted and not inevitable. With mounting evidence of ongoing health problems, health services must extend their horizons of care and need to anticipate increases in demand beyond the immediate emergency.

Read Angus Cook's critical review '10th Anniversary Review: Natural disasters and their long-term impacts on the health of communities' in issue 2, 2008 of Journal of Environmental Monitoring.

Reference
A Cook *et al*, *J. Environ. Monit.*, 2008, **10**, 167 (DOI: 10.1039/b713256p)

Essential elements

A winning combination!

Visit the RSC stand, booth 411, at the ACS Spring National Meeting & Exposition in New Orleans, US, 6–10th April 2008 and you could be a winner! To celebrate the success of their monthly podcast and the launch of their new mini-podcast 'Chemistry in its element – a tour of the periodic table' the award-winning *Chemistry World* is offering an iPod to one lucky listener.

Or give your energy levels a boost with our cookies and cakes event in anticipation of the summer launch of our brand new journal - *Energy & Environmental Science,* linking all aspects of the chemical sciences relating to energy conversion and storage, alternative fuel technologies and environmental science. Sign up to e-alerts to secure your entry into a prize draw for a solar-powered charger for your mobile phone, MP3 player and other mobile devices.

Meet the editors of our

journals, pick up some free copies and make the most of the RSC books sale – offering up to 20% off selected titles

Celebrate with us as four titles from our successful journal portfolio mark their 10th 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. Check out the *RSC eBook Collection*, a fully searchable online reference library covering more than 750 titles, or discuss with us the award-winning *RSC Prospect* enhanced HTML articles.

Plus, why not take this opportunity join over 44 000 people worldwide by becoming a member of the RSC and benefit from the wealth of knowledge that we contribute to the chemical science community.

We look forward to seeing you there!

Visit www.rsc.org/rscatacs

Hot off the press

The µTAS 2008 conference in San Diego, US, is featuring a new award sponsored by *Lab on a Chip* titled 'Under the Looking Glass: Art from the World of Small Science.' Applications are encouraged from any person attending the conference and the winner will be selected by a panel of senior scientists in the field of µTAS.

Applications must show a photograph, micrograph or other accurate representation of a system that would be of interest to the µTAS community. They must also contain a brief caption that describes the illustration's content and its scientific merit. The winner will be selected on the basis of aesthetic appeal, artistic allure and scientific merit. In addition to having the image featured on the cover of *Lab on a Chip*, the winner will also receive a financial award at the conference.

For more information email loc@rsc.org

April free access

Do you have online access to one or more journals from RSC Publishing? Would you like to have access to even more content?

From April 1st to April 30th 2008, you can!

Like any organisation, we are keen to reward our loyal customers. So, to show our appreciation for your continued support of RSC journals, we are providing you with free online access to all of our online journals – completely free!

All you need is a current institutional subscription (or rights to access online) for one or more RSC journal titles. Then, for the whole of April 2008, you and your colleagues will be able to read all content, published between 1997 and the present day, in all RSC journals.

A complete list of all journals included in this offer is listed on the website. The list includes all our established titles, such as *ChemComm*, *The Analyst*, *Green Chemistry*, *Lab on a Chip* and *Journal of Materials Chemistry*, as well as more recent additions *Soft Matter* and *Molecular BioSystems*.

Visit www.rsc.org/april_access for full details

Chemical Science (ISSN: 1478-6524) is published monthly by the Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge UK CB4 0WF. It is distributed free with *Chemical Communications*, *Dalton Transactions*, *Organic & Biomolecular Chemistry*, *Journal of Materials Chemistry*, *Physical Chemistry Chemical Physics*, *Chemical Society Reviews*, *New Journal of Chemistry*, and *Journal of Environmental Monitoring*. *Chemical Science* can also be purchased separately. 2008 annual subscription rate: £199; US $396. All orders accompanied by payment should be sent to Sales and Customer Services, RSC (address above). Tel +44 (0) 1223 432360, Fax +44 (0) 1223 426017. Email: sales@rsc.org

Editor: Nina Notman

Associate editor: Celia Clarke

Interviews editor: Joanne Thomson

Web editors: Edward Morgan, Tina Morrell, James Hodge

Essential elements: Daniel Bradnam, Valerie Simpson and Kathryn Lees

Publishing assistant: Ruth Bircham

Publisher: Janet Dean

RSC Publishing