

Chemical Technology

Fueling the future



Generally hailed as a clean, efficient technology, commercial application of fuel cells has been hindered by high cost and unreliability. Focusing on two of the most widely used cells, proton exchange membrane fuel cells and solid oxide fuel cells, Frank de Bruijn, from the Energy Research Centre of the Netherlands, discusses the current status of this green technology for mobile and stationary uses. Environmental benefits include energy savings and decreased emissions of air pollutants such as NO_x and SO_x.

F de Bruijn
Green Chem., 2005, 7, 132

Alignment of mesochannels



Tetsu Tatsuma and colleagues from the University of Tokyo, Japan, have patterned gold surfaces with enzymes and algal cells. Using a combination of techniques the group have successfully fabricated super-hydrophobic/super-hydrophilic patterns, for lab-on-a-chip devices. Electrodeposition was used to create a gold surface which was modified with a self-assembled monolayer of a hydrophobic thiol. Super-hydrophilic patterns were generated via photocatalytic lithography. Enzymes or algal cells could then be immobilised on the hydrophilic surface.

H Notsu *et al*
J. Mater. Chem., 2005 (DOI: 10.1039/b418884e)

Keeping an eye on your chips



A team of scientists from the University of Twente, The Netherlands, have developed a device for following the progress of lab-on-a-chip reactions. Willem Verboom and colleagues have integrated a monitoring port into a microfluidic system to allow longer reaction and measuring times. The window added to the apparatus permits laser desorption ionisation, using MALDI (matrix-assisted laser desorption ionisation), to allow measurements to be made directly from the reaction medium.

M Brivio *et al*
Lab Chip, 2005 (DOI: 10.1039/b418986h)

Metal vapour generation



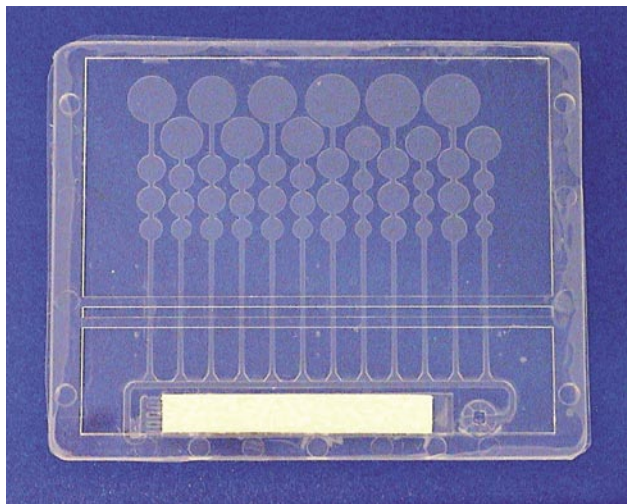
The mechanism of chemical vapour generation (CVG) of transition and noble metals may be more complex than previously thought, according to researchers in Canada and Italy. CVG is widely used for sample introduction in atomic spectrometric analysis, and CVG of metals was thought to be a two-step process. Now Ralph Sturgeon at the National Research Council Canada and colleagues, have proposed a multistep mechanism involving unstable complexes. The new mechanism helps to explain some of the complex results seen during CVG experiments.

Y-L Feng *et al*
J. Anal. At. Spectrom., 2005 (DOI: 10.1039/b417172a)

Application highlights

Cancer markers are detected using polymer microchips

Cervical cancer gets microchip treatment



Simpler, quicker diagnosis of cervical cancer might be possible thanks to a disposable polymer microchip device developed by scientists in Norway and Germany.

A disposable microchip will help make cancer detection faster

Anja Gulliksen, working at biotechnology company Norchip and Oslo University, and colleagues have demonstrated a microchip system that detects the cancer marker human papilloma virus (HPV), a prerequisite for developing cervical cancer.

The detection limit for their system is comparable to conventional routine diagnostic methods although the volumes required are much smaller. This means that the microchip and its detection system have the potential to be used at the point of care.

The system detects high-risk HPV types using real-time nucleic acid sequence-based amplification (NASBA) performed in the copolymer microchip. The small volume sample is distributed into parallel reaction channels by the microchip. In future it is hoped that several different target molecules

could be detected from just one sample.

Gulliksen and her group suggest the possibility of integrating the detection microchip with a sample preparation microchip. 'Our vision is to be able to produce a portable hand-held bioactive micro-TAS [total analysis system],' says Gulliksen. The group envisages a setup that is easy enough to be used by anyone and cost-effective enough to be accessible to all.

Gulliksen notes that high quality sample preparation is crucial for validating the technology and for them to be able to achieve that they will need to have a well functioning sample preparation microchip that will work for any sample material.

Katherine Davies

Reference

A Gulliksen *et al*, *Lab Chip*, 2005 (DOI:10.1039/b415525d)

Mass spectrometry technique developed for quick on-the-spot analysis

Airport explosives detection made easy

Chemists in the US are developing a mobile mass spectrometer to detect traces of explosives quickly and on-the-spot.

Graham Cooks and colleagues at Purdue University, US, are using desorption electrospray ionisation (DESI) mass spectrometry in their attempts to streamline airport security. In their method, the object under scrutiny is sprayed with a mist of alcohol and water. Molecules from the object's surface are picked up and carried to the mass spectrometer as the mist bounces off the object. The mass spectrometric measurement then takes three seconds, and analysis a further three seconds, so that any explosive material can be quickly spotted.

This technique tackles common problems with detecting explosives, where samples have to be taken away to be analysed. The DESI method can be used on all kinds

of surfaces, is very sensitive and doesn't need a vacuum. Plans to make a hand-held analyser are under way, according to Cooks.

'A very large step has been taken in solving the scientific problems associated with specific detection of low levels of explosives with high certainty in short times and without complex sampling procedures,' says Cooks.

He adds that DESI was not originally intended for any particular application, but 'the fact that the method works for a large variety of surfaces is indeed fortunate. We were lucky perhaps to make the appropriate observations but they were made in conjunction with an interest in removing the limitations imposed by vacuum systems on mass spectrometry'.

Katharine Sanderson

Reference

Z Takáts *et al*, *Chem. Commun.*, 2005 (DOI: 10.1039/b418697d)

Seeing the whole picture



A new approach to investigating petroleum-contaminated sites has been explored by US researchers. Todd Halihan and colleagues at Oklahoma State University and the University of Nevada have used electrical resistivity imaging (ERI) to track pollutants.

Although this technique has been used for geological mapping, this is the first example of its use in a remediated site to give quantitative information about pollution. ERI is particularly useful for mapping liquids, such as gasoline, which are lighter than water.

Electrical resistivity imaging has now been used to monitor remediated sites

Reference

T Halihan, *J. Environ. Monit.*, 2005 (DOI: 10.1039/b416484a)

Findings from these investigations show that methods used in the past, for example discrete point sampling of liquids or indirect measurement through borehole or drilling techniques, did not provide accurate pictures of contamination in an entire area.

Conversely, ERI allows researchers to look at a complete region. It could provide a cheaper and better long term solution for monitoring sites contaminated with gasoline or other non-aqueous liquid pollutants.

Niamh O'Connor

Screening for SARS in blood serum

Chinese research is pointing to an effective SARS diagnostic test.

In November 2002 a severe acute respiratory syndrome (SARS) emerged killing hundreds of people before it was eventually contained eight months later. Relatively little is known about this infectious disease, but with the possibility of its return, an accurate means of diagnosing SARS is urgently needed.

Now scientists in Beijing have identified the antigen that will allow them to develop blood serum tests for SARS. Knowing the culprit of the infection to be the SARS-associated coronavirus (SARS-CoV), Sheng-Qi Wang and colleagues developed an antigen screening method based on protein microarrays to evaluate SARS-CoV fragments in sera from SARS patients.

The recombinant GST-N2 fusion protein was a strong antigen in all SARS-CoV proteins and Wang

hopes to use it to develop a clinical SARS antibodies testing method.

Carolyn Ackers

Reference

D-D Lu, *et al*, *Analyst*, 2005, **130**, 474

SARS killed hundreds of people in 2002-03, with China being the worst hit nation

Three-in-one spectroscopy

A way to monitor chemical reactions as they happen during catalysis has been developed.

Killing three birds with one stone, Angelika Brückner from the Institute for Applied Chemistry Berlin-Adlershof, Germany, combined three spectroscopic techniques to look at the same catalytic reaction, at the same time, in the same reactor. The techniques are usually used individually but this is not ideal because discrepancies can arise between the samples used and the reaction conditions. By using the three techniques simultaneously identical conditions are guaranteed.

The complementary techniques are: electron paramagnetic resonance to tell how many unpaired electrons are in an atom; UV/vis spectroscopy which uses light from the ultraviolet and visible regions to see what electronic transitions a molecule is undergoing; and Raman spectroscopy which shows the energy state of a molecule. All of these properties are affected by an atom's oxidation state.

Brückner has high hopes for this new development. The ability to simultaneously analyse product composition is becoming increasingly important in catalysis research. *Lorna Jack*

Reference

A Brückner, *Chem. Commun.*, 2005 (DOI: 10.1039/b418790c)

Essential elements

The final countdown...

The final countdown to the launch of the RSC's two new interdisciplinary journals, *Molecular BioSystems* and *Soft Matter*, has begun! Readers can now sample the first articles online for free.

Molecular BioSystems focusses on the interface between chemistry and the -omic sciences and systems biology; the first print issue will be available in May 2005. The first full paper, from Seth Orlow of the NYU School of Medicine, US, looks at the use of a chemical genetic screen to identify compounds that could be of use in designing drugs to increase skin pigmentation. Forthcoming

articles include methods, communications and highlights, on topics ranging from new bio-analytical techniques, to the role of genomics in the development of cancer drugs.

Meanwhile *Soft Matter* will focus on the science underpinning the properties and applications of soft matter. The first print issue will be published in June 2005. Articles include papers and reviews on themes ranging from specialised techniques for producing nanostructured materials, to gels for use in medical applications.

Both journals will publish Opinions - articles to introduce

a new or controversial subject, with a view to encouraging debate for publication in subsequent issues of the journal. The first Opinion in *Soft Matter* is from Richard Weiss, professor at Georgetown University, Washington, US. It discusses soft matter and the use of rheoreversible gels in art conservation.

Published as Advance Articles these research papers provide an excellent taster of what's to come.

☑ To see for yourself and to register for regular email alerts, visit: www.molecularbiosystems.org and www.softmatter.org

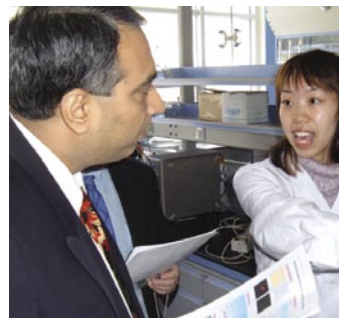
And finally.....



Staff from the RSC's publishing and membership divisions have just returned from an extensive two-week tour of China.

The trip, organised to develop links with key academics and institutions, saw RSC staff travel to 25 universities throughout China. Investment in Chinese research and the growth in its scientific output over recent years, have been immense. Last year alone, US\$265 million was injected into funding basic research projects.

To aid communication, a list of the benefits of publishing in RSC journals, translated into Chinese and Japanese, is now available on the RSC website. Translations into other languages will be appearing soon.



Cocktails for ChemComm

200 people gathered at a reception in the San Diego Marriot Hotel on 13th March to celebrate *ChemComm's* 40 successful years of publication. Coinciding with the 229th ACS National Meeting, the reception was hosted by Dr David Giachardi, RSC Chief Executive. Among the guests were representatives from the ACS, RSC President Dr Simon Campbell and international figures from the world of chemical sciences.

As the current *ChemComm* publicity campaign highlights, the journal publishes a vibrant cocktail of research. To celebrate this, guests enjoyed cocktails specially named in



honour of *ChemComm*. "Weekly issues, coupled with expanded three-page communications and the new

improved format, are excellent news for our authors and readers," commented Sarah Thomas, editor of *ChemComm*. Roeland Nolte, chair of the editorial board added "I am proud to be associated with such a prestigious journal. *ChemComm* truly is the perfect mix."

A series of Anniversary Articles covering high-profile subjects within the chemical sciences have been commissioned and will be published throughout the year.

☑ To read the first of these articles, or to find out more about *ChemComm*, visit www.rsc.org/chemcomm

Chemical Technology (ISSN: 1744-1560) 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*, *Journal of Materials Chemistry*, *Analyst*, *Lab on a Chip*, *Journal of Environmental Monitoring* and *Green Chemistry*. *Chemical Technology* can also be purchased separately. 2005 annual subscription rate: £199; US \$328. 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

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