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Chemical Technology

Nanoforests

Researchers in the USA and Ireland have used single walled carbon nanotube (SWNT) forest electrodes to develop a sensitive amperometric immunosensor. The self-assembled forests are constructed from oxidatively shortened SWNTs onto Nafion/iron oxide-coated pyrolytic graphite electrodes. James Rusling and his team have observed that antibodies are strongly adsorbed on the surface of the SWNTs giving good assay results for enzyme-labelled biotin. They anticipate that the limits of detection of this high sensitivity immunosensing system may be improved further, for example by using high affinity monoclonal antibodies.

J L Rusling *et al*
Analyst, 2004, **129**, 1176

Up, up and away

Researchers from the University of Cambridge, University College London and ACNielsen BASES, UK, have developed a solid state sensor for balloon-borne profiling of ozone concentrations in the atmosphere. The instrument, based on a tungsten oxide sensor, is able to operate continuously during the balloon flight, unlike ground-based sensors which often provide readings which are averaged hourly. Future work will focus on treating the effects of the reducing air pressure on the sensor, to produce more accurate readings.

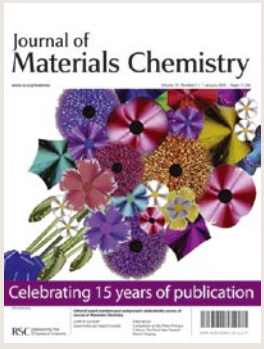
G M Hansford *et al*
J. Environ. Monit., 2005 (DOI: 10.1039/b412184h)

Two chips are better than one

A new concept for continuous measurements on microchips, developed by scientists in Dortmund, Germany, addresses some of the problems associated with fluid handling in microchip-based separation systems. Peter Jacob and colleagues at the Institute for Analytical Sciences coupled a system chip, serving as a 'world-to-chip' interface, with an exchangeable analysis chip. This two-chip system, which eliminates the need for cleaning, refilling or removal of the separation chip between measurements, generates results with good reproducibility and provides analytical flexibility.

O Vogt *et al*
Lab Chip, 2005 (DOI:10.1039/b411739p)

Amorphous materials



When the molecular structures of small organic molecules are designed they can form stable amorphous glasses characterised by well defined glass-transition temperatures. This new class of functional materials termed amorphous molecular materials is suitable for use in a wide range of applications including organic electroluminescent and photovoltaic devices. Yasuhiko Shirota discusses the rise of this interdisciplinary field, the molecular design concepts used to control the molecular morphology and the materials' functions and performance in a selection of devices.

Y Shirota
J. Mater. Chem., 2005 (DOI:10.1039/b413819h)

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Application highlights

New method mimics spiders to produce microscale fibres and tubes

Spinning webs with microfluidics

Spiders' webs have inspired scientists in South Korea and the US to design a new way to make microscale polymeric fibres and tubes.

Spiders produce their silk threads by generating a liquid that solidifies when exposed to air. Inspired by this process, Sanghoon Lee and co-workers at Dankook University, Cheonan, and Hanyang University, Seoul, in collaboration with David Beebe and colleagues at the University of Wisconsin, Madison, have developed a microfluidic system that can produce microscale structures in a similar way.

While spiders' silk solidifies on exposure to air, the polymeric structures produced by Lee's system solidify on exposure to light. The new technique avoids the need to rely on some form of 3D construct, that traditional methods need.

The technique combines 3D multiple stream laminar flow and 'on-the-fly' *in situ* photopolymerisation. This means that the polymerised fibre can move through the device in the same direction as the flow without touching the channel's inner surface. It then emerges from the device as a solid polymerised fibre.

Fibres and tubes of all shapes and sizes can be made simply by changing the channels in the system. By controlling the sample and sheath volume flow rates, the fibre dimensions can be altered without re-tooling the channels. This makes the device very versatile – a single system has produced both stimuli-responsive woven fabric and biosensing fibres. The authors believe the technique has the potential to be widely used in many different fields. *Rowena Milan*

Polymer scientists have taken inspiration from spiders

Reference
W Jeong *et al*, *Lab Chip*, 2004, **4**, 576

Using sunlight to create carbon-carbon bonds the green way

Green chemistry's shining light

A method for making carbon–carbon bonds using green technology has been developed by Irish scientists.

Creating carbon–carbon bonds is a basic challenge for synthetic chemists, but it can be difficult if the carbon atoms are isolated from the functional groups that activate these reactions. Radicals needed to make the reactions work better are traditionally formed using metal catalysts – reagents that green chemists try to avoid.

Seeking an alternative green chemistry route to carbon–carbon bond formation, Roisin Doohan and Niall Geraghty at the National University of Ireland, Galway, have found a way to generate carbon radicals photochemically. A photomediator (typically benzophenone) is essential to the reaction – it contains a carbonyl group that, when subjected to light, will produce the radicals needed to make the bond-forming reactions work.

As well as avoiding toxic reagents, this reaction has other environmental attractions: sunlight can be used to trigger the reaction and the photomediator can be attached to a solid support, which means it might be recycled.

In their work, Doohan and Geraghty carried out the same reactions either in a photoreactor or using solar radiation. Cyclopentane and cyclohexane in alkyne solutions were reacted using either a soluble or a supported photomediator.

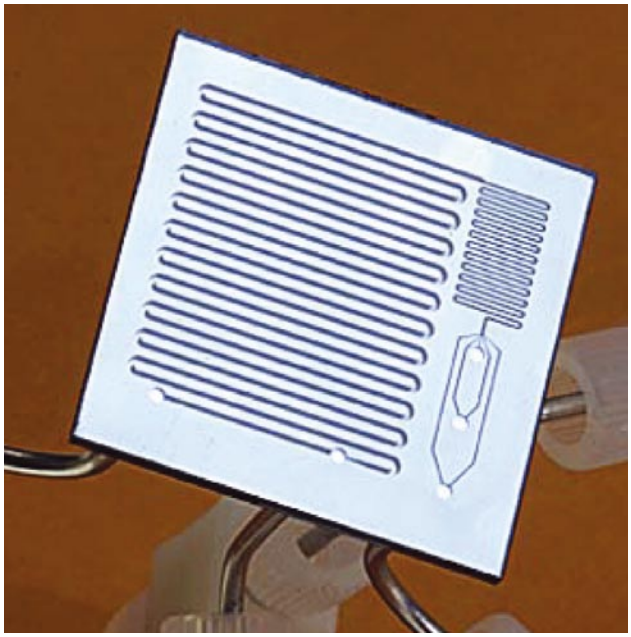
The reactions produced a mixture of isomers and there was no evidence that any secondary photochemical isomerisation had taken place. Although the solar reactions took longer to work than those carried out in the photochemical reactor, they gave comparable yields in most cases. However, the supported photomediators required longer reaction times and performed poorly compared to the soluble benzophenone photomediator.

If efficient and robust supported photomediators can be developed, this green chemistry methodology could have a bright future. *Lorna Jack*

Here comes the sun: green chemists harness light to drive C–C bond forming reactions

Reference
N W A Geraghty and R A Doohan, *Green Chem.*, 2005 (DOI: 10:1039/b411786G)

Optimising organic chemistry



Microreactors could give a quick answer to finding the right reaction conditions

The best way to do a reaction could be easier to work out thanks to a microreactor developed by a team of US and Swiss scientists.

Finding the best conditions for a reaction is an important consideration for organic chemists. Unfortunately this process takes up a lot of time and starting materials. Being able to discover the ideal conditions faster and more efficiently will impact on the speed that organic chemistry will develop in the future.

Peter Seeberger and co-workers from Massachusetts Institute of Technology, US, and ETH Honggerberg, Switzerland, made a silicon–glass based microreactor. By systematically studying a challenging organic transformation they were able rapidly to obtain comprehensive information about different reaction conditions. The microreactor's advantages were clear to see, as 44 reactions were run in one afternoon, using just two milligrams of starting material for each run.

Seeberger believes that by combining the microreactor with online detection and screening, the whole process could be automated in future. *Meriel Dyche*

Reference

D M Ratner *et al*, *Chem. Commun.*, 2005 (DOI: 10.1039/b414503h)

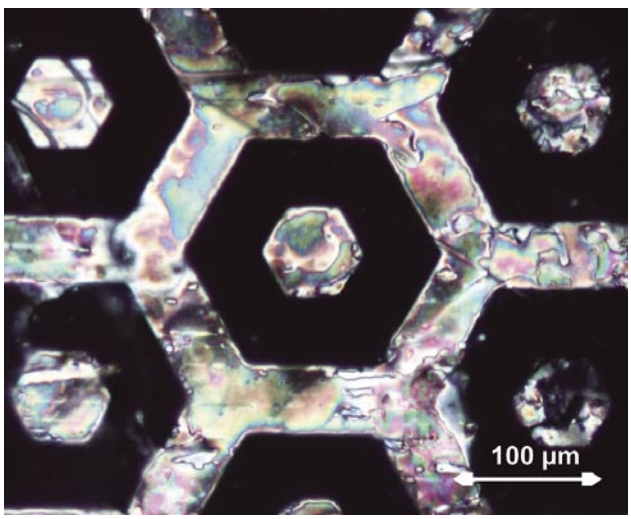
Giving liquid crystals the brush-off

Polymer molecules in the shape of tiny brushes can help liquid crystals line up on a surface.

Paul Hamelinck and Wilhelm Huck from the University of Cambridge, UK, made a patterned surface where polymers could grow on only part of the pattern. By controlling the radical polymerisation they grew polymers with lots of branched side chains, like a brush.

These brushes arrange themselves into a dense, organised array so that they can only grow upwards. The array forms a layer with a thickness that can be carefully controlled to as little as five nanometres.

When liquid crystal molecules are added to the modified surface, the high level of organisation in the brushes forces the liquid crystal molecules to align with each other. This controlled alignment will be useful for developing tuneable optoelectronic devices in the future. *Carol Stanier*



Organised brushes force liquid crystals to line up with one another

Reference

P J Hamelinck and W T S Huck, *J. Mater. Chem.*, 2005 (DOI: 10.1039/b413670e)

Tossing Pebbles into cells

Scientists in the UK, have found a simple way to introduce sensors into cells without causing them stress.

Calcium sensors are often based on fluorescent dyes, which is a less than perfect technique, often leading to readings that don't reflect the cell in its natural state. An alternative system is to use Pebbles (Probes encapsulated by biologically localised embedding). The fluorescent dye is then protected by a matrix and cell damage is avoided.

Jonathan Aylott and his team in Nottingham and Hull introduced Pebbles to the cells by a simple and brief incubation step. They attached a synthetic cell-penetrating peptide, based on the regulating HIV-1 Tat protein, to an external sensor matrix. This allowed the sensor to get into the cell without damaging the cell membrane.

Because the cells aren't stressed by this process, the system has great potential for cell research, and especially in areas like early embryo development and stem cells.

Now that sensors have made it safely into the cell, Aylott says that 'one of the greatest challenges facing this work is the systems used to monitor the signal given by the sensor'. *Carolyn Ackers*

Reference

A Webster, S J Compton and J W Aylott, *Analyst*, 2005 (DOI: 10.1039/b413725f)

Essential elements

Celebrations all round at RSC journals

2005 is a momentous year for RSC Publishing, with two of its prestigious journals celebrating milestone anniversaries. *ChemComm* bursts into 2005 celebrating its 40th anniversary and *Journal of Materials Chemistry* salutes 15 years of publication.

To commemorate these notable occasions, both journals are publishing specially commissioned articles. *ChemComm* is running a series of 40th anniversary articles throughout 2005, reviewing the very latest ideas and opinions from all areas of the chemical sciences. The first in the series appears in issue 1, and is a fascinating profile of Hans Wynberg (the first ever *ChemComm* author!) written by E. W. Meijer.

These special anniversary articles will be complemented by editorial features, highlighting some of the key trends in the communications published in *ChemComm* since its inception as a journal of The Chemical Society in 1965.

Journal of Materials Chemistry welcomes in the new year with a special celebration issue, with contributions from members, past and present, of the prestigious editorial board. The issue showcases the breadth of coverage and quality of work that has become the hallmark of the journal.

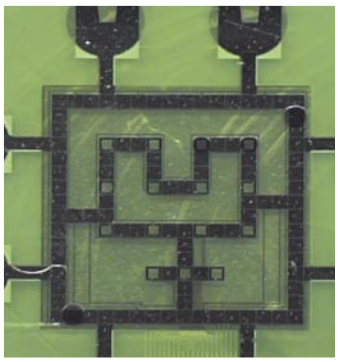
Issue 1 of each journal are the first of their new weekly instalments, a move that sees *Journal of Materials Chemistry* become the first weekly journal in its field.

●To find out more, visit www.rsc.org/chemcomm or www.rsc.org/materials

A *Lab on a Chip* special delivery

Lab on a Chip moves from strength to strength in 2005 by doubling in frequency to monthly issues and starts the year with a cutting-edge special issue on cell biology.

'The science and application of cell biology in microsystems is moving rapidly from exploratory demonstrations to sophisticated and targeted applications where the unique properties of microsystems can be leveraged to provide new or enhanced functionality,' write David Beebe and Albert Folch in their editorial. They describe how more intelligent



use of microscale phenomena and systems has improved areas including: providing insights into basic biological questions such as mechanisms in the blood-brain barrier; aspects of culturing cells in microsystems; patterning cells within microchannels; and microfluidics and cell biology in embryology. Contributions from internationally acclaimed experts such as Toner, Kennedy, Jensen, Laurell, Bhatia, Shuler and Lee are highlighted.

Since launch in 2001, *Lab on a Chip* has grown rapidly and has already achieved an impressive Impact Factor of 4.3. To access the contents list for the special issue, or to find out more about the journal, visit: www.rsc.org/loc

Clean energy

The RSC book, *Clean Energy*, has been well-received by the UK's Select Committee on Science and Technology. Ron Dell (formerly Atomic Energy Research Establishment, UK) and David Rand (CSIRO Energy Technology, Australia), are well-placed as authors, having both spent their professional careers working in the energy field. This book presents a broad survey of the energy problems facing society over the coming decades, along with prospects for their solutions. To find out more, visit: www.rsc.org/is/books/cleanenergy.htm

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