

# Materials Monthly

Making materials matter

July 2001

## Playing in the big game

"If I were asked for an area of science and engineering that will most likely produce the breakthroughs of tomorrow, I would point to nanoscale science and engineering," says Neal Lane, Assistant to the President of the USA for Science and Technology. Which might explain why the US National Nanotechnology Initiative was awarded US\$500 million in 2001.

"The value of nano-scale is becoming more and more widespread as researchers identify emerging properties of materials," says Dr Mihail Rocco, Senior Advisor for Nanotechnology at the USA's National Science Foundation. "However, only the tip of a very big iceberg is currently visible."

And the US isn't the only country moving quickly to exploit the exploding area of nanotechnology. In Germany six 'Competence Networks' have been formed to advance collaboration in nanotech. Four Centres of Excellence in nanotech are being funded in 2001 (funding formula usually 60:40 – industry:government). In Japan a new Nanomaterials program has been initiated which will develop novel materials science and create new network systems to unify current disparate terms and data used in nanotech.

National nanotech initiatives are also being planned, started, or are in place in the UK, China, Korea and Taiwan.

Currently, Australia is one of the few countries with a nanotech capacity that has not yet devised a coherent national strategy as to how it will position itself with regard to nanotechnology. Which has many scientists working in the area worried that Australia may miss out on the next technology revolu-

tion. Their concerns led to two special workshops being run at the CSIRO Telecommunications & Industrial Physics labs in Sydney at the end of March.

The first was titled 'Nanotechnology in Australia' in which leading national and international researchers and managers in the field of nanotechnology met to discuss and define Australia's strengths and weaknesses. The second workshop following immediately on from the first was 'Nanotechnology in Australian Industry'. Sponsored by the Department of Industry, Science and Resources and the CSIRO, this second workshop

sought to identify opportunities for the practical transfer of nanotechnologies to industry in Australia.

Guest speakers at both workshops

(Cont on page 2)

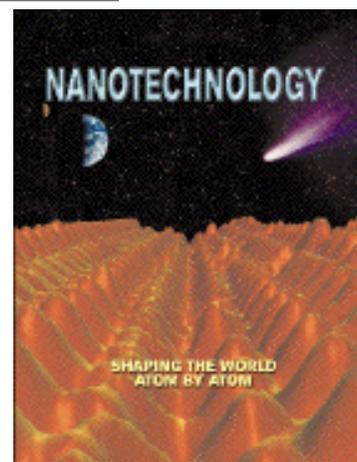
**"Nanotechnology is the builder's final frontier"**

-Richard Smalley  
Nobel laureate, Rice University

### Inside this MM

- 2 Direct from the Director
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Volume II, Issue 5



For a great introduction on nanotechnology, check out a booklet prepared by the US National Science and Technology Council (see: [itri.loyola.edu/nano/IWGN.Public.Brochure/](http://itri.loyola.edu/nano/IWGN.Public.Brochure/))



# Direct from the Director

Phil Evans, Forestry Department

There is currently a government inquiry into Australia's capacity in the area of nanotechnology. The inquiry, set up by the Department of Industry, Science and Resources, is being coordinated by Ernst & Young and sets out to establish: who are Australia's present players in nanotechnology, and how best to build a national capability in nanotechnology.

It is pleasing that news of the importance of this field has permeated through to government. However, let's hope that the findings of the inquiry will translate into research dollars because overseas, nanotechnology is set to attract significant research funding.

The National Science Foundation (NSF) in the USA has just announced a budget request of \$4.47 billion for the next fiscal year and nanoscale science and engineering has been allocated the highest increase in funding, up to \$174 million. The aim of this nanotechnology initiative is to create materials by design and manufacturing (contact Tom Cooley of NSF, [tcooley@nsf.gov](mailto:tcooley@nsf.gov) for further information). Nanotechnology, as well as aeronautics and space research, is also set to benefit from a 17.5 billion euro research and innovation proposal currently on the table of the European Parliament (contact Stephen Gosden, [stephen.gosden@cec.eu.int](mailto:stephen.gosden@cec.eu.int) at the EU Information and Communications Unit).

A key feature of both the NSF and EC proposals is the creation of centres or networks of excellence to integrate

research activities, and maximise cross-fertilization of ideas. For example, NSF's request seeks \$25.6 million for new science and technology centres while in the European initiative special measures have been proposed to increase the mobility of researchers and their ability to network at both a national and European level.

Australia has strengths in nanotechnology (see this issue's lead article) but we need to make better use of the expertise that currently resides here. Initiatives to allow our researchers to network and interact with other researchers in Australia and overseas would be a most welcome first development towards enhancing our capacity in this emerging field.

If you're working in the area of nanotechnology and want to get involved register your interest with the DISR inquiry by emailing:

[rebecca.hanna@ernstyoung.com.au](mailto:rebecca.hanna@ernstyoung.com.au) (ph(03) 9288 8162) or [craig.fowler@ernstyoung.com.au](mailto:craig.fowler@ernstyoung.com.au) (ph(03) 9288 8947).

"Nanotechnology has given us the tools to play with the ultimate toy box of nature - atoms and molecules"  
-Horst Stormer  
*Nobel laureate, Columbia University*

*(Playing in the big game, continued from page 1)*  
included Dr Mihail Rocco from the USA, Dr Otilia Saxl, Director of the Institute of Nanotechnology, UK, and Prof Komiyama from the University of Tokyo.

The take away messages from the workshops was that nanotechnology is still opening up, that Australia has several strengths that potentially could place it as a world leader but that as a nation we lack a sense of cohesion and vision.

Australia's current research strengths lie in nanoparticle research, nanotubes and biomimetics. Our science advantage lies in having multi-disciplinary and multi-functional (science+industry+government) infrastructure already in place with CRCs, CSIRO and university networks. Our weakness lies in no cohesive strategy at the national level, and the disparate approach of science, industry and government.

The workshop proposed a number of strategies to address these weaknesses including the creation of a national nan-

otechnology strategy, a national nanotechnology website with a database of who's who in Australian nanotechnology, the establishment of nanotechnology centres around Australia and a twice yearly national forum. It's expected a government website on nanotech will be launched later this year.

Will Australia be a main player in what is believed to be the biggest technology revolution ever?

### More information

**Nanotech in Aust. Industry**  
[www.isr.gov.au/industry/advancedmanufacturing/Reports/reports.html](http://www.isr.gov.au/industry/advancedmanufacturing/Reports/reports.html)

**Nanotech in the USA**  
[www.nano.gov](http://www.nano.gov)

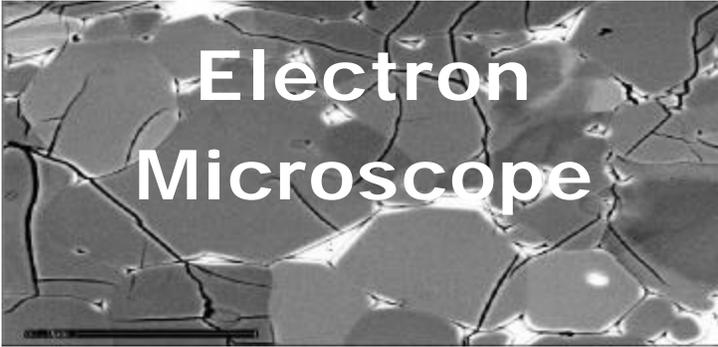
**Nanotechnology in the UK**  
[www.nano.org.uk](http://www.nano.org.uk)



The US is spending \$US500 million to establish a nanotech capability. What's Australia doing?

# Materials on Campus

## Electron Microscope



The ANU Electron Microscope Unit (EMU), is sited in the Research School of Biological Sciences. It is a central service available to all ANU staff and students from both the Research Schools and the Faculties. The Unit's aim and function is to provide a high quality service covering the broad areas of both materials and biological microscopy. EMU is run by Sally Stowe, the Facility Coordinator, together with Roger Heady, Frank Brink, Cheng Huang, David Llewellyn and Lily Shen.

Established in 1989, the EMU\* possesses seven electron microscopes (four scanning EMs and three transmission EMs), basic light microscopes and a wide range of equipment for specimen preparation and image handling. (\*The JCSMR, the RSC, the RSES and Dept of Geology also maintain electron microscope facilities with varying links to the central Unit.)

Recent technology highlights at the EMU include the acquisition of a new high pressure freezer and foreshatter detector.

### High Pressure Freezer

Last year the EMU acquired one of the first examples in the world of a new high pressure freezer for specimen preparation. The instrument, a Leica 'EM-PACT', applies a very high pressure (about 2,000 atmospheres) to a specimen for a few milliseconds before it is frozen in liquid nitrogen. The pressure slows the formation of sub-microscopic ice crystals and allows almost instantaneous preservation to a much greater depth than other methods of freezing. This avoids many artefacts which may arise from conventional chemical treatments.

Material preserved in this way can be used with a number of second-stage cryo- techniques including – freeze substitution, freeze-fracture, cold stage SEM, or cryo-sectioning for immunolabelling or cold stage TEM.



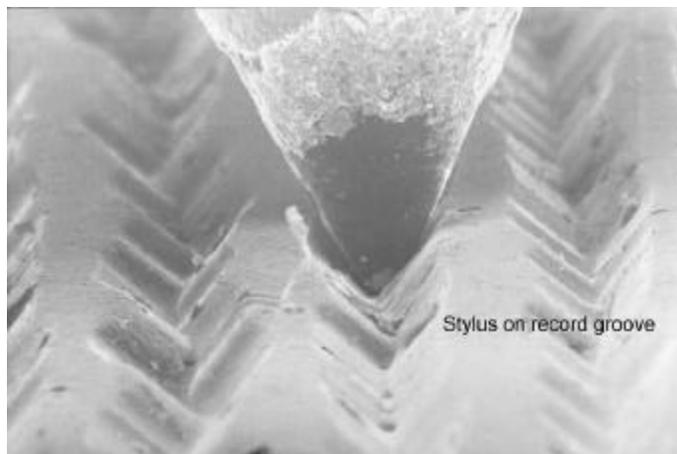
A TEM of a mitochondrion in crayfish muscle prepared by high pressure freezing and

### EBSP upgrade

The Kikuchi Backscatter system on the JEOL 6400 scanning electron microscope has recently been upgraded with the addition of a foreshatter detector (an Electron BackScatter Diffraction Pattern, EBSP, system) and a faster PC. This improves the ease of use and the accuracy of pattern identification on detailed crystallographic orientation maps.

### Usage and availability

No direct charge is currently levied on members of the ANU for routine use of these basic services, but users with external funds are expected to make a financial contribution (which is to be discussed with the Coordinator of the EMU).



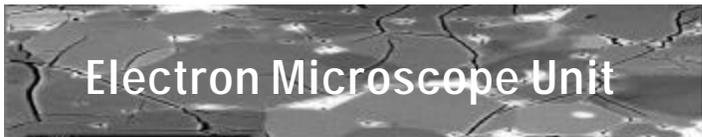
The EMU facilities may be used for undergraduate courses, as long as only small groups of students (8-10 people on SEM, 4 people on TEM) are in the unit at any one time. Organisers of courses who intend to use the EMU are asked to discuss arrangements with the Coordinator as early as possible.

Users are normally instructed on a one-to-one basis, as the user learns the techniques needed for their project. Instructional videotapes and books are also available for viewing within the unit. Short workshops are also held from time to time on general or specific aspects of electron microscopy. **Annual EMU Workshops for research students and staff are held at the beginning of each year.** These introductory courses are strongly recommended for all users. In October, workshops are planned on EM maintenance and TEM operation. Workshops are also planned for May, 2002, on Forensic SEM.

### Further information

<http://www.anu.edu.au/EMU>

## Electron Microscope Unit



# Jobs & Scholarships

## Australia

### Postdoctoral Fellow/Research Fellow

#### Experimental Surface Physics(closes 1/8/01)

Research School of Chemistry, ANU

<http://www.anu.edu.au/hr/jobs/academic.html#pse408>

### Postdoctoral Fellow, Advanced Process Control of Crystallisers(closes 1/8/01)

Curtin University of Technology, Western Australia

[http://www.parkercentre.crc.org.au/research/chemeng\\_postdoc\\_vacancy.htm](http://www.parkercentre.crc.org.au/research/chemeng_postdoc_vacancy.htm)

## Overseas

### Research Assistant/Fellow (closes 18/7/01)

#### polymeric structures for spinal bracing

Brunel University, UK

<http://jobs.ac.uk/jobfiles/YE039.html>

### Assistant Director of Research (closes 1/8/01)

Department of Materials Science and Metallurgy

Cambridge University

<http://jobs.ac.uk/jobfiles/HJ714.html>

### Project Managers, Surface Science (closes 7/8/01)

Molecular Profiles Ltd

University Park, Nottingham, UK

<http://jobs.ac.uk/jobfiles/HJ415.html>

### Associate Professor, Biomaterials (closes 25/7/01)

University of Connecticut

<http://jobs.ac.uk/jobfiles/CD877.html>

### Wood Products Extension and Research

#### Assistant Professor (available 1/2/02)

College of Agricultural Sciences, Penn State, USA

for more info contact: Dr. Judd H. Michael

[jhm104@psu.edu](mailto:jhm104@psu.edu)

### Research Officer, Amorphous Silicon Alloys (closes 3/8/01)

University of Surrey, UK

<http://jobs.ac.uk/jobfiles/PB022.html>

### Research Associate, Liquid Crystal Physics

#### (closes 27/7/01)

University of Manchester, UK

<http://jobs.ac.uk/jobfiles/HJ839.html>

### Short tem contract, Laser Cleaning of Oxidised

#### Materials (closes 30/9/01)

University of Burgundy, France

<http://jobs.ac.uk/jobfiles/WA167.html>

### Postdoctoral Research Associate, Flame

#### Sensors (closes 31/7/01)

Imperial College, UK

<http://jobs.ac.uk/jobfiles/IE938.html>

## For Your Diary

### ▶ Austronics 2001

22-23 September

13th Australian International Electronics Industry Exhibition, Powerhouse Museum, Sydney

see [www.ausexhibit.com.au/austronics/showinfo.html](http://www.ausexhibit.com.au/austronics/showinfo.html)

### ▶ Combio 2001

30 Sept - 4 October

Incorporating the **45th Annual Conference of the Australian Society for Biochemistry & Molecular Biology**, the **20th Annual Conference of the Australian and New Zealand Society for Cell and Developmental Biology** the **41st Annual Meeting of the Australian Society of Plant Physiologists** and the **International Proteomics Conference 2001**. Venue: National Convention Centre, Canberra.

see [www.asbmb.org.au/combio2001/](http://www.asbmb.org.au/combio2001/)

### ▶ MM2001

4-7 October

7th Australian **Molecular Modelling** Workshop; Leonard Huxley Building, ANU

see [jcsmr.anu.edu.au/MM2001/](http://jcsmr.anu.edu.au/MM2001/)

### ▶ Materials Week

1-4 October

International Congress on Advanced Materials and Processes, Munich, Germany

see [www.materialsweek.org/](http://www.materialsweek.org/)

### ▶ International Composites Conference

28 Oct - 3 November

3rd International Conference, Lake Louise, Canada; see [composites-lake-louise.mcmaster.ca/](http://composites-lake-louise.mcmaster.ca/)

# Material Honours

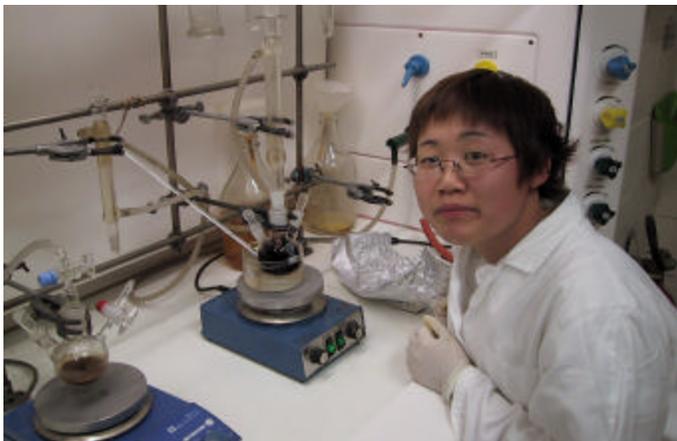
Each year CSEM offers two scholarships to students undertaking Honours in materials science. The scholarships, each worth around \$5,000, are awarded to students coming to the ANU from another institution, who are working on a project that involves collaboration between groups that comprise CSEM. The aim is to bring in new blood while fostering interaction between the groups that perform materials science on campus. The hope is that the student(s) will continue on in their research at ANU as a graduate student.

Last year Ah Young Park was the successful candidate. Ah Young graduated from the Victoria University of Wellington in New Zealand majoring in Chemistry and Technology. Last summer she came to ANU as a Summer Scholar working on electrochemistry with Dr Graham Heath at RSC.

This year she is doing Honours in the Department of Chemistry with three supervisors: Dr Mark Humphrey, Dr Graham Heath, and Dr Marek Samoc. Her project involves synthesizing molecules with strong nonlinear optical (NLO) properties, examining their spectroelectrochemistry and evaluating their NLO properties.

When NLO materials are subjected to laser light (i.e high intensity electric fields), the propagation characteristics of the light can be modified. NLO materials have enormous potential including frequency doubling or tripling of laser light, wave mixing, telecommunications, and information processing.

For more information on CSEM's Honours Scholarship for 2002, contact the Director of CSEM (see back page) or visit the CSEM Scholarship Website at: [www.anu.edu.au/CSEM/Undergrad%20courses/Honours-scholarship.html](http://www.anu.edu.au/CSEM/Undergrad%20courses/Honours-scholarship.html)



Ah Young Park, recipient of the 2001 CSEM Honours Scholarship. When asked what she thought of ANU, Ah Young said the facilities were excellent: "It's a great place to do science," she said.

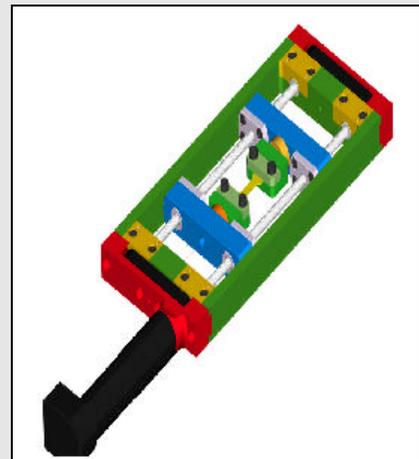
## The pull of raman microscopy

The Raman Microscopy Unit (RMU) at the University of Canberra has recently acquired a special heating and freezing stage for use in the microscope and X-Ray systems. This equipment will be coupled to the recently created, ANU-built micro-tensometer stage making the microscope uniquely suited to study stresses at the interfaces between the fibres and matrices of many composites.

Raman spectroscopy is a non-destructive, easy-to-use analytical technique in which laser light is shone on material being studied. The light interacts with the material causing the bonds between its atoms to vibrate. The scattered light arising from this interaction is analysed as a Raman spectrum and provides a signature which reveals the chemical structure of the material.

The micro-tensometer allows pieces of test material to be placed under sustained tension while the microscope records chemical changes at any point on the material.

"I only know of one such set-up like this in the world," says Dr. Vincent Otieno-Alego, a corrosion scientist who heads the RMU at UC.



The micro-tensometer places a piece of test material under sustained tension.

## Material Grabs

### Grading timber with microwaves

CSIRO's new Speedgrader can 'look' inside timber up to 50mm and measure the size of natural features such as knots, slope of grain and the presence of juvenile wood. Using microwaves, Speedgrader is safe, economical and fast. [www.dbce.csiro.au/whatsnew/viewpress.cfm?press\\_id=89](http://www.dbce.csiro.au/whatsnew/viewpress.cfm?press_id=89)

### Nitrogen semiconductor

Scientists at the Carnegie Institution of Washington have created an opaque semiconducting solid by subjecting nitrogen gas to extreme pressure. [unisci.com/stories/20012/0510011.htm](http://unisci.com/stories/20012/0510011.htm)

### Optic brick wall

Researchers from Bell Laboratories in the United States have established the theoretical limit to the information-carrying capacity of optic fibres. [www.abc.net.au/science/news/stories/s320303.htm](http://www.abc.net.au/science/news/stories/s320303.htm)

## MM webspotting

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[www.crc-accs.com.au/](http://www.crc-accs.com.au/)

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[www.microtechnologycrc.com/](http://www.microtechnologycrc.com/)

© CRC for Innovative Polymer Research

[www.crcp.com.au/](http://www.crcp.com.au/)

© CRC for Industrial Plant Biopolymers

[www.botany.unimelb.edu.au/botanyunimelb/1pages/research/labs/crc/CRC.html](http://www.botany.unimelb.edu.au/botanyunimelb/1pages/research/labs/crc/CRC.html)

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[www.parkercentre.crc.org.au/](http://www.parkercentre.crc.org.au/)

Check out CSEM's fab new Links Page

Announcing

CSEM's July Seminar

### Biomaterials

THE NEW FRONTIER OF MEDICINE

speaker: **Prof Arthur Brandwood**

School of Biomedical Engineering,  
University of New South Wales

venue: **Florey Lect Thtre, JCSMR, ANU**

date: **Wednesday, 25 July**

time: **4pm** (drinks/nibbles following lecture)

# CSEM

Centre for Science & Engineering of Materials

#### Faculties

Department of Chemistry

Department of Engineering

Department of Forestry

Department of Geology

Department of Physics

Institute of the Arts

#### Institute of Advanced Studies

Research School of Biological Sciences

Research School of Chemistry

Research School of Earth Sciences

John Curtin School of Medical Research

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**Materials Monthly comes out in the first half of each month. We welcome your feedback and contributions. Please send them to David Salt, Editor, *Materials Monthly*, care of CSEM. Please let us know if you wish to be added to our electronic or postal mailing lists.**

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