

# Materials Monthly

Volume II, Issue 2

February 2001

Centre for Science and Engineering of Materials

## What makes a Wollemi?



Fossilised leaves of the Wollemi Pine. Images from the Royal Botanic Gardens of Sydney web site: [www.rbgsyd.nsw.gov.au/html/Wollemi.html](http://www.rbgsyd.nsw.gov.au/html/Wollemi.html)

The death of a mature Wollemi Pine tree has given ANU scientists the opportunity to be the first to study the wood properties of this 'living fossil'.

The Wollemi Pine (*Wollemia nobilis*) was discovered by chance in August 1994 by David Noble, a NSW National Parks and Wildlife Service officer. It belongs to a new genus of plants previously known only as fossils that date back to the age of dinosaurs, some 150 million years ago. The Pine is one of the world's rarest species with only 43 adult trees known to be in existence.

This unusual conifer that grows to more than 35 metres high and has bark like bubbling chocolate, has already yielded the known anti-cancer chemical taxol, previously associated mainly with Yew trees from the Northern Hemisphere.

The older Wollemi Pines have multiple trunks of different ages and, in many cases, the original trunk is long gone. Scientists estimate that some of the trees may be between 500 and 1000 years old.

Three small groves of trees occur about 150 kilometres north-west of Sydney, within the boundaries of the very rugged Wollemi National Park. The Pines are growing on wet ledges in a deep, sheltered rainforest gorge.

Rod Peakall from the Department of Botany and Zoology is already involved in Wollemi research. His team are studying the Pines' breeding system and extent and distribution of genetic diversity in order to maximise the chances of its preservation.

Now CSEM members have the opportunity to get involved by studying the material properties of the tree's wood. The following members are currently conducting research on the Pine: John Banks of the Forestry Department will be using dendrochronological methods to estimate the age of the tree; while Roger Heady of the Electron Microscopy Unit will be examining the wood anatomy and microstructure using scanning EM.

There are many other avenues for research that could involve CSEM members, for example, microfibril angle using X-ray diffraction, chemical composition of the woods mineral constituents, strength properties...

If you are interested in conducting research on the ANU's Wollemi Pine then please contact John Banks on 6125 3632 or [john.banks@anu.edu.au](mailto:john.banks@anu.edu.au)

### What's Inside

- 2 Direct from the Director
- 3 Molecular Materials on Campus
- 4 Jobs & Scholarships For your diary
- 5 New CRC  
New Solid State NMR
- 6 Communication News & Contacts



# Direct from the Director

Phil Evans, Forestry Department

ANU is different from many Universities in that it does not have a Department of Materials Science. Instead the Centre for the Science and Engineering of Materials attempts to provide an internal and external focus for the materials science at ANU—a different approach to the vexed problem of providing an organisational structure for an academic discipline. A small number of innovative Universities have adopted similar models. At the University of California, Santa Barbara (UCSB) they have established a Materials Research Laboratory (MRL) which supports interdisciplinary research in four materials-related areas; Complex Fluids, Solution Synthesis at Molecular Interfaces, Heterogeneous Polymeric Structures and Non-equilibrium Phenomena in Complex Materials. UCSB-MRL also has technology and educational outreach programs (see their web site for further details [www.mrl.ucsb.edu/](http://www.mrl.ucsb.edu/)).

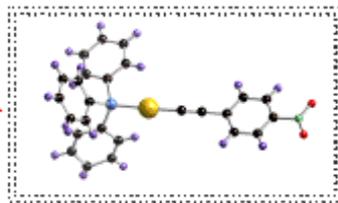
Princeton has established the Princeton Materials Institute (PMI), which is similar to UCSB-MRL, and acts as a multidisciplinary centre for education and research in materials science on the Princeton campus. PMI offers an undergraduate certificate in materials as well as a traditional (North American) graduate program in materials science. They have a number of interdisciplinary research programs including ones on Computational Materials, Thermal Barrier Coatings, Ultralight Metal Structures and Ceramics. They are proposing to develop two more interdisciplinary research programs on Nanotechnology and Organic Electronics, respectively (see [www.princeton.edu/~pmi/](http://www.princeton.edu/~pmi/)).

The latest multidisciplinary materials research centre is The Advanced Materials and Process Engineering Laboratory (AMPEL) at the University of British Columbia. The research initiatives at AMPEL include Photonics and Nanostructures, Composites and Polymers, Metallurgy, Forensic Dentistry and Superconductors. AMPEL also has a Graduate Program (see [www.science.ubc.ca/~ampel/information.html](http://www.science.ubc.ca/~ampel/information.html)).

AMPEL, UCSB-MRL and PMI are all housed in a state of the art buildings containing specialised services and equipment for materials research. Funding for these three multidisciplinary research centres is provided by the respective universities, governments and industry whereas CSEM relies solely on University support. This may change soon with a proposal to establish an Australian Materials Network of which the ANU, through CSEM, will be a founding member. More on this subject in next month's newsletter.

# Molecular Materials on Campus:

Department of Chemistry

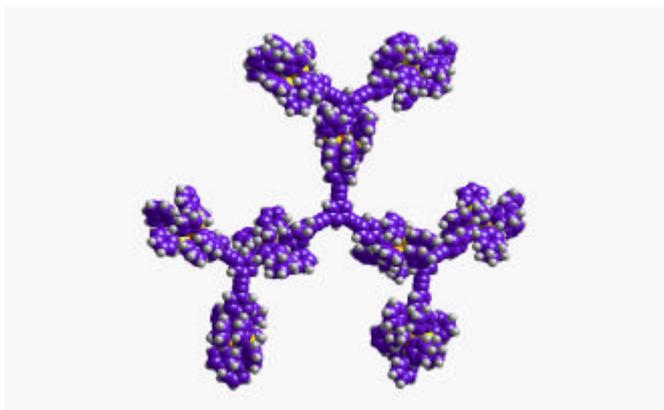


## The Molecular Materials Group

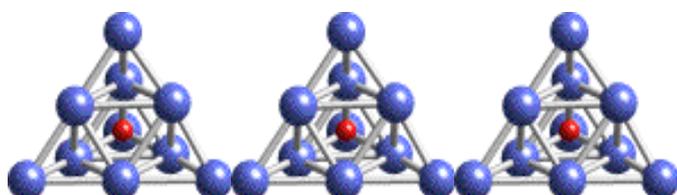
The aim of the groups' research is to prepare new types of potentially useful materials by increasing our understanding of how chemical structure can control molecular properties. The group is interested in the synthesis of oligomeric, dendritic (hyperbranched) and polymeric metal-containing systems, and the investigation of their electronic, electrochemical and optical properties.

Current research involves two main areas:

1. Materials with potential in **nonlinear optical applications** which are of particular interest in the emerging photonics technologies. These materials are based on arylalkynylmetal building blocks, leading into oligomeric and dendritic assemblies. For further information see next column.



2. Materials with potential as "**optical limiters**", affording optical device protection, which could be used in both laboratory and military applications. These materials incorporate metal clusters into processable organic-based polymeric backbones i.e. polymetallic polymers. For further details see [chemistry.anu.edu.au/Staff/MGH/MGHRI.php3](http://chemistry.anu.edu.au/Staff/MGH/MGHRI.php3)

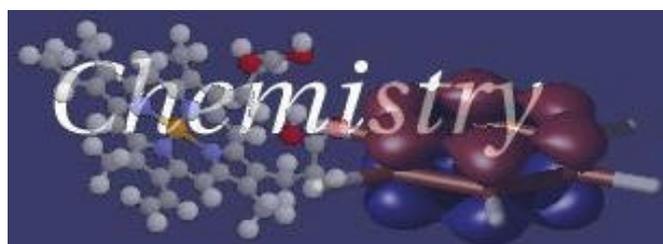


## Nonlinear Optical (NLO) Materials

Nonlinear optical materials are of interest for their potential applications in all-optical technology. Organometallic complexes combine the advantage of organic materials (fast NLO responses) with the design flexibility of inorganic complexes (variation in oxidation state, coordination number, coordination geometry, and co-ligands, and intense MLCT transitions). Initial work has focussed on metal acetylide complexes. These are usually thermally robust and oxidatively stable, and accessible in high yields by well-established synthetic methodologies.

The group has been systematically varying molecular components in order to derive structure-NLO property relationships to facilitate organometallic NLO materials design. Studies have focussed on the effect of metal valence electron count, ease of oxidation, nature of phosphine co-ligand, length of acetylide ligand, and the effect of varying the bridging functionalities on both second-order and third-order NLO merit. Our ongoing studies are involved with extending these small molecule-based studies into the macromolecular realm to afford useful and processable materials.

There has been an explosion of interest in dendrimers (hyperbranched oligomers) recently, with the current move to prepare functional dendritic materials. We are currently investigating the NLO properties of arylalkynylmetal-based dendrimers with a variety of core units, branching groups and spacers.





# Jobs & Scholarships



## ANU

### Experimental Physics Lectureship - Atom Laser Technology

Department of Physics  
[www.anu.edu.au/hr/jobs/fs149.pdf](http://www.anu.edu.au/hr/jobs/fs149.pdf)

### Fellow/Senior Fellow/Professor - Computational Condensed Matter Physics

Research School of Physical Sciences and Engineering - Department of Theoretical Physics  
[www.rspysse.anu.edu.au/theophys/](http://www.rspysse.anu.edu.au/theophys/)

### Postdoctoral Fellow/Research Fellow (2 positions) - Experimental Plasma Physics

Research School of Physical Sciences and Engineering  
Plasma Research Laboratory/ National Fusion Plasma Research Facility  
[jeffrey.harris@anu.edu.au](mailto:jeffrey.harris@anu.edu.au)

## Australia

### Chair - X-Ray and Synchrotron Physics

School of Physics and Materials Engineering - Monash University, Australia  
[barry.muddle@eng.monash.edu.au](mailto:barry.muddle@eng.monash.edu.au)  
[jobs.ac.uk/jobfiles/YB381.html](http://jobs.ac.uk/jobfiles/YB381.html)

## OS

### Postdoctoral Research Associates - Polyurethanes for Medical Devices

Department of Materials Science and Metallurgy - University of Cambridge  
[jobs.ac.uk/jobfiles/NA519.html](http://jobs.ac.uk/jobfiles/NA519.html)

### Research Associate/Research Fellow - The Operation of a Smart Biomolecular Machine

Department of Chemistry and the Department of Physics and Astronomy - University of Edinburgh  
[jobs.ac.uk/jobfiles/HH642.html](http://jobs.ac.uk/jobfiles/HH642.html)

### Postdoctoral Research Associate - Materials Deformation

CLRC Rutherford Appleton Laboratory  
[jobs.ac.uk/jobfiles/LD720.html](http://jobs.ac.uk/jobfiles/LD720.html)

### Postdoctoral Research Fellow - Wood Products Manufacturing

Department of Wood Science - University of British Columbia  
For more info contact: [maness@interchg.ubc.ca](mailto:maness@interchg.ubc.ca)

### Research Associates - Processing, modelling and characterisation of vapour deposited thin films

Department of Materials - Imperial College of Science, Technology & Medicine  
[jobs.ac.uk/jobfiles/HH238.html](http://jobs.ac.uk/jobfiles/HH238.html)

### Postdoctoral Research Position - Magnetic Microscopy of Ferromagnetic Nanostructures

Department of Physics - University of Bath  
[jobs.ac.uk/jobfiles/HH313.html](http://jobs.ac.uk/jobfiles/HH313.html)

### Graduate Opportunity - Chemistry or Material Science

Advanced Biotechnologies Ltd - University of Brighton  
[jobs.ac.uk/jobfiles/HH564.html](http://jobs.ac.uk/jobfiles/HH564.html)

### Research Scholars (20 positions) - Communications Technologies, Biomedical Engineering, Materials Science

University of Limerick  
[jobs.ac.uk/jobfiles/LD625.html](http://jobs.ac.uk/jobfiles/LD625.html)

## Scholarships

### CSEM Honours Scholarships - Materials Science

CSEM has two honours scholarships of up to \$5000 available in 2001. The project must be a) on materials; b) multidisciplinary and c) involve more than one department in CSEM.

### PhD Studentship - Tissue Engineering / Material Science Surface Modification

Royal Free and University College Medical School - University College London  
[jobs.ac.uk/jobfiles/HH369.html](http://jobs.ac.uk/jobfiles/HH369.html)

### PhD Projects - Superconducting Materials

School of Metallurgy and Materials - University of Birmingham  
[jobs.ac.uk/jobfiles/BC387.html](http://jobs.ac.uk/jobfiles/BC387.html)

### PhD Studentships - Optoelectronic Devices and Materials

School of Physics and Chemistry - University of Surrey  
[jobs.ac.uk/jobfiles/JB093.html](http://jobs.ac.uk/jobfiles/JB093.html)

## For Your Diary

- CSEM Seminar & Workshop on Raman Microscopy** 7 & 8 March  
 "The use of Raman Microscopy for the Characterisation of Materials" will be presented on 7 March by Vincent Otieno-Alego of the University of Canberra at 4pm in the Forestry Dept Lecture Theatre #103. The seminar will be followed, on 8 March, by a morning hands-on workshop at UCAN to which people are encouraged to bring their own samples for analysis. CSEM is supporting this activity and a number of free places are available to members. Please contact Vincent for more info and to secure a place: [otieno@science.canberra.edu.au](mailto:otieno@science.canberra.edu.au)
- Australian Workshop on Nanotubes and Fullerenes at ANU** 3-4 May  
 see [rspysse.anu.edu.au/nanotube/awnf2001](http://rspysse.anu.edu.au/nanotube/awnf2001)
- Australian Electrical and Electronic Manufacturer's Association national conference** 27-29 May  
*Cleaner, Greener, Smarter* in Melbourne  
 see [www.aeema.asn.au/conf2001/](http://www.aeema.asn.au/conf2001/)
- ICMAT '01 Materials for Advanced Technologies** 1-6 July  
 International Conference, Singapore  
 see [www.mrs.org/sg/icmat2001](http://www.mrs.org/sg/icmat2001)
- AMPT '01 Advances in Materials and Processing Technologies** 18-21 Sept  
 International Conference, Madrid, Spain  
 see [www.fundacion.uczm.es/ampt/](http://www.fundacion.uczm.es/ampt/)



# Paper: a High Tech Material

## The New CRC for Functional Communication Surfaces

ANU will be a key participant in this new CRC via CSEM members in the Department of Applied Maths, RSPHysSE. The focus of the CRC is on developing new products and manufacturing processes in the rapidly expanding area of specialised paper/polymer surfaces for the “knowledge economy”. The research program will deliver well over \$300 million per annum of ongoing benefits to the Australian economy via the development of:

- (1) novel products in the area of high value print media, printed packaging and paper products, security printing and banknote printing;
- (2) advanced writable and re-writable substrates for the communication printing, packaging and supply chain industries;
- (3) new processes and materials for evolving coating and printing technologies;
- (4) postgraduate engineers and scientists for the paper, packaging, surface information and printing industries.

According to Tim Senden, The Department of Applied Maths will bring a background in materials science from the perspective of structure-property relationships. Well developed protocols for the analysis of pore structure in rocks will be blended into the new challenges that porous media such as paper and cardboard bring. From the experimental perspective Applied Maths has a strength in the field of fluid wetting and surface chemistry. Two new techniques, imaging ellipsometry and computed tomography (both successful MEC bids) are currently being installed and will add to the facilities available to the CRC. Applied Maths is also committed to running several courses for CRC members covering topics such as surface chemistry and quantification of the properties of porous media.

## Farewell and Best Wishes to Bronwyn Fox

Sadly, CSEM is losing one of its youngest and brightest materials scientists.

Bronwyn has just finished a PhD on ‘ageing of high temperature carbon fibre composites’ in the Department of Engineering and will be leaving the ANU to take up a position as Lecturer in Materials Science at Deakin University. Our loss is most definitely their gain.



We wish Bronwyn all the best in her new venture and hope that we will see her back at ANU in the near future.

## New Solid-State NMR

The new Solid-State Facility at the University NMR Centre is now available for general use. In the first instance, routine spectra of three nuclei,  $^{13}\text{C}$ ,  $^{31}\text{P}$ ,  $^{29}\text{Si}$  can be acquired. Other nuclei will be added to this list at a future date or on request. The solid-state probe is capable of performing cross-polarization experiments and spins the solid sample at  $54^\circ$  in order to narrow the resonance lines of solid sample.

Many solid samples can be studied using NMR techniques including polymers, insoluble solids and minerals. Any enquiries regarding training or service should be directed to the technical Staff: Peta Simmonds (6125 3731) or Chris Blake (6125 8074).

For more information on the University NMR Centre and its Facilities visit the website <http://bloch.anu.edu.au/index.html>

# Communication News

## **CSEM Seminar and Workshop on Raman Microscopy, 7 & 8 March**

"The use of Raman Microscopy for the Characterisation of Materials" will be presented on 7 March by Vincent Otieno-Alego of the University of Canberra at 4pm in the Forestry Department Lecture Theatre #103. The usual CSEM nibbles and drinks will follow. The seminar will be followed, on 8 March, by a morning hands-on workshop at the UCAN Microscopy Unit. Participants are encouraged to bring their own samples for analysis. CSEM is supporting this activity and a number of free places are available to members. Please contact Vincent for more info and to secure a place: [otieno@science.canberra.edu.au](mailto:otieno@science.canberra.edu.au)

**\*Enrolment Days, 15, 16 & 19 February\*** - to make sure any interested materials scientists do not escape our net, Nick Welham of RSPHysSE will be staffing a CSEM desk during the enrolment period (thanks Nick). Those of you present in your faculty roles, please keep an eye and ear open for potential materials science students.

**Position Vacant** - Jenny will have just retired from her role as Communication and Student Recruitment Officer for CSEM as you read this Feb issue. The position has been advertised via the ANU's external web site and applications close on Feb 16. Please spread the word to all enthusiastic science communicators. See: [www.anu.edu.au/hr/jobs/3feb.html#11](http://www.anu.edu.au/hr/jobs/3feb.html#11).

**Materials Monthly available online in PDF** - remember our newsletter can be accessed via the CSEM web site at [www.anu.edu.au/CSEM/newsletter](http://www.anu.edu.au/CSEM/newsletter), spread the word.

# CSEM

Centre for Science and Engineering of Materials

## **Faculties**

Department of Chemistry  
Department of Engineering  
Department of Forestry  
Department of Geology  
Department of Physics

## **Institute of Advanced Studies**

Research School of Biological Sciences  
Research School of Chemistry  
Research School of Earth Sciences  
John Curtin School of Medical Research  
Research School of Physical Sciences and Engineering

## **Institute of the Arts**

Materials Workshops

# Materials Monthly

Volume II, Issue 2

February 2001

# Contacting CSEM

Phil Evans, Director

Phone: +61 2 6125 3628

Email: [phil.evans@anu.edu.au](mailto:phil.evans@anu.edu.au)

Jenny Edwards, Promotions Officer

Phone: +61 2 6125 3525

Email: [jennifer.edwards@anu.edu.au](mailto:jennifer.edwards@anu.edu.au)

Amanda Cook, Administration Officer

Phone: +61 2 6125 3525

Email: [amanda.cook@anu.edu.au](mailto:amanda.cook@anu.edu.au)

Fax: +61 2 6125 0746

Postal: Department of Forestry (#48), Australian National University, ACT 0200

Location: Department of Forestry (#48), Wood Sciences Building, Linnaeus Way, ANU

**We welcome any feedback, enquiries or contributions.**

**Please let us know if you wish to be added to our electronic or postal mailing lists.**

Electronic copies of *Materials Monthly* can be accessed at:

[www.anu.edu.au/CSEM](http://www.anu.edu.au/CSEM)