ANU Centre for Science and Engineering of Materials

Materials Monthly

Making materials matter *July 2002*

Centre for Science and Engineering of Materials Prizes

Rewarding Excellence in Undergraduate Materials

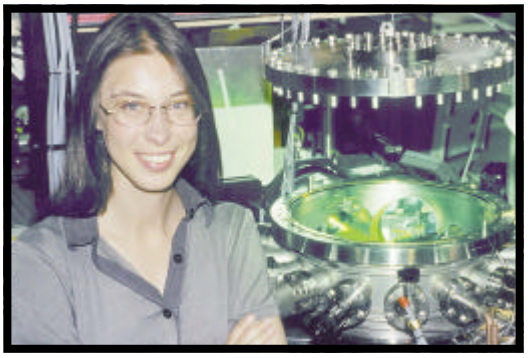
CSEM is proud to announce two new prizes for students studying materials science and engineering in their Honours year. Each prize is worth $2,000 and will go to the student judged as having the best final year thesis. One award will go to the best thesis in the field of the 'Science of Materials'. The other will go to the thesis in the field of 'Application of Materials'.

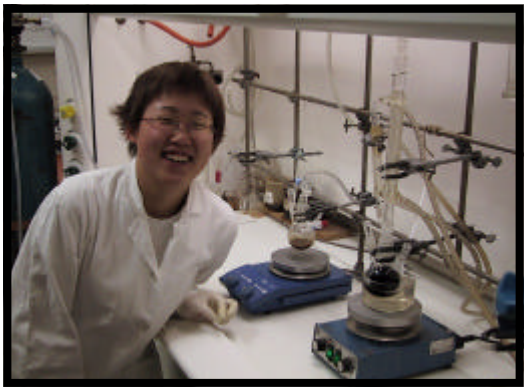
"We're seeing some amazing work in materials science and engineering being turned out by our young enthusiastic undergraduates," said Dr Zbigniew Stachurski, Director of CSEM. "This is one small way of acknowledging the quality of their efforts and rewarding the most outstanding among them."

Dr Stachurski was keen to point out that the awards are not only limited to science and engineering students.

"While the 'Science in Materials' Prize is more focussed on the fundamental nature of materials, the 'Application of Materials' Prize is open to any endeavour that explores the novel or valuable use of new or old materials," he said. "This might include the historical aspects of the use of straw and clay in dwelling construction, the making of stone tools in ancient cultures, the artistic applications of wood in furniture design or the development of new ways of blowing glass or shaping metal. It really is wide open and I encourage everyone dabbling in materials to consider entering."

The beauty of the awards is that they don't require the students to go to much additional work to enter. If you're enrolled in a program leading to the award of an undergraduate Bachelor degree at ANU and are submitting your final year Honours thesis this year, you're eligible. All you have to do is submit a copy of your thesis to the Director of CSEM by the 30 November.





More information

Full details of the Award conditions are on page 2. If you have any queries, please contact the Director of CSEM (see back cover for contact details).

Inside this MM

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Centre for Science and Engineering of Materials Prizes

AWARD CONDITIONS

1. There shall be two prizes for award by Council each year which shall be known as the Centre for Science & Engineering of Materials Prizes.
2. Each prize shall be valued at $2,000.
3. The prizes shall not be shared.
4. The prizes shall be awarded for:
   (i) The final year thesis in the field of **Science of Materials** (judged as best by the Panel); and
   (ii) The final year thesis in the field of **Application of Materials** (judged as best by the Panel).
5. Assessment of the theses will be made by the Panel which will be a group appointed by the Director, Centre for Science & Engineering of Materials.
6. It is expected that the theses submitted for the award of the prizes will be retained by CSEM for record and display purposes. The Intellectual Property rights will remain with the individual students.
7. In order to be eligible for the prizes students must:
   (i) have been enrolled in a program leading to the award of a degree of Bachelor offered by the University; in the year of the award of the prize, have submitted for examination the final year (Honours) thesis; and
   (ii) have submitted a copy of the thesis to the Director, CSEM, Department of Engineering, FEIT, by **30 November in that year**.
8. The prize winners shall receive a certificate and a cheque.
9. If, in any year, submitted theses are, in the opinion of the Council on the advice of the CSEM Panel, deemed inadequate or inappropriate and do not justify awarding the prizes, the prizes shall not be awarded in that year.

Priority Backgrounders

Want to find out what ANU is doing in the four ARC priority areas of Genome-Phenome, Nanotechnology, Photon Science and Complex Systems. Check out:

http://www.rsphysse.anu.edu.au/admin/genometemp/genome.pdf

http://www.rsphysse.anu.edu.au/admin/nips_pdfs/nanotechnology.pdf

http://www.rsphysse.anu.edu.au/admin/nips_pdfs/photon_science.pdf

http://www.rsphysse.anu.edu.au/admin/nips_pdfs/complex_systems.pdf

Words of substance

"In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual."

Galileo Galilei

Supercomputing at ANU

The ANU Supercomputer Facility (ANUSF) supports computational science and engineering through the provision of both high performance computing infrastructure and expertise to University researchers and students.

The ANUSF is also now responsible for providing services associated with the National Facility of the Australian Partnership for Advanced Computing (APAC). The centre piece of the National Facility is the HP Compaq AlphaServer Supercomputer (see below for details).

Expertise is provided at all levels, from basic operational support to algorithm development and implementation and collaboration in research projects. The facility also runs courses on various high powered computing topics from time to time as well as supporting formal education programs at the ANU. The ANUSF is located in the Leonard Huxley Building.

▲▲ The robot driven tape library can store up to 300 Terabytes of information.

ANUSF Facilities

The AlphaServer Supercomputer

The APAC Compaq Supercomputer consists of 127 x ES45's (508 processors). Each node contains a 1 Ghz chip (total peak speed of over 1 Teraflops)and 72 Gbytes of disk. Nodes are interconnected by a fat-tree low latency (MPI <5 usecs), high bandwidth (500 Mbytes/sec) Quadrics switch.

The total memory is 672 Gbytes (each ES45 processor has at least 4 Gbytes of memory but a substantial number have significantly more). The default configuration of these larger memory nodes is four with 16 Gbytes and 36 with 8 Gbytes, and some of these nodes have a larger local disk (up to 200 Gbytes). Under special circumstances these will be re-configured in the light of demand.

The total disk capacity is over 10 Tbytes.

▲▲ Dr Bob Gingold, Head of the ANUSF, stands next to one of three banks of Compaq processors that comprise the ANU supercomputer. In total there are 120 processes linked to form a supercomputer with a peak speed of nearly 1 teraflop, with total memory of nearly 0.5 terabytes, and total disk storage of over 10 terabytes. Behind Bob (to the right) is the robot driven tape library that serves as a mass data storage system.

Mass Data Storage System

The Mass Data Storage System at the ANUSF provides data storage and retrieval capabilities far beyond disk or workstation tape-drive technology. The Mass Data Storage System consists of a server with a large disk cache which is the front end to a robot-driven tape library which can store a maximum of 300 Terabytes. This is expected to increase to 1.2 Petabytes late in 2002. A number of high speed tape drives are used to transfer data between the tapes and disk cache. Hierachical Storage Management software is installed to make the filesystems appear as a normal Unix file system.

The store is connected to ANU's Internet backbone (an A100 ATM Switch using a 100Mb/s FDDI interface) allowing fast storage and retrieval of data. An ATM switch (155Mb/s) is also used to connect the Visualisation Lab to the Mass Data Store, enabling overall gigabit speed data transfer capability. Multiple Gigabit links are also used to connect the APAC peak facility to the Mass Data Store, enabling high bandwidth data transfer capability. The National Facility will be connected to the GrangeNet broadband network (2.5Gbps) in the latter part of 2002.

ANUSF VizLab

The ANUSF 'VizLab' was established in 1990 to assist researchers and post-graduate students interpret the data generated by computer simulations, remote sensors and experiments through the application of modern computer graphics techniques.

The Vizlab supports high performance graphics workstations and virtual environment systems with a range of relevant software tools. Vizlab staff designed and wrote the software for the early Wedge VR systems at ANU. The Vizlab also provides video taping facilities to record computer generated animations.

Availability

The AlphaServer Supercomputer is available to research staff and postgraduate students at the ANU subject to a set of conditions of use (see the ANUSF website). There are two ways to get a substantial grant on the AlphaServer Supercomputer:

▷through the ANU Supercomputer Time Allocation Committee (which allocates ANU's own share of the system);

▷through the APAC Merit Allocation Scheme (which allocates resources on a national basis).

Materials Science

The ANU Supercomputer Facility has played a major role in many areas of materials science and engineering. Some examples of work that has been carried out in recent years include: molecular potential energy surfaces (Michael Collins, RSC); mantle plumes (Geoff Davies, RSES), fluid dynamics (Denis Evans, RSC), simulation of seismic wave propagation (Brian Kennett, RSES), modelling the diffusion of pollutants in soil (Mark Knackstedt, RSPhySE), and structural and mechanistic chemistry, (Leo Radom, RSC).

More information

ANU Supercomputer Facility home page:
http://anusf.anu.edu.au/

APAC National Facility home page:
http://nf.apac.edu.au/

Opportunities

Employment Alert

The publication *Materials Today* is launching a jobs vacancy section this fall to promote positions for materials scientists at all levels. Vacancies will be advertised in the magazine and on-line, and you have the opportunity to receive details of these vacancies ahead of time through their 'Jobs alert' e-mail. To receive this regular alert, please send an email to materialstoday@elsevier.com and write "Subscribe to Jobs E-alert" in the subject box.

This is a free e-mail service and you can unsubscribe at any time.

More information: http://www.materialstoday.com

For more information on great sources for employment in materials science, see MM Webspotting on the back page.

The Machines that Ate Acton!!

Look out, here come the monster machines of ANU.

One of the premier events at this year's National Science Week is a technology tour of some of ANU's biggest and most impressive machines. Over three days (Tuesday 20 August till 22 August) the aim is take several hundred people (with an emphasis on science teachers and students) around five of the universities 'big guns': the Big Dish, the Heliac, the Particle Accelerator, the SuperComputer and the SHRIMP.

The event is being staged by CSEM with the National Institute of Physical Sciences (NIPS) and bookings are through NIPS (starting from the beginning of August).

More information: David.Salt@anu.edu.au

CHAPMAN 2002: Field Emission SEM

Steve Chapman (Protrain Ltd) will be running a two-day course in field emission SEM operation in October: Monday 21st and Tuesday 22nd, using the ANUEMU's Hitachi 4500 SEM.

The cost is $200 for ANU and MACACT staff and students, $300 for others. There will be a limit of eight students. (Attendence at MIA 2002 Series I, or equivalent experience, is a prerequisite.)

More information: http://www.anu.edu.au/EMU/General/workshops/workshops.htm#MIA

Conferences / Seminars

◄✧► **Seminar: Unlocking the secrets of Mokume Gane, Ian Ferguson** — **24 July**
10.30 am, Upstairs Gold and Silversmithing Workshop, School of Art
(use gallery entrance opposite Liversidge st on Ellery cres.)

◄✧► **Communicating science for enterprise** — **5 August**
Australian Academy of Science Shine Dome, Canberra
http://asc.asn.au

◄✧► **Seminar: Foreign Multinationals in the Australian Innovation System** — **7 August**
Dr Alan J. Jones, Manager, Innovation Policy, Department of Industry, Tourism and Resources
12:30 - 2:00 PM, National Graduate School of Management, Sir Roland Wilson Building (120)
More information: vicki.veness@anu.edu.au

◄✧► **Photonic Crystals Down Under** — **18-24 August**
first conference on photonic crystals in the Southern Hemisphere, Canberra
http://wwwrsphysse.anu.edu.au/nonlinear/meeting/

◄✧► **A short course in Active Noise and Vibration Control** — **5-6 September**
University of Newcastle
More information: Dr Reza Moheimani (reza@ee.newcastle.edu.au)

◄✧► **1st Australian Nanotechnology Conference** — **25-27 September**
Novatel Hotel, Brighton, Sydney
http://www.mateng.asn.au/IMEA_Services/Conferences/Nano.htm

◄✧► **Logic and Automated Reasoning Summer School** — **2-13 December**
RSISE, ANU
http://arp.anu.edu.au/lss

Smart materials engineering takes flight

Here's neat little story by Will Logie, a fourth year engineering student, on how intelligent design incorporating old and new materials can produce an aircraft that can fly on a beam of sunlight.

Designing and constructing a successful solar powered aircraft is highly dependant on the power to weight ratio. Success depends on the optimisation of a number of factors. The power comes from the number of solar cells, however the more cells the greater the weight. Weight is everything so the selection of construction materials very important.

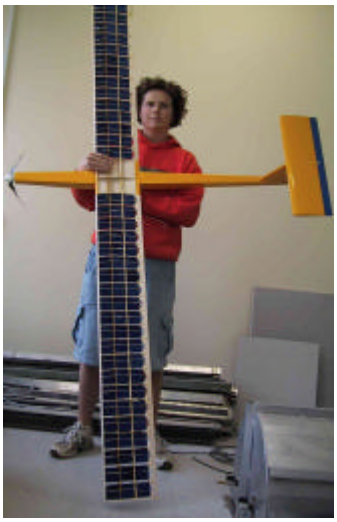
As is often the case, it's often the simplest solutions that are the best. It was decided early on in the project that the majority of the aircraft would be built from balsa wood, which has one of the best strength to weight ratios available. To add additional strength and rigidity to this frame, a heat-activated (yellow) shrink film was used as a skin on the balsa wood. The wing containing the cells is covered in a transparent film.

Balsa however was not strong enough to be used as the wing supports. To gain as much stiffness as possible, a wood and foam sandwich was used in which DIAB Divinycell foam was laminated between thin spruce wood, the result being spars measuring 18mm high with a stiffness of about 4 N/mm.

To save on weight in the construction of the tail section, extruded insulation foam (blue foam) was cut using hot wire and laminated with the heat-shrink film giving a very aerodynamic and light weight tail section.

The engine is a light weight high efficiency 20 Watt DC motor made by Maxon motors (that's a story of materials science by itself). Powered by 126 solar cells installed in the wings, it rotates a reduction gearbox coupled to a carbon fibre propeller. Given a nice sunny day the aircraft should stay airborne for hours.

More information:
wlogie
@ozemail.com.au



Will Logie with the plane. The wings are still have be covered in transparent film. ▶▶

Materials Grab Bag

Proposing a protocol

putting emails on notice

Getting frustrated with email notifications? Once they were just part of the background noise but now they're jamming the inbox (especially with the establishment of the many National Institutes around campus).

For most of us, emails are a necessary evil. We need to monitor and process them quickly. Unfortunately, many email broadcasters are making this difficult. Often we have to wade through a long list of who else has received the message, open an attachment or visit a website just to figure out what the message was about (and then discover it's merely a third reminder about something we're not interested in). The net effect is people start ignoring the information being disseminated because they can't be bothered spending the time to access it.

CSEM depends upon broadcast emails to get information out so it's in our best interest to ensure the system is reliable and user-friendly. Consequently, we're proposing an 'Email Protocol' to improve the use of broadcast emails.

The protocol is based on two simple themes:

1. Reducing the flow of unnecessary emails:

- ▷minimising the number of reminders sent (are any required?)
- ▷giving due consideration to each message as whether it needs sending at all

2. Maximising the effectiveness of any email sent:

- ▷ensure subject field is simple and clear about what message contains (not a generic: 'Materials Seminar Series')
- ▷ensure the mail list is written in the BCC (Black Carbon Copy) field so its hidden from the receiver
- ▷never send the contents of the message as an attachment or website url (it's one more thing for the receiver to do)
- ▷never use formatting in your message (it often gets interpreted in strange ways by the receiver's machine)
- ▷keep the message short and simple, and always provide a contact point for follow up information.

This isn't rocket science, merely common sense and good manners. We'll endeavour to stick to it (let us know if we don't), and we're asking that all CSEM members might apply it too. And, if you agree with the approach, you might like to suggest this protocol to the next email broadcaster who may be wasting your time through poor or unnecessary emails.

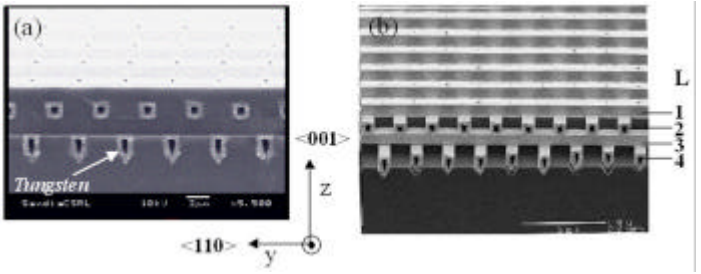
CSEM would be interested in knowing what you think about this (especially if you have ideas on how the protocol might be improved).

Here's some background on email etiquette:
http://www.library.yale.edu/training/netiquette/
http://www.emailreplies.com/Email-ettiquette-links.htm

MM webspotting:

Top Job Spots

- **Academic positions at ANU**
  http://www.anu.edu.au/hr/jobs/academic.html
- **Academic Jobs in the UK and Europe**
  http://www.jobs.ac.uk/
  (select Academic/Research/Teaching under 'Job Type', then Physical Sciences under 'Category' and then 'Materials Science under Sub-Category')
- **Materials Research Society - Classifieds**
  http://www.mrs.org/career_services/classified/ads/
- **ANSTO positions vacant**
  http://www.ansto.gov.au/info/vac/anstovac.html
- **CSIRO employment**
  http://recruitment.csiro.au/
- **Geoscience Australia jobs**
  http://www.ga.gov.au/jobs/positions/index.jsp



▲▲See the light

Images of a 3-D tungsten photonic crystal, taken by a scanning electron microscope (a. with oxide and b. without oxide). The 1D tungsten rod-width is 1.2 microns, the rod-to-rod spacing is 4.2 microns. The spacing of the rods acts to transmit certain frequencies of light: increasing the visible light, while decreasing the infrared (wasted heat).

This tungsten lattice — in effect, a tungsten filament fabricated with an internal crystalline pattern — was developed at the Sandia National Laboratories in the US. It has the potential to raise the efficiency of an incandescent electric bulb from 5% to greater than 60%!

More information: http://www.sandia.gov/media/NewsRel/NR2002/tungsten.htm

CSEM

ANU Centre for Science & Engineering of Materials

Faculties
Department of Chemistry
Depart of Engineering
Department of Forestry
Department of Geology
Department of Physics

Institute of the Arts
Materials Workshops

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 & Engineering

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Materials Monthly comes out 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.

Electronic copies of *Materials Monthly* can be accessed at: **www.anu.edu.au/CSEM**