

Materials Monthly

Making materials matter

December 2002

Prize Material

Despite a diverse set of quality entries, the judges were unanimous: the 2002 CSEM Prizes have been awarded to Alan Swanson

for developing an innovative new form of furniture (called air furniture), and Sachin Doshi for trialling a novel doping techniques in the fabrication of quantum well lasers.

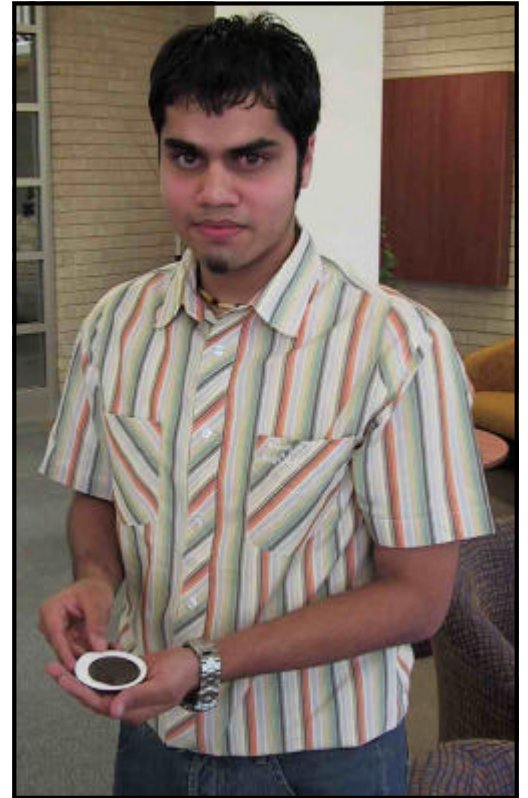
This is the first year CSEM has run the awards. They aim to reward excellence in undergraduate studies relating to materials science and engineering. There is one award for best final year thesis for applications of materials, and another award for best thesis for science of materials.

Six entries were received, three from students studying for a Bachelor of Science, two from students studying for a Bachelor of Engineering, and one student from the School of Arts.

Though a small field, the three judges were very impressed with both the quality on display and the breadth of the entries. Judging the event were Dr Zbigniew Stachurski (CSEM and the Department of Engineering), Dr Heather Kennet (Department of Physics) and Dr Tim Senden (Applied Maths, RSPHysSE). "The high calibre of the entrants augers well for the future running of this event," commented Dr Stachurski.

Professor John Baird, Dean of the Faculty of Engineering and Information Technology presented the Prizes at the CSEM Christmas drinks (held on the 12 December).

"When you look at the topics being covered, it's apparent just how specialised some aspects of materials engineering are becoming," said Professor Baird. "It's great to see that cutting edge areas of materials engineer-



▲▲ Sachin with a gallium arsenide semiconductor wafer. He used these as a base for fabricating optoelectronic devices using novel doping

ing such as quantum well intermixing are being tackled at an undergraduate level."

Despite the high quality being presented, the three judges were unanimous in their choices. Alan Swanson and Sachin Doshi stood out as having demonstrated exceptional ability and application in the preparation of their final year thesis. Each will receive a certificate and \$2000 for their efforts.

Alan received the CSEM Prize for Application of Materials for researching and developing a new form of furniture he's called 'air furniture'. The furniture involves the

(Continued on page 2)



▲▲ Alan demonstrates his 'air furniture'.

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Prize Material

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lamination of thin plywood (plantation-grown hoop pine) onto extruded Styrofoam. The resultant furniture is light, seamless, attractive and incredibly strong.

Thin laminations of plywood have allowed for the creation of flowing seamless curves that are both aesthetic and functional. For example, by curving the plywood 'skin' from the seat of the chair around to the leg, tensile strength is maintained through both planes. In conjunction with the foam substrate (which is both light with high compressive strength), this allowed Alan to create a pseudo joinery, and therefore make articulated furniture. A curved transition also distributes the 'racking' or cantilevered load (force)



▲▲ Sachin discusses his project with Professor Zygmunt Rymuza who gave a special CSEM seminar on tribology and MEMS prior to the presentation of the Prizes.

The entrants in 2002 CSEM Prizes (in alphabetical order)

- ▷ **Anne Barnett**, (Bachelor of Science Honours) Anne explored the phenomenon of intermixing in quantum well devices induced through ion implantation.
- ▷ **Adrian Cheung** (Bachelor of Engineering Honours) Adrian investigated the structural characteristics of germanium and gold nanocrystals embedded in silica.
- ▷ **Sachin Doshi** (Bachelor of Engineering Honours) Sachin worked on semiconductor materials being used in optoelectronic devices.
- ▷ **Katie Dowell** (Bachelor of Science Honours) Katie investigated the age and the genesis of black opal nobbies from Lightning Ridge.
- ▷ **Tomoko Hara** (Bachelor of Science Honours) Tomoko looked at the uses of laser light to characterise distant vegetation in remote sensing.
- ▷ **Alan Swanson** (Bachelor of Arts Honours) Alan developed an innovative new type of furniture called air furniture.

and therefore, unlike a right angle, does not create a stressed point or line.

Alan undertook the project as part of his Bachelor of Arts Honours year in Wood, and carried out the work in the Wood Workshop, Canberra School of Art (National Institute of the Arts).



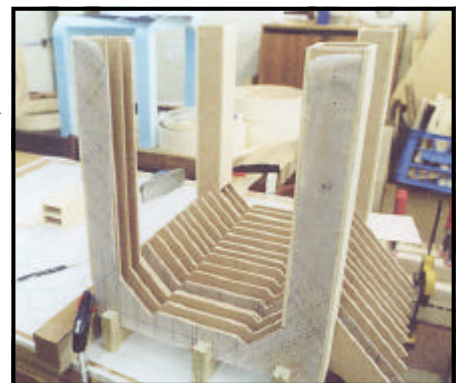
▲▲ John Baird presents Alan Swanson's prize to Rodney Hayward (Head of the Wood Workshop) as Alan couldn't make the presentation.

Sachin received the CSEM Prize for Science of Materials for investigations on semiconductor materials being used in optoelectronic devices. Using a technique known as Deep Level Transient Spectroscopy, Sachin studied the effect of defects in doped gallium arsenide semiconductors. These defects are critical to quantum well intermixing, and he found that the diffusion lengths of the defects are small.

He then applied what he had learnt to fabricate novel Zn-doped quantum well lasers but discovered that Zn-diffusion was detrimental to device performance. To get around this he used a unique doping technique called C-doping. Discrete laser devices were fabricated and characterised on the C-doped structures, and C was found to be a promising replacement for Zn on quantum well devices grown in RSPHsSE's Metal-Organic Chemical Vapour Deposition reactor. With more testing it's hoped that C-doping might become a viable technology for fabricating integrated optoelectronic devices.

Sachin undertook the work as part of his Bachelor of Engineering Honours year. The work was done with the Department of Electronic Materials Engineering (RSPhysSE) and the Department of Engineering (FEIT).

Details showing the wood-ribbed structure of Alan's air chair. ▶▶

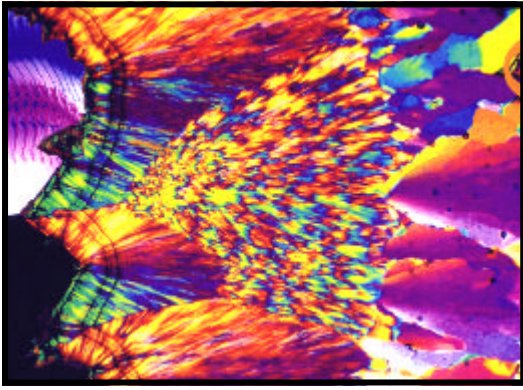


Words of substance

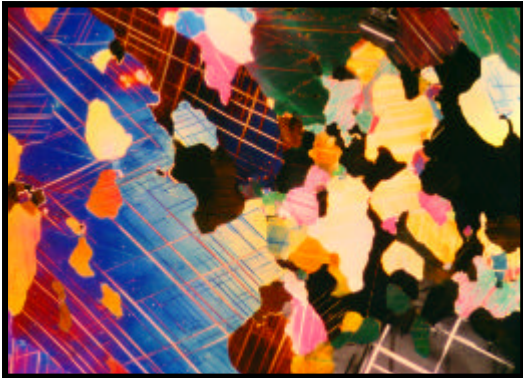
"Only those who attempt the absurd will achieve the impossible."

M C Escher

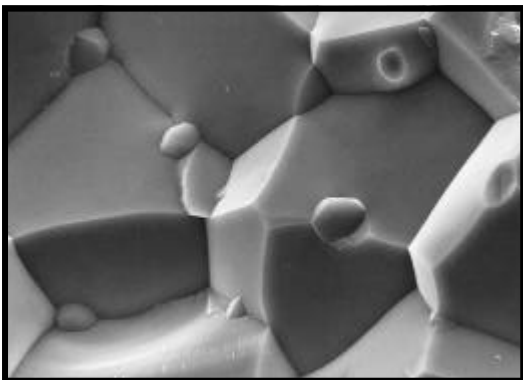
CSEM Xmas Rock Quiz



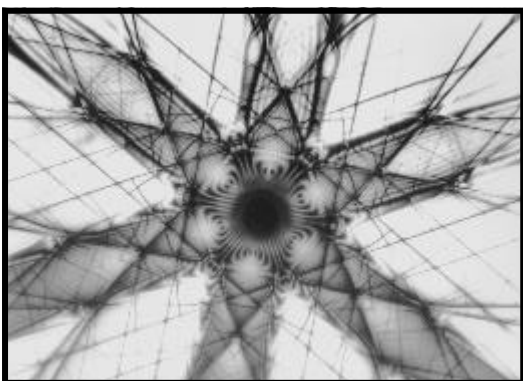
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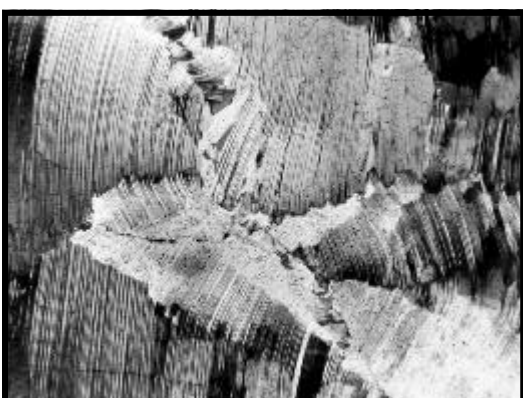
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So, you think you can pick a basic olivine from a silicon crystal? Try this quick quiz. Match the following images with its correct label. (Answers at bottom of page 5) These stunning shapes and colours are bought to you by the wonderful people at Earth Materials, (RSES). The pictures are all light or electron micrographs, and were taken by Shuqing Zhang, HarriKokkonen and John Fitz Gerald.

Captions (match the letters with the numbers)

a: Diffraction by silicon crystal (Large angle convergent beam electron diffraction pattern, Si [111] zone)

b: Line defects in quartz crystal (Edge and screw dislocations produced in experiment at high stress)

c: Grains in ceramic (Structure of alumina and spinel grains at a fracture surface of Lucalox translucent ceramic)

d: Twins and grains of the mineral albite (from a high pressure metamorphic rock, also California)

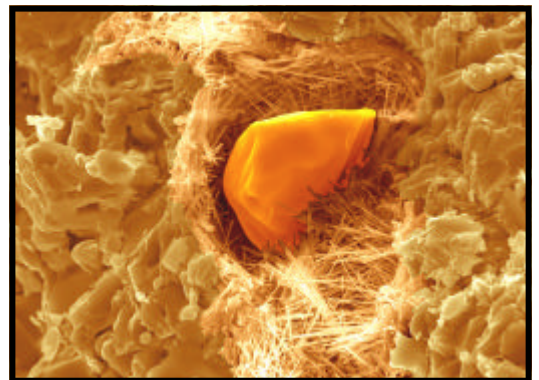
e: Polycrystal of olivine (Olivine aggregate of very low porosity and good grain size distribution synthesised by hot pressing)

f: Fibrous structure of quartz vein (from a gold deposit in McLaughlin, California)

g: Deformed Carrara marble (Twins and recrystallisation due to plastic deformation at high temperature in the laboratory)

h: Mineral reaction in progress (fibres of wollastonite grown in experiment, quartz at centre has reacted with calcite to left & right)

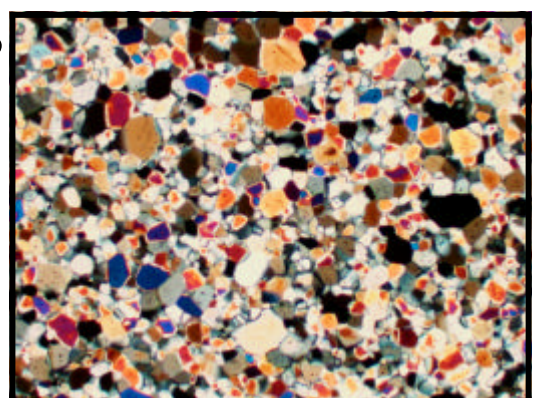
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Opportunities

New technology pages

Have a look at CSEM's home page
<http://www.anu.edu.au/CSEM>

There's a new red button on the left hand side titled Materials Technology that will take you through to an index setting out some of the wonderful materials technology that's available across the ANU campus. Click on any of the items shown here and you'll be whisked to a very readable summary of what that technology is, who runs it and why it's important. Then there are links that will take you to the department or school that operate that equipment.

This is the beginning of the CSEM technology website where ANU's best and brightest machines connected to materials research will be profiled. In the first instance we're repurposing copy coming out of *Materials Monthly*. The first four machines to be profiled are: the MOCVD reactor, the heavy ion facility (AMS and PAC correlations), the SHRIMP and the CT Xray lab.

If you have a machine involved in materials research that you'd like us to write up and include on our site, please let CSEM know. It's good (cheap) way of increasing the profile of your technology.

Check out the technology site yourself at:

<http://www.anu.edu.au/CSEM/technology.htm>

WEIS Scheme

The National Institute of Engineering and Information Sciences is offering a Visiting Fellowship for a Senior Academic Woman in Engineering and Information Sciences.

The main purpose of the Fellowship is to address an intellectual and role model gap for women in engineering and information sciences at the ANU. The Fellow is expected to make an important contribution to women in the disciplines associated with NIEIS through her research and academic role during the period of the fellowship.

She will be expected to participate in events organised by the ANU's peer-mentoring program for women in information sciences and engineering, PEERWISE. She will also be expected to participate in mentoring programs for junior academic women and for graduate and undergraduate women, within the NIEIS consortia.

The Fellowship will last for a maximum of 3 months and will provide support up to a maximum of \$8000 for accommodation and \$2,500 for travel.

Applications close 28 February, 2003.

For more information including an application form, see: <http://www.rsise.anu.edu.au/nieis/VF.html>

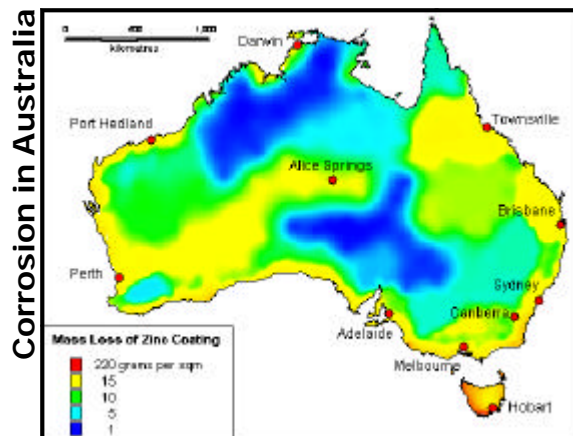
Conferences / Seminars

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| ◀◆▶ Australian Synchrotron
A workshop for potential users
http://www.synchrotron.vic.gov.au/whats_new/user_workshops.asp | 29-31 January 2003 |
| ◀◆▶ 3rd Australasian Polymer Summer School
Lake Hume Resort, Albury NSW
http://www.crcp.com.au/ | 3-5 February 2003 |
| ◀◆▶ The New Cosmology
16th International Physics Summer School, ANU
More information: http://www.mso.anu.edu.au/newcosmology/ | 3-14 February 2003 |
| ◀◆▶ 27th Annual Condensed Matter and Materials Meeting
Charles Sturt University, Wagga Wagga
http://www.spme.monash.edu.au/wagga/ | 4-7 February 2003 |
| ◀◆▶ AMAS VII
The Biennial Symposium of the Australian Microbeam Analysis Society
University of Melbourne, http://www.microscopy.org.au/amas/Symposium_HomePage.html | 18-20 February 2003 |
| ◀◆▶ IGORR 9
International Group on Research Reactors,
Sydney, http://www.frm2.tu-muenchen.de/igorr/igorr.html | 24-28 March 2003 |
| ◀◆▶ Nanoengineering World Summit
Boston Massachusetts
http://www.iec.org/events/2003/nanoengineering/ | 23-25 June 2003 |

MM webspotting: CSEMs of the world

Although we thought our name 'CSEM' was unique in all the world, it turns out there are other places that use it.

- ◆ **CSEM: Cambridge Society for Early Music**
<http://www.csem.org/history.htm>
- ◆ **CSEM: Center for Space Environment Modeling**
<http://www.windows.ucar.edu/csem/>
- ◆ **CSEM: Centre for Structural and Architectural Engineering (Uni of Bath)**
<http://www.bath.ac.uk/ace/csemwebpage/env.htm>
- ◆ **CSEM: Canadian Society of Endocrinology and Metabolism**
<http://www.csem.mcgill.ca/>
- ◆ **CSEM: Centre for the Study of Emotion and Motivation (Uni of Southampton)**
<http://www.soton.ac.uk/~csem/>



Australian scientists have joined forces with a major Australian corporation to launch a new mapping system that predicts corrosion in any part of Australia, including all 14,700 towns and suburbs.

More information:
<http://www.csiro.au/index.asp?type=mediaRelease&id=Prrustmap>

CSEM

ANU Centre for Science & 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 & Engineering

Institute of the Arts

Materials Workshops

Happy
Christmas to
all our CSEM
members

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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

Answers to the rock quiz: 1:f; 2:g; 3:c; 4:a; 5:d; 6:h; 7:b; 8:e