

Materials Monthly

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Centre for Science and Engineering of Materials

Open Day Opens Eyes



Exciting combinations attractive to new students

CSEM's Open Day display attracted the attention of some very clever and enthusiastic students. We set up a bright and eye catching display amongst the science departments in the refectory area of the Student Union building.

While it is very hard to judge just how many of the interested prospective students will actually turn into materials science enrolments, we were very pleased by the level of interest and how that interest was equally spread amongst the 'high tech', 'chemistry', 'biomaterials' and 'art' (design and conservation) areas that we were promoting.

Several students interested in undertaking an engineering degree found our materials science stream a very attractive alternative. Likewise students interested in the life sciences streams found

the idea of broadening their unit combinations to include engineering and chemistry units an interesting idea. As we suspected it was those students with an interest in both the sciences and engineering that found our approach to be most exciting.

One student in particular, Elizabeth, was extremely keen to combine her passion for art with her strong interest and talent in the sciences. Materials science was the only area that seemed to provide this potential opportunity. CSEM staff will be meeting with senior representatives of the Institute of Art to see if we can make the art/materials science combination a real option for such talented students.

Thanks to Nick Welham for his assistance throughout the day.

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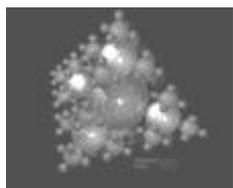
Direct from the Director

Phil Evans, Forestry Department

CSEM: What's in a Name?

During the course of interviewing people for the position of promotions officer for CSEM, the interview panel asked the candidates to explain what they understood the term 'materials science' to mean. Not surprisingly, most people struggled with this difficult question, as I expect would most of the practicing materials scientists in CSEM. Searching through scientific dictionaries and encyclopedias I found quite a number that contained no entry for materials science. For example, both the McGraw-Hill Encyclopedia of Science and Technology (1987) and Yule's Concise Encyclopedia of the Sciences (Yule 1980) have no entry for materials science. Definitions of materials science are, however, present in some other reference works, for example, McGraw-Hill Dictionary of Scientific and Technical Terms - 'The study of the nature, behaviour and use of materials applied to science and technology', and the Academic Press Dictionary of Science and Technology (Morris, ed, 1992) - 'The scientific study of the structure, properties and performance of metals, ceramics, polymers and semiconductors'. These definitions seem somewhat unsatisfactory and if taken literally could exclude some areas such as materials conservation (as applied to art) and, in the case of the Academic Press definition, biomaterials, that are now clearly included under the aegis of materials science. CSEM encompasses both the science and engineering of materials (MSE - materials science and engineering) for which far better definitions have recently started to emerge. More on the subject of MSE in next month's newsletter.

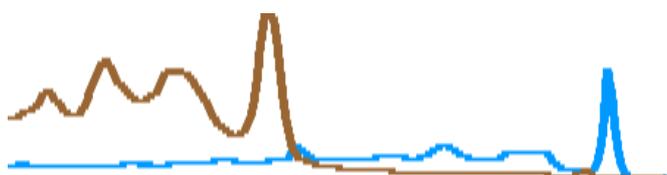
Materials on Campus:



Research School of Chemistry *Crystalline Materials*

Solid State Inorganic Chemistry

The interests of this group centre upon synthesis, structural characterisation and crystal chemical understanding of inorganic solids, including compositionally and/or displacively flexible structures, solid ionic conductors, ferroics, and tough ceramics. We aim to understand the fine details of the structures, and hence local crystal chemistry, of the crystalline materials in order to provide a rational basis for selecting materials with specific physicochemical properties. We are therefore heavily committed to detailed structural characterisation using a range of experimental research tools, but principally transmission electron microscopy (TEM) in combination with powder and single crystal X-ray diffraction (XRD). Achievements over recent years include the first coherent view of the crystal chemistry underlying the phenomenon of ferroelectricity within the Aurivillius family of displacive ferroelectrics, the use of incommensurate, compositely modulated structure formalism to describe, refine, and interpret “infinitely adaptive”, wide range non-stoichiometric solid solution fields, and the discovery and subsequent modelling of displacive flexibility and its diffraction consequences in *b*-cristobalite and other displacively flexible framework structures.

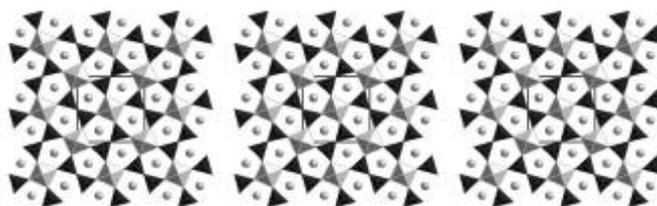


Laser and Optical Spectroscopy

Light, chemistry, and photophysics are natural partners. The amount of energy in a single particle of visible light can be just the amount needed to do chemistry. Nature takes supreme advantage of this in the process so essential to all life on the planet, photosynthesis. Spectroscopy looks into the interaction of light, visible and invisible, with matter. Light can be absorbed or emitted. Particularly with lasers, other processes are possible. The wide range of spectroscopic techniques available may be utilised as analytical or diagnostic tools, right down to the single molecule level. At a more fundamental level they provide potent methods with which to probe the innermost secrets of all chemical species. Spectroscopy maps out the detailed electronic structure of matter,

critical to bonding and reactivity. Lasers continue to revolutionise spectroscopy. Laser light is *very* different to ordinary light (sunlight or lamplight etc.). Lasers can be purely of one colour, to better than one part in a billion. Light pulses can be compressed into unimaginably short pulses and amplified to a point where the very distinction between light and matter becomes blurred. Put simply, lasers allow processes to occur that are just not seen with “normal” light sources.

The group performs spectroscopic measurements on a wide range of materials and systems: organic and inorganic, molecular, ionic, amorphous, crystalline, and increasingly, biological. We design, develop and invent special experiments and apparatus to target particular questions. A molecule may be very different in solution to ‘trapped’ in a crystal. These critical environmental influences may be identified and probed via the application of laser selective spectroscopies.



Disordered Materials

This group combines diffuse X-ray scattering methods with computer simulation to deduce the arrangement of atoms and molecules in disordered crystals. Conventional crystal structure determination reveals only averaged arrangements, inadequate to explain some of the basic properties of many minerals, inorganic compounds, organic compounds and alloys that exhibit crystalline disorder. Diffuse scattering gives information on how neighbouring atoms or molecules mutually interact. Areas in which we have applied the techniques include: disordered molecular crystals, guest-host systems such as urea inclusion compounds, non-stoichiometric inorganic materials and minerals, *e.g.*, cubic stabilised zirconias, mullite and wüstite, flexible framework structures such as silica polymorphs and their analogues, alloys, and quasi-crystal phases.

For more info about crystalline materials research see see: rsc.anu.edu.au/Home.html

Recent ANU Materials Publications

Systematic structural change in selected rare earth oxide pyrochlores as determined by wide-angle CBED and a comparison with the results of atomistic computer simulation. Y.Tabira, R.L.Withers, L.Minervini and R.Grimes. *J.Solid State Chem.* **153**, 16-25, (2000).

Nano-indentation and Nano-scratch of Polymer/Glass Interface. Part I: Experimental and Mechanical Analysis. A.Hodzic, Z.H. Stachurski and J.K.Kim. *Polymer*, **41**, 6895-6905, (2000).

Towards a unified description of the AMOB2O5 (A = K, Rb, Cs, Tl; M = Nb, Ta) family of compounds. S.Schmid, R.L.Withers, D.Corker and P.Baules. *Acta Cryst. B* **56**, 558-564, 2000.

Chemical frameworks and hyperbolic tilings. S.T. Hyde and S. Ramsden, DIMACS Series in Discrete Mathematics and Theoretical Computer Science **51**, "Discrete Mathematical Chemistry", Pierre Hansen, Patrick Fowler and Maolin Zheng (eds), 203-224, (2000).

Polycontinuous morphologies and interwoven helical networks. S.T. Hyde and S. Ramsden, *Europhys. Lett.* **50**, 135-141, (2000).

Hyperbolic 2D forests and euclidean entangled thickets. S.T. Hyde and C. Oguey, *Eur. Phys. J. B.* **16**, 613-630, (2000).

Fractionation of carbohydrates in *Arabidopsis* seedling cell walls shows that three radial swelling loci are specifically involved in cellulose production. L Peng, C.H. Hocart, J.W. Redmond, and R.E. Williamson. *Planta* **211**, 406-414 (2000)

Gibberellin-induced changes in growth anisotropy precede gibberellin-dependent changes in cortical microtubule orientation in developing epidermal cells of barley leaves. Kinematic and cytological studies on a gibberellin-responsive dwarf mutant, M489. C.L. Wenzel, R.E. Williamson, and G.O. Wasteneys, *Plant Physiol.* **124**, 813 (2000)

Laboratory measurements of seismic wave dispersion and attenuation: recent progress, in Earth's Deep Interior: Mineral Physics and Tomography from the Atomic to the Global Scale. I. Jackson. *AGU Geophys. Monogr. Ser.* **117**, S. Karato (ed.), 265-289 (2000).

Silicate perovskite analogue ScAlO3: temperature dependence of elastic moduli. J. Kung, S.M. Rigden and I. Jackson. *Phys. Earth Planet. Interiors* **120**, 299-314, (2000).

Adverse effects of heartwood on the mechanical properties of wood-wool cement boards manufactured from radiata pine wood. K. Semple and P. Evans. *Wood and Fiber Science* **32**(1), 37-43, (2000).

The ability of physical treatments to reduce checking in preservative-treated slash pine posts. P. Evans, R. Wingate-Hill and R. Cunningham. *Forest Products Journal* **47**(5), 51-55, (2000).

Jobs

Australia

Chair of Mechanical Engineering and Head of Department, Mechanical and Manufacturing Engineering, **University of Melbourne**. www.unimelb.edu.au/ExecServ/Seniorapp/index.htm

Postdoctoral Fellow, Research Fellow or Fellow, **Australian Photonics Cooperative Research Centre**, Planar Waveguide Device Modelling and Design. www.photonics.com.au

Research Fellow/Research Associate, ARC Special Research Centre for Offshore Foundation Systems, **The University of Western Australia** (several positions). jobs.uwa.edu.au/

Overseas

Research Associate in Biopolymer Modification & Research Scientist, The Biocomposites Centre, **University of Wales**. jobs.ac.uk/jobfiles/MA717.html & [MA718.html](http://jobs.ac.uk/jobfiles/MA718.html)

Postdoctoral Research Position, Department of Materials, **Oxford** (2 positions). jobs.ac.uk/jobfiles/XE435.html & [XE436.html](http://jobs.ac.uk/jobfiles/XE436.html)

Readership in Colloid/Interfacial Chemistry, Department of Chemistry, **Imperial College**, London. jobs.ac.uk/jobfiles/CD086.html

Lecturer/Professor in Marine Structures, Department of Marine Technology, **University of Newcastle upon Tyne**. jobs.ac.uk/jobfiles/LC362.html

University Lectureship, Department of Earth Sciences, **University of Cambridge**. jobs.ac.uk/jobfiles/HE546.html

Lectureship in Materials Chemistry, **Manchester Materials Science Centre**. www.man.ac.uk/reference/686/00

Research Assistant/Fellow, Production of living tissue-engineered bone substitute materials, Wolfson Centre for Materials Processing, **Brunel University**, Middlesex. jobs.ac.uk/jobfiles/KB067.html

2 PhD Positions in Applied Biophysics, The fabrication and characterisation of novel model surfaces for hair and fabrics, Ecole Polytechnique, Federale de Lausanne, **Switzerland**. jobs.ac.uk/jobfiles/IC640.html

Post-doctoral position in modelling multiphase flow in porous media, TH Huxley School of Environment, Earth Sciences and Engineering, **Imperial College**, London. jobs.ac.uk/jobfiles/IC640.html

Post-doctoral research assistant, IRC in Biomedical Materials with Centre for Computational Science, St Bartholomew's and the **Royal London School of Medicine and Dentistry**. jobs.ac.uk/jobfiles/BA989.html

Post-doctoral Fellow for the high pressure beamline ID30 at **ESRF, Grenoble**, France. www.esrf.fr/exp_facilities/ID30/index.html



Surfing www.anu.edu/CSEM

Accordinging to web usability guru Jakob Nielson (who charges \$20,000 US per day for his services), speed is one of the most important qualities of any website. "Ten seconds is the longest a user will wait for a page to download — more than that and you have lost them." The other key elements for a good user experience are ease of use, high quality content and up-to-date content. The single biggest mistake made by most websites is that they are not designed from the users' perspective. **In short, identify your target audience and provide them with information, not pretty pictures!**

The CSEM web site has been revamped over the last couple of weeks. Hopefully the simple layout is attractive and clear, downloads very quickly and is easy to navigate. Designed with the prospective student in mind, the menu bar on the left of each screen clearly directs visitors to undergraduate,

postgraduate or research information. People can also download copies of this newsletter or easily access information on the Centre.

We plan to improve the site's content further in the next couple of months and will need your help. Please have a surf and let us know if you find any problems or have ANY suggestions on ways to improve the site. We would like to expand and update the information available under research programs. In particular we wish to develop and maintain a comprehensive list of potential post-graduate research projects.

Remember to bookmark the CSEM site and let any interested students know the address.

jobs.ac.uk - worth a bookmark too

While materials science jobs might seem few and far between in Australia there is obviously quite a large demand for materials scientists in the UK and beyond. A recent search of the web site 'jobs.ac.uk' pulled out nearly 50 positions under the category of materials science. Just some of these are listed on the previous page.

The mission of 'jobs.ac.uk' is "to be the leading recruitment website for academic and associated communities." Thirty seven universities and institutions of higher education in the

UK established the website to ensure that the academic community would have its own dedicated recruitment website for the future.

While the site is dominated by job listings from the UK there are attempts to expand its international listings and the location search categories includes USA and Canada, West Indies, Other America, Europe, Asia, Australasia and Africa. The advanced search capability of the site allows you to fine-tune your search using over 100 occupation categories.

For Your Diary

- **Real-time Confocal & Multi-Photon Imaging @ JCSMR** Oct 3
Seminar presented by Bio-Rad. JCSMR, Florey Lecture Theatre, 10am-12pm
For details contact Isolda Ferreiro, Bio-Rad on 1800 224 354
- **ANU Scanning Electron Microscopy Masterclass** Oct 3-5
ANU Electron Microscopy Unit, queries stowe@rsbs.anu.edu.au
- **CSEM Seminar - *Bend, Stretch, Twist ... new insights into plant cell wall properties from genetic and physiological studies.*** Oct 4
presented by Geoff Wasteneys, Plant Cell Biology Group, RSBS
4-5pm, Department of Forestry Lecture Theatre 103
- **3rd ANU Australian Small Angle and Surface Scattering Meeting** Oct 11-13
Research School of Chemistry, further info Stephen.Holt@anu.edu.au, x 3571
- **ANU Soft Matter Workshop @ RSPHysSE** Oct 16-29
further info David Williams, drw110@rsphysse.anu.edu.au, x 0690
- **5th Pacific Rim Bio-Based Composites Symposium** Dec 10-13
hosted by ANU at Rydges Canberra Hotel, Canberra
- **PICMET '01 (Portland Int. Conf. on Management of Eng. and Tech.)** Jul 29 - Aug 2, 2001
Theme: *"Technology Management in the Knowledge Era: Life in the e-World"*
see www.picmet.org

Communication News

CSEM Seminar - Bend, Stretch, Twist ... new insights into plant cell wall properties from genetic and physiological studies. Presented by Geoff Wasteneys of the Plant Cell Biology Group, RSBS. On Wednesday October 4 from 4-5pm in Department of Forestry Lecture Theatre 103. We look forward to seeing you all there - drinks and nibbles afterwards!

Open Day Success - September 2nd saw CSEM 'on show' with the Departments of Science during ANU Open Day. Interest in the materials science undergraduate 'streams' was very encouraging.

CSEM Web Site - the CSEM site has undergone a revamp and now has links to undergraduate information. The content of the site will continue to be upgraded over the next few months. Feedback welcomed! Check out www.anu.edu.au/CSEM

New Promotional Materials - we hope to have drafts of the new CSEM promotional materials (folder and information sheets) for you to check out and comment on in the next few days.

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

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We welcome any feedback, enquiries or contributions.

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

www.anu.edu.au/CSEM