

## From the Research Director

Let me begin by wishing all staff, students, friends and clients of the Centre a very happy, prosperous and productive 2008.

In reflecting on a very busy three months, I can report spending the month of November travelling in Korea and China, presenting invited lectures at a series of conferences, including the 6th Pacific Rim International Conference on Advanced Materials and Processing (PRICM-6) in Jeju Island, the Shanghai International Nanotechnology Cooperation Symposium (SINCS07) and the International Conference on Nonferrous Materials (ICNFM2007) in Changsha, and at Chongqing University. All presented important opportunities to represent and promote the Centre in this crucial region. One particularly pleasing outcome was confirmation that Materials Australia will co-host (with TMS-USA) the next in the PRICM series of conferences in Cairns in 2010, in an event that should see well in excess of 1,000 attendees principally from China, Korea, Japan and the USA.

My extended travel in China also gave me an opportunity to continue the important dialogue with the Aluminium Corporation of China Limited (CHALCO), and included meetings in Beijing and a valuable visit to the Suzhou Institute for Nonferrous Metals Research. The very recent engagement of CHALCO, and parent company CHINALCO, in the 'negotiations' between BHP-Billiton and Rio Tinto appears to have taken some analysts by surprise, but clearly signals the intentions of CHINALCO/CHALCO to be a global force in both the resources sector generally and in the light metals business specifically. It serves to highlight the priority that I have been giving to the development of an effective relationship between Monash University, the Centre and CHALCO, and the establishment of the Australia-China International Centre for Light Alloy Research (ICLAR) with CHALCO as lead institution in China.

Closer to home, the Centre's Annual Workshop in Sydney in December was, from my own perspective and that of many to whom I spoke, a great success. It was truly pleasing to see the degree of cohesion that we have been able to achieve in just two years of operation across six institutions, and I have had much positive and constructive feedback as a result. I would like to again thank all those who participated and contributed to this success. It was especially pleasing to be able to host an important delegation from China throughout the Workshop and feel comfortable that the Centre was projecting not just high quality research, but a high degree of unity and cohesion. I would also particularly like to thank our international and external visitors, and members of the International Technical Advisory Committee, who not only participated, but also contributed much in the way of support and constructive advice. A special thanks must also go to local host, Professor Michael Ferry and staff, and to Astrid Nordmann and Nancy Place for their untiring efforts in professional organization.

Mid-January, I traveled to England as a member of an International Panel convened by the UK Engineering and Physical Sciences Research Council (EPSRC) to review the status of the materials research programme across the UK. What was on the one hand an exhausting week of visits, interviews and reviews, was on the other hand a valuable opportunity to gain an intensive overview of the materials scene in general and the 'metals and alloys' sub-programme in particular. While the industrial and manufacturing base in the UK has been in decline for some time, there are still substantial strengths in metallurgical research, now localized to just a few key institutions. I was impressed by the integrated 'systems approach' that is now a feature of institutions such as Birmingham, Sheffield, Manchester and Oxford, where high-level processing capability is integrated with conventional materials design and characterization activities, and often facilitated by high-level simulation and modeling capabilities. It confirmed to me that the philosophy that we have sought to adopt in the Centre, around strategic targets in materials design and application underpinned by a platform in computational materials science, is competitively placed. However, we have some way to go in matching UK

institutions in our ability to process at reasonable scale. The capability, in this regard, that has emerged in UK institutions has been largely the result of close cooperation with industry partners, such as Rolls Royce, who have taken an admirably visionary approach to the way in which they work with the university sector. It would seem to me that this Centre is very well-placed to embrace the best aspects of the UK model, with the ongoing strategic development of capability across six major institutions and the exciting prospects of major engagement with companies such as CHALCO.

This third year of the Centre's existence is rich with opportunities as the Centre moves into a crucial phase. A mid-term review by ARC looms later in the year and, normal metrics aside, our core challenge will lie in demonstrating that the Centre is providing a value that well and truly exceeds the sum of the parts. I am confident that the Centre is well-placed to do this, but I encourage all participants to give this issue their attention as we approach this critical stage.



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## Centre Visitor

**Nobel Laureate Dr Heinrich Rohrer** will be visiting and working with the Australian Key Centre for Microscopy and Microanalysis at the University of Sydney during February.

Dr Rohrer will be contributing in a foresight project designed to identify future trends and needs in microscopy and will work with AMMRF users, researchers and students at a special research workshop at the Key Centre.

This is an outstanding opportunity for the AMMRF and the Centre of Excellence, and while visiting Sydney, Dr Rohrer has agreed to present a public lecture entitled '*Nanotechnology - A Key to Sustainability*'. Further information is available on the following website: <http://www.ammrf.org.au/events.php>

# Nano-materials prepared by Severe Plastic Deformation

The "NanoSPD" group in the Department of Materials Engineering at Monash University is internationally renowned for active research in the area of ultra-fine-grained /nano-materials by Severe Plastic Deformation (SPD). Almost all research projects involve international cooperation and the group is registered with the international NanoSPD scientific body (see: <http://www.nanospd.org>). The international leadership of Monash's group is based on the special ECAE with Back-Pressure equipment designed and manufactured under the supervision of Dr. Rimma Lapovok. Her first rig for room temperature ECAE was designed and built in 1998, with the second modification became operational in 2001. Later Rimma designed another rig for high temperature ECAE with Back-Pressure and is currently working on a new large scale rig for ECAP of Ti alloys, which is part of a LIEF grant involving several universities in Victoria and NSW.

The unique features of Monash University's equipment were a base for starting a series of projects on the compaction of metallic particles. The first project on compaction of magnesium swarf (2002) has shown increase of magnesium recovery rate after re-melting of ECAP produced compacts from 68 to 92%. Since joining the CoE in 2006 Rimma has commenced several projects on the compaction of metallic powders, with special emphasis on titanium powders. For two years she was leading a project on low temperature compaction of Ti-6Al-4V powder supported by DARPA. It was found that compaction of this powder to above 98% of theoretical density, and 700 MPa of green strength, can be obtained by ECAE with Back-Pressure at temperatures as low as 400°C. Additionally, the hard work and enthusiasm of Dr. Dacian Tomus has greatly contributed to the success of this challenging project. The project has recently been completed and results have been communicated at two international conferences in New Zealand and Korea. Two publications that present project results are currently in press in Journals: *Scripta Materialia* and *Materials Science & Engineering*.



## New sheet metal wear tester at Deakin Uni

The new sheet metal wear tester funded by the Victorian State Government (Department of Innovation, Industry and Regional Development) has now been commissioned and is operational at Deakin University.

In this system, metal is fed off a coil into a press that forms small channel sections. This test was originally developed by Volvo to evaluate die coatings for forming of automotive sheets. At Deakin, the equipment will also be used to consider the role of lubricants as well as a range of metals, including light metals.

As the process is a real forming process, longer term wear issues can be considered, such as galling, surface quality and friction behaviour. Results from this test will also be correlated with the new pin on disc tester, also purchased under DIIRD funding. The first phase of the work will be to validate new finite element models developed to model wear in sheet metal forming.

## Golden Jubilee Year at the Electron Microscope Unit

This year marks the 50th anniversary of the Electron Microscope Unit at the University of Sydney. Back in the 1950s, there was growing demand from researchers across the University of Sydney for access to electron microscopy; this new technology was seen as an essential tool for research, particularly in the life sciences.

The University of Sydney decided to meet this need by providing an electron microscope as part of a centralised service that was not associated with any one department or faculty, but that would serve all equally. Thus was born the Electron Microscope Unit (EMU) back in 1958. Various events and activities will be held throughout the year to celebrate the Golden Jubilee, including:

### Honouring 50 Years EMU at the University of Sydney 14 February 2008

With hundreds of members of the Australian and international microscopy & microanalysis community in attendance, the EMU will be hosting a Happy Hour event at the *20th Australian Conference on Microscopy & Microanalysis (ACMM-20)*, *4th Congress of the International Union of Microbeam Analysis Societies (IUMAS-IV)* in the Perth Convention Exhibition Centre.

### Exhibition at the University's Macley Museum August 2008 - January 2009

This exciting 6-month exhibition allows insight into the fascinating world of microscopy. Open to the public and free, *Small Matters - Exploring the World of Microscopy* will offer schools, students, staff and families an introduction to basic modern microscopy techniques and the underlying scientific principles. During the official opening event (date TBC), we will also launch our history book *50 Great Moments, Celebrating the Golden Jubilee of the University of Sydney's Electron Microscope Unit*.

## Honorary Doctorate for Professor Yuri Estrin



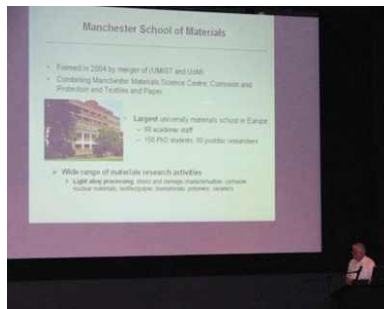
The CoE has pleasure in congratulating Professor Yuri Estrin on the award of an Honorary Doctorate (*Doctor honoris causa*) from the Russian Academy of Sciences. This is the only honorary doctorate that was given by the Academy in 2007 within the area of Chemistry and Materials Science. The citation reads:

*'This honorary doctorate has been awarded to you in recognition of your world-class achievements in Materials Science and Engineering, particularly in the areas of physical metallurgy, materials modelling, and development of new materials'*.

Yuri, who joined Monash University last year on a joint appointment with CSIRO, has been associated with the CoE from its very inception. His career as a researcher has started at the Institute of Crystallography of the Academy of Sciences in Moscow, and he can now add his honorary degree to the PhD he received from the same institution some 30 years ago.

## Annual Centre Workshop

The Centre recently hosted its second Annual Workshop at the University of New South Wales on the 4th and 5th of December. The event was attended by over 100 delegates representing all six nodes of the Centre, partner investigators, international collaborators and industry colleagues.



Key features of the workshop included the 2nd Ian Polmeal Lecture presented by Professor John Humphreys from the University of Manchester, and poster sessions which enabled Centre staff and students to present results of their research efforts.

Congratulations are extended to Julien da Costa Teixeira and Kaveh Kabir who respectively won Best Staff and Best Student Poster Awards for their work on *'The effect of solute and precipitates on the work hardening of Al-Cu based alloys: development of a quantitative description of the yield strength-elongation correlation'* and *'Structural response of hybrid sandwich panels with aluminium foam core and thin aluminium face sheets under bending loading'*.

## Hamish Fraser's visit to the CoE ...



Professor Hamish Fraser of the Ohio State University visited the CoE in December for the purpose of attending the Annual Workshop in Sydney. Hamish arrived in Melbourne for a meeting with Dr. Colleen Bettles and Dr. Mark Gibson (of CSIRO) to finalize the content of his presentation on their joint CoE-based project for the workshop. Additionally, several strategic meetings took place between Hamish and Dr. Nick Birbilis,

Prof. Rudy Buchheit and Yunzhi Wang (both from the Ohio State University), with the theme of collaboration regarding integration of modeling and simulation in corrosion science. Practical aspects of corrosion were studied in detail at several wineries in the Mornington Peninsula!

On the morning of the 3rd December, the exodus of CoE staff and visitors to Sydney took place. The team was housed in an exquisite hotel, the Crowne Plaza at Coogee Beach, within a short commute to the workshop's venue at the University of New South Wales. That afternoon, a meeting was held between Drs Colleen Bettles, Dr. Mark Gibson and Hamish, and Drs. Jawad Haidar and John Dunlop, both of CSIRO, working from Lindfield, NSW. The topic of the meeting involved characterisation of Ti-based particulate. The Centre workshop was held over the next two days during which many interesting talks were presented. While most of the attendees left on the late afternoon/evening of the 5th December, Prof. Fraser flew from Kingsford-Smith on the next morning. A very pleasurable and worthwhile trip, thanks to the folks of the CoE!!

*By Hamish Fraser*

## Upcoming conferences

### TMS 2008

9-13 March 2008, New Orleans, USA  
[www.tms.org.au](http://www.tms.org.au)

### 5th Symposium on Ultra Fine Grained Materials (UFG V)

9-13 March 2008, New Orleans, USA  
<http://www.tms.org/Meetings/Annual-08/AM08-techprogEP.html>

### International Magnesium Association

**65th Annual World Conference**  
18-20 May 2008, Warsaw, Poland  
[www.intlmag.org](http://www.intlmag.org)

### Aluminium China 2008

28-30 May 2008, Guangzhou, China  
[www.aluminiumchina.com](http://www.aluminiumchina.com)

### 4th International Conference on Nanomaterials

18-22 August 2008, Goslar, Germany  
[www.nanospd4.org](http://www.nanospd4.org)

### 11th International Symposium on Physics of Materials

24-28 August 2008, Prague, Czech Republic  
<http://material.karlov.mff.cuni.cz/events/ispma11/ann1.html>

### 5th International Conference on Advanced Materials and Processing (ICAMP5)

3-6 September 2008, Harbin, China  
<http://icamp.hit.edu.cn>

### Titanium 2008

21-23 September 2008, Las Vegas, USA  
[www.titanium.org](http://www.titanium.org)

### ICAA11 11th International Conference on Aluminium Alloys

22-26 September 2008, Aachen, Germany  
[www.dgm.de/dgm/icaa11](http://www.dgm.de/dgm/icaa11)

### Corrosion and Prevention 2008

16-19 November 2008, Wellington, New Zealand  
[www.corrosion.com.au](http://www.corrosion.com.au)

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## Staff & student profiles

This issue's staff and student profiles are **Kevin Spencer** at the University of QLD and **Arun Kumar** at Monash University.



**Dr. Kevin Spencer** comes from Ottawa, Canada and his research at the University of Queensland concerns the surface treatment of light metals using cold spray solid state coatings.

The focus of the work is on improving the corrosion and wear resistance of light metals and to study the properties of the coating/substrate interface.

The ultimate goal is to improve the service properties of light metals so their use may be expanded, and also to expand the use of the cold spray technique into new areas.

Past work at the CANMET Materials Technology Laboratory in Canada involved deformation processing of magnesium, while his postgraduate work focused on transformation plasticity in stainless steels, and the formability of aluminium sheet alloys.

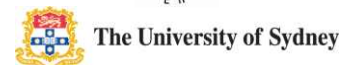
Kevin lives in Brisbane and his main hobbies include competitive swimming, rock climbing, hiking and sailing.



**Arun Kumar** is a student at Monash University and his research interests include structure-property relationship and phase transitions in materials from the angle of chemical bonding and atomic properties, sol-gel processing of materials, CVD, chemical characterisation of materials by infra-red spectroscopy and thermal analysis techniques etc.

His current project in the area of light metal alloys is concerned with development of sol-gel coatings for aluminium and magnesium alloys for corrosion protection. The project involves a wide variety of characterisation techniques including FTIR, thermal analysis, SEM, corrosion/adhesion performance evaluation, etc.

Arun is married to an anthropologist wife who is currently an Honorary Research Associate at the Monash Asia Institute. He has a son about to commence a Bachelor of Computer Science, and in his spare time Arun enjoys listening to music and confronting the questions relating to the meaning of life.



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