ALTIMA

ARC Centre of Excellence Design in Light Metals Newsletter: Volume 1 Spring 2006

IN THIS ISSUE

Congratulations!

We are pleased to announce that one of the Centre's postdoctoral research staff, Dr. Brian Gable from Monash University, was recently awarded 'Best Poster' prize at the 10th International Conference on Aluminum Alloys (ICAA10) which was held in Vancouver, Canada. The particular theme of this conference was "Innovation Through Research and Technology". It attracted over 400 delegates and showcased in excess of 120 poster presentations.

Brian was awarded a certificate and monetary prize for his work on 'The Effect of Alloying Additions on Vacancy Behaviour in Aluminium-Copper Alloys' which was conducted in collaboration with CSIRO (Anita Hill, Tim Bastow, Kate Nairn,Terry Kratzer) and the Research Director of the Centre, Professor Barry Muddle.

This work is supported under the Monash CSIRO Collaborative Research Support Scheme (CRSS).

Congratulations to Brian and his team for their achievement!

Shown above is a photo of Brian shortly after receiving his award from Conference Chairman, Professor Warren Poole.

From the Research Director

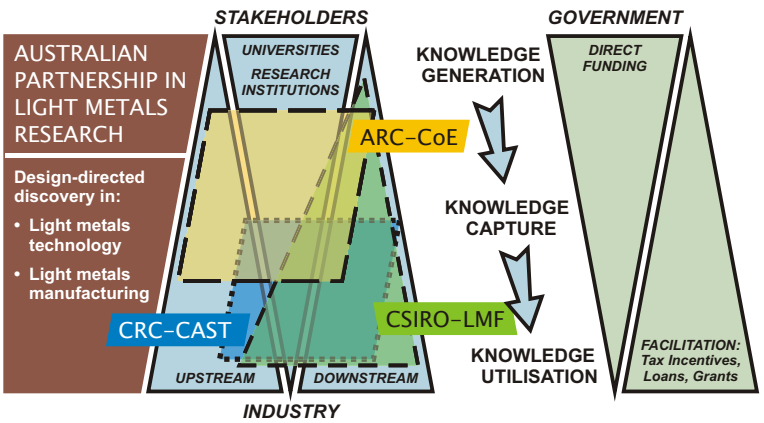
The ARC Centre of Excellence for Design in Light Metals is inclusive of the leading groups in light metals research nationally, creating a team that commands global recognition. As shown below, it is positioned to coordinate a strategic fundamental research platform in the light metals that has been missing in the national research framework.

In the short time that it has been funded, the Centre has successfully forged a strong and effective collaboration with both the CRC for Cast Metals Manufacturing (CAST) and the CSIRO Light Metals Flagship, having established the Australian Partnership in Light Metals Research.

This represents a unique opportunity in the national context, creating an alignment of national research capability that spans the full range from ***'upstream'*** minerals processing and metal production to ***'downstream'*** materials processing and light metals manufacture. The vision captured in the accompanying figure will be realised in terms of structure; the welcome challenge is to now realise the potential.

While fully committed to fulfilling its obligation in the immediate national interest, the Centre is equally committed to becoming a global partner of choice in light metals research. It takes the view that a country as rich as Australia in the natural resources that underpin light metals industries internationally must sustain a major engagement in light metals technology at the highest levels. Through its network of Partner Institutions internationally and by engagement with light metals industries globally, the Centre is embarked on a mission to enhance the national research profile and promote Australian technology capability.

From the time of application, the Centre has been fortunate to attract the strong support of the Victorian State Government. Funding of ~$1.5m for the period 2006-08 will see creation of a Victorian Facility for Light Metals Surface Technology as a key platform in the Centre's research capability. Surface engineering of the light metals is a burgeoning field of research and development globally, and the development of a unique Facility and associated capability within the Victorian manufacturing precinct has exciting potential for the State. Output from this Facility will have potentially strong impact in the automotive, aerospace and packaging sectors.



The Centre has made rapid progress in the establishment of five Research Programs that individually engage all six institutions. Projects within the Programs are without exception collaborative and involve partnership of at least two participating institutions. These Programs will be detailed in future editions of the Centre's newsletter.

Barry Muddle

Australian Partnership in Light Metals Research

The Centre of Excellence for Design in Light Metals (CoE) and the Cooperative Research Centre for Cast Metals Manufacturing (CAST CRC) are joint collaborators with CSIRO through the CSIRO Flagship Collaboration Program which was launched at Monash University on the 18th of August.

CSIRO Flagships are targeted at national goals which are closely aligned to the Commonwealth Government's National Research Priorities. Each Flagship involves collaboration between leading Australian scientists, research institutions, commercial companies and CSIRO.

Their scale, longer time-frames and clear focus on delivery and adoption of research outputs are designed to maximise their impact in key areas of economic and community need.

Flagship Clusters are funded under the Flagship Collaborative Research Program to support specific research projects which have outcomes and deliverables. The CAST/CoE Cluster will link the CAST CRC and the Centre of Excellence for Design in Light Metals with the CSIRO Light Metals Flagship in a national research collaboration based upon the Flagship themes of Aluminium/Magnesium Manufacturing and Titanium.

By partnering the CoE for Design in Light Metals and the CAST CRC, the Cluster brings two proven approaches to the development of advanced materials technologies.

The Centre of Excellence brings a strong internationally recognised fundamental science approach to the design of alloy and hybrid materials while the CAST CRC introduces an approach that focuses on developing technologies that are fit for purpose through a research, development and commercialisation process.

The research focus of the Cluster embraces a unique approach to integration of protocols in both component and materials design, and advanced modelling and simulation, with innovations in both materials and processes.

The technology focus of the Cluster encompasses both short and longer term approaches to reduction in unsprung weight of vehicles through substitution of light metal alloy and composite components for conventional steel forgings, castings and sheet. It also addresses the production of cost-effective titanium products from powder precursors.

The immediate commercial focus of the Cluster will be on accelerated uptake of light metal components in both the Australian automotive sector and global first wave adopters for that sector.

Medium to longer term objectives will include increased global markets for the light metals, principally in the transport sector, and increased opportunities for commercial return on national investment in light metals research and technology development.

The Cluster Themes and Projects in the Centre of Excellence/CAST collaboration are:

Theme 1: Design, Forming and Surface Protection of Lightweight Automotive Components

- Light metal technologies for unsprung weight suspension components
- Surface protection for magnesium wheels

Theme 2: Cost Effective Titanium Products from Powder Precursors

- Thermohydrogen processing of titanium
- Design of titanium alloys for powder processing

Centre Visitor

The Centre is pleased to be hosting Associate Professor Lori Bassman at its node at the University of New South Wales. Lori is visiting from the Department of Engineering at Harvey Mudd College in California, USA.

Lori has been developing a speckle interferometric microscope for simultaneous measurement of surface deformations in three dimensions. Recent work has been on observation of localised deformations during creep of high-purity aluminium. Future development of the system will be aimed at short time scale phenomena, specifically shock deformation in polycrystals. She has also done work in computational modeling of coupled mechanical, compositional, thermal and electrial phenomena in polycrystalline thin films. Some of Lori's publications include:

1. **E. B. Flynn, L. C. Bassman, T. P. Smith, Z. Lalji, L. H. Fullerton, T. C. Leung, S. R. Greenfield, and A. C. Koskelo**, "Three-Wavelength Electronic Speckle Pattern Interferometry with the Fourier-Transform Method for Simultaneous Measurement of Microstructure-Scale Deformations in Three Dimensions," *Applied Optics* **45**, May 2006.
2. **T. Smith, L. Bassman, Z. Lalji, E. Flynn, T. Leung, S. Cramer, N. vonGersdorff, S. Greenfield, A. Koskelo**, "Laser Speckle Interferometry for Measuring Three-Dimensional Mesoscopic Deformations in Polycrystalline Surfaces." *American Physical Society Meeting*, March 2005.
3. **K. Garikipati, L. Bassman & M. Deal**, "A Lattice-Based Micromechanical Continuum Formulation for Coupled Composition-Mechanics in Polycrystalline Solids," *Journal of the Mechanics and Physics of Solids* **49**, June 2001, pp. 1209-37.
4. **K. Garikipati & L.C. Bassman**, "Atomistically-based Field Formulations for Coupled Problems of Composition and Mechanics," in *Multiscale Materials Modeling, Materials Research Society Proceedings* **653**, 2001, pp. Z9.6.1–6.

Victorian Facility for Light Metals Surface Technology

The Victorian State Government, through its Department of Innovation, Industry and Regional Development, provides funding to support the Victorian Facility for Light Metals Surface Technology.

This represents a strategic investment in essential capability and infrastructure within the framework of a designated Victorian Facility that will provide national leadership and global competitiveness in Light Metals Surface Technology.

The program will be based largely in Victoria at Monash and Deakin Universities, with strong collaborative engagement.

Major strategic objectives of the Facility include:

- appointment of senior research leaders in light metals surface engineering, capable of providing research leadership and growth of a major research initiative;
- development of dedicated laboratory facilities for surface processing/engineering and for characterisation of the physical and mechanical properties of light metal surfaces;
- leveraged acquisition of key elements of infrastructure, particularly for characterisation of the physical and mechanical properties of light metal surfaces; and
- alignment and collaboration with CSIRO through the Light Metals Flagship and the Australian Partnership in Light Metals Research.

Immediate research priorities will include:

- development of technology for the application of mechanically durable surface protection of magnesium alloys in order to expand applications of such alloys into large volume markets; and
- novel approaches to improving the surface properties of aluminium alloys for improved wear and fatigue resistance, and enhanced toughness.

Staff & student profiles

This issue's staff and student profiles are **Associate Professor Michael Ferry** at the University of New South Wales and **Mr. Julian Rosalie** at Monash University.

Michael's research interests are concerned mainly with the mechanisms of microstructure and texture evolution during solidification, solid-state phase transformation and deformation and annealing with particular emphasis on Al-, Mg- and Ti-base alloys and their composites. He has expertise in the area of texture evolution using X-ray methods and the more recently developed techniques of EBSD and microdiffraction in the TEM. Current research on light alloys includes:

(i) Experimental investigations and modelling of static and dynamic grain stability in particle-containing alloys; (ii) Recovery/recrystallisation mechanisms in deformed single-phase and two-phase aluminium alloys; (iii) Synthesis, flow behaviour and superplastic nanoforming of Mg- and Al-base amorphous alloys, and (iv) Processing and thermomechanical behaviour of conventional and multi-functional titanium alloys.

Michael lives just south of Sydney in a little beachside suburb called Austinmer with his wife Debbie and kids, Matt and Meg. In his spare time, he enjoys reading biographies about virtually anyone and dabbles in cricket, squash and surfing although the latter occurs less frequently compared with days gone by.

Julian's research interests involve the characterisation and modelling of the early stages of microstructural evolution in aluminium alloys. Current work includes investigations of nucleation on defects, in particular dislocation loops, and work on understanding the interactions between different intermediate precipitates using transmission electron microscopy.

Julian lives with his partner Caitlin, two cats and one ferret. His interests include Aikido and Yoga and he is active in the Monash Yoga Society.

Annual CoE workshop

The Centre will be hosting its Annual Workshop at Monash University on the 21st and 22nd of November.

All Centre research staff, students and affiliates are encouraged to attend the workshop to discuss current research initiatives and future research programs. Professor David Embury from McMaster University in Canada will be a special guest at the workshop and will provide an international context for the research portfolio. A Centre dinner will also be held on the evening of Wednesday 22nd November.

All researchers, but most particularly postgraduate research students, are invited to submit a poster presentation outlining their existing or planned research activity. Posters already presented at other conferences or functions are welcome, and the Centre will be awarding prizes for the best submissions. The Centre is especially keen to encourage posters that can be used for display purposes at Centre nodes.

Further workshop information including a detailed timetable will be circulated shortly. Please register your interest in attending the workshop by email or telephone to Dr. Astrid Nordmann (Tel: (03) 9905 5791 or email: astrid.nordmann@eng.monash.edu.au) before October 31. Please indicate your intention to submit a poster by sending a title and abstract by September 29.

Upcoming conferences

Aluminium 2006: 6th World Trade Fair & Conference
20-22 September 2006, Essen, Germany
http://www.aluminium2006.com

Titanium 2006
1-3 October 2006, San Diego, USA
http://www.titanium.org

COM 2006: 45th International Conference of Metallurgists
1 - 4 October 2006, Montreal, Canada
http://www.metsoc.org

Die Casting Conference
Australian Die Casting Association
9 – 11 October, 2006, Melbourne, Australia
http://www.diecasting.asn.au

10th AWS/AA Aluminum Welding Conference & Exhibition
30-31 October 2006, Georgia, USA
http://www.aws.org/expo/alum.html

Asia-Pacific Aluminium Conference 2006
2-5 November 2006, Goa, India
http://www.alucastindia2006.com/

7th International Conference on Magnesium Alloys and their applications
6-9 November 2006, Dresden, Germany
http://www.dgm.de/magnesium/

4th International Conference on Advanced Materials & Processing (ICAMP-4)
10 – 13 December 2006, Hamilton, New Zealand
http://mape.waikato.ac.nz/icamp

5th International Conference on Materials Processing for Properties & Performance (MP3 2006)
11 – 15 December 2006, Singapore
http://www.iommp3.org/

3rd International Conference on Advances of thin Films and Coatings Technology (Thin Films 2006)
11 – 15 December 2006, Singapore
http://www.thinfilmSingapore.org

2007 TMS Annual Meeting & Exhibition
25 February – 1 March 2007, Orlando, USA
http://www.tms.org/Meetings/Annual-07

GIFA 2007
12 - 16 June, 2007, Dusseldorf, Germany
http://www.messe-duesseldorf.de/gifa/

Light Metals 2007
25-30 August, 2007, Toronto, Canada
http://www.metsoc.org

Titanium 2007
7-9 October 2007, Orlando, USA
http://www.titanium.org

IMA's 64th Annual Magnesium Conference
13-15 May 2007, Vancouver, Canada
http://www.intlmag.org

Contact the Centre

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ICAA-10 conference

A strong Centre contingent attended the 10th International Conference on Aluminium Alloys (ICAA-10) in Vancouver, 9-13 July, 2006.

Professor Simon Ringer from the University of Sydney was a Keynote Lecturer; Professor Barry Muddle (Monash University), Associate Professor Carlos Caceres (The University of Queensland) and Dr Allan Morton (CSIRO/Monash University) were Invited Speakers.

Dr Brian Gable from Monash University won a Best Poster Prize and Professor Barry Muddle became the first Australian to be appointed to the Conference International Advisory Committee. ICAA-11 will be held in Aachen, Germany in September 2008.

Join our mailing list

If you would like to be placed on the ALTIMA mailing list, or are interested in submitting articles for publication in the newsletter, please send an email to altima@eng.monash.edu.au, or visit the "Publications" section of the Centre's website at www.arclightmetals.org.au and fill in the subscription form.

Our partner universities

- **Monash University**
  Department of Materials Engineering
- **University of Queensland**
  School of Engineering
- **University of New South Wales**
  School of Materials Science and Engineering
- **Deakin University**
  School of Engineering and Technology
- **University of Sydney**
  Australian Key Centre for Microscopy and Microanalysis
- **University of Melbourne**
  Department of Mechanical and Manufacturing Engineering