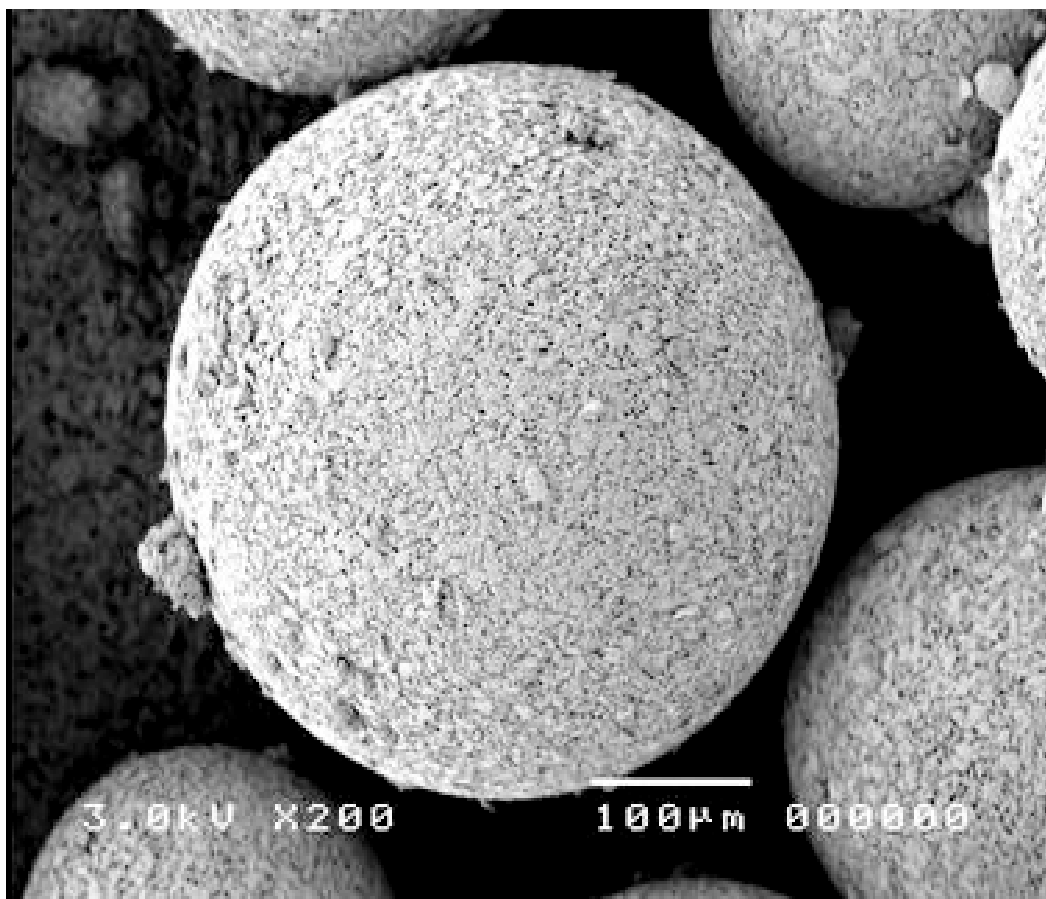




# NEWSBULLETIN

OF THE AUSTRALASIAN CERAMIC SOCIETY

VOLUME 21, NUMBER 1, April 2006



OFFICIAL PUBLICATION OF THE AUSTRALASIAN CERAMIC SOCIETY

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<http://www.austceram.com>

Subscriptions should be forwarded to the  
National Secretariat

## COVER PHOTO

Freeze granulated diamond composite

## PRINTING

The *Newsbulletin of the Australian Ceramic Society* is printed by  
Bright Print

## **PRESIDENT'S ADDRESS APRIL 2006**

I am happy to confirm that the dates for AustCeram 2007 have now been set for July 4-6<sup>th</sup> 2007 in Sydney and as tabled previously this will be a joint event with Materials Australasia (IMEA). The conference committee including Lou Vance and Dan Perera are working hard to make this a successful event and I sincerely hope that society members will assist them in any way they can. Further information on this event is presented in this Newsbulletin.

It is also with great pleasure that I can inform you of developments at the Federal level with the acceptance by council at a recent meeting to wholeheartedly support a "wind of change" proposal initiated by your Vice-President, Dan Perera, to radically change the way the society is handled. These changes may include the following changes subject to acceptance by our membership at the Society AGM to be held on Thursday 20 July (to be confirmed):

- no current society member will pay annual fees
- a joining fee will be applied for *new* members and corporate bodies but not for students
- all communications from the society to our members will be via e-mail only
- a members only section will be created on the society web site which will contain, amongst other things, the current Newsbulletin and Society Journal
- the Newsbulletin will no longer be produced in a hard copy format
- only limited numbers of hard copies of the Journal will be printed to satisfy paying subscribers
- the website will be upgraded and regularly updated via your Federal President, Secretary and State Branch Presidents

There are many benefits which can be realised through this approach and it will be council's job to present these in an appropriate format at the AGM. In the meantime I, like my council colleagues, would welcome constructive debate on these and any other topics of importance to our membership.

In the very near future there are also a few international events which the Society has endorsed including the 1<sup>ST</sup> International Congress on Ceramics (Toronto, Canada 25-29 June 2006) and Ceramitec 2006 (Munich, Germany 16-19 May 2006). I would like to encourage participation at these events at all levels and for members to take the opportunity to promote the excellence of Australian activities in all aspects of ceramics and materials science.

Until the next time.

**N.A.Stone**  
**President; Australasian Ceramic Society.**

## LETTER TO THE EDITOR

### CERAMICS IN THE BUSH

After more than 50 years in ceramic technology in Sydney, I retired to Mudgee NSW, an area renowned for ceramic raw materials of many kinds. Here I have been busy making stoneware and porcelain entirely from these and experimenting with traditional Chinese glazes. Other activities include helping local potters with technical problems and raw material sources, and designing kilns for wood firing.

One of my friends, a local sculptor in clay, using majolica techniques learnt in Italy, was recently intrigued by clay dug up during building activity on her property. I showed her how to extract the clay content from the crude soil which contained a lot of rock fragments. Tests showed that the clay required about a 30 % addition of ground silica for glaze fit and drying properties. As she had no facilities for determining the solids content of the slip which was the end result of the levigation process, I made a simple hydrometer from some rigid plastic tube, sealed at the bottom with a crutch tip and loaded with lead to make it float upright. I calibrated this in my laboratory to indicate a density which would contain a solids content to work to. All that was necessary then was to take a known volume

of slip and stir in the calculated amount of silica.

All went well until one morning she went to check a batch. She had left a measuring cylinder outside overnight, with the hydrometer. She poured in some slip, which she knew from experience was close to the standard density, but the hydrometer reading was crazy. She pulled it out and a lump fell off. It was a large frog clinging desperately to the hydrometer to keep its head above the clay! I haven't stopped laughing.

Regards,  
Phillip Robinson  
Mudgee

Foundation and Life Member

A note from the Editor:

Phillip also writes that he is 91 and possesses neither typewriter nor computer. (His handwriting is however elegant and far more human than MS Word).

If any other members have interesting stories or reminiscences they wish to share please do not hesitate.



## Materials Division

The Australian Nuclear Science and Technology Organisation (ANSTO) is keen to develop collaborative R&D projects, and encourages industry to make use of the facilities and expertise available in the Materials Division.

**Some of Our Current Projects are in the Areas of:**

- Waste Management/Synroc
- Sol-Gel Processing

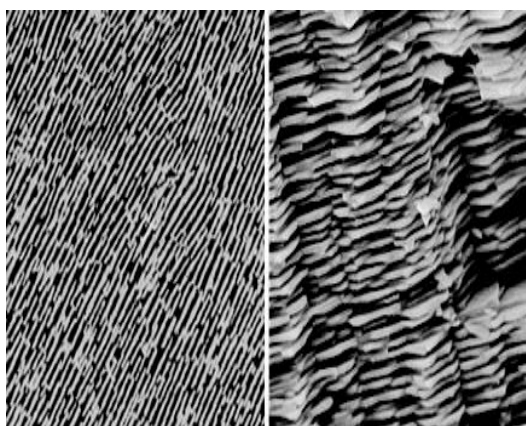
**Our Key Facilities Include:**

- Large Batch Ceramic Powder Processing
- Spray Dryers up to Pilot Plant Size

## MOTHER-OF-PEARL ON ICE: NEW CERAMICS MIGHT SERVE IN BONES AND MACHINES

PETER WEISS

Beneath the shimmer of an oyster's mother-of-pearl, an intricate microstructure bestows both strength and toughness on the natural ceramic. Now, scientists have come up with a way to replicate that structure in humanmade substances.



**BRICK-A-STACK.** Novel materials made from microplates of ceramic such as alumina (left) joined by metal mortar replicate the microstructure and properties of natural mother-of-pearl of an abalone shell (right). The two micrographs are at different scales; the artificial plates are actually about 10 times as thick as those in the mother-of-pearl.

*Deville et al./Science*

The process exploits one of the most common transformations in nature—the freezing of water—so it's remarkably simple and potentially inexpensive and environmentally friendly, its developers say.

These researchers, at the Lawrence Berkeley (Calif.) National Laboratory, have used their new approach to create an exceptionally rugged substance that may serve as a scaffold for new bone growth. The method also works well with non-biological

materials, report Sylvain Deville and his colleagues in the Jan. 27 *Science*. Using it, the team has fabricated novel metal-ceramic composites that benefit from a seashell-like internal architecture.

Mollusks such as abalone and oysters create their iridescent armor, known as nacre, from brittle calcium carbonate microcrystals and pliant proteins arranged like bricks and mortar, respectively (SN: 5/16/92, p. 328). Materials specialists have long envied the composite's resilience, which is superior to that of human-made ceramics.

Past efforts to artificially replicate the shells' architecture have typically stalled after a few microlayers or generated cruder laminations than those in the real stuff, says team member Eduardo Saiz (SN: 6/21/03, p. 397: Available to subscribers at <http://www.sciencenews.org/articles/20030621/note12.asp>). Using the new method, he, Deville, and Antoni P. Tomsia of the Lawrence Berkeley lab and Ravi K. Nalla, now at Intel Corp. in Chandler, Ariz., fabricated centimeters-thick chunks of ceramic with internal layering almost as thin as that of natural nacre.

"This is an exciting paper," comments Manfred Rühle of the Max Planck Institute for Metals Research in Stuttgart, Germany. The new approach "represents a breakthrough in processing advanced materials," he adds.

To make a microstructured ceramic, Deville and his colleagues mixed water with finely ground ceramic powder and polymer binders. They then poured the blend into a chamber a few centimeters across. By carefully controlling subfreezing

temperatures at the chamber's bottom and top, the researchers produced a temperature gradient that generated an ice structure sometimes observed in frozen seawater.

In that structure, sheets of microscopic hexagonal ice crystals formed vertically in the chamber. As those crystals grew, they forced the powder and binders to congregate between the pure-ice sheets. Freeze-drying removed the ice, and high-temperature sintering then solidified each ceramic-binder layer into a solid plate. Finally, the researchers selected a substance to play the

role of nacre's protein and introduced it into the spaces between the ceramic plates.

To create bonelike composites, the researchers employed epoxy as the mortar between plates of hydroxyapatite, which is the predominant ceramic in bone and teeth. For nonbiological materials, they bound alumina plates with a mortar containing an alloy of aluminum and silicon and, in some cases, titanium. Such composites may prove useful to many industries, including electronics, machining, and aerospace manufacturing.



## **CORPORATE MEMBERSHIP**

Is your company interested in becoming a  
Corporate Member?

Corporate Members may nominate two  
representatives of their organisation as  
members and receive free advertising space in  
a Society publication on one occasion.

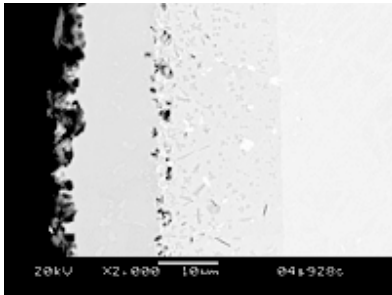
A membership form is available on the  
*Australasian Ceramic Society* website at the  
following address:

<http://www.ozemail.com.au/~ausceramsoc>

## NEWS IN BRIEF

### NEW COATING PROTECTS STEEL AND SUPERALLOYS

*Pacific Northwest National Laboratory develops durable, low-cost, sprayable material.*



An electron micrograph of a coated 316 stainless steel coupon in cross-section shows the diffusion-reaction layers. Starting from the left hand side of the photo, which is the surface of the steel the following layers are visible: 1) Aluminum oxide outer layer (not visible at lower magnifications) 2) FeAl layer, 3) Fe<sub>3</sub>Al inner layer, and 4) 316SS. (Original high-resolution image.)

RICHLAND, Wash – Researchers at Pacific Northwest National Laboratory have developed a new ceramic-based coating for steel and superalloys that prevents corrosion, oxidation, carburization and sulfidation that commonly occur in gas, liquid, steam and other hostile environments.

The low-cost, easy-to-apply material is available for licensing and joint research opportunities through Battelle, which operates PNNL for the Department of Energy and facilitates the transfer of lab-created technologies to the marketplace.

The new coating bonds with the metal substrate and is “resilient, inexpensive and simple,” said PNNL scientist Chuck

Henager. Because the coating is fabricated at significantly lower temperatures than typically required for conventional ceramic coatings, the new process also can save energy and reduce harmful emissions, he said.

Researchers created the coating by mixing a liquid preceramic polymer with aluminum metal-flake powders to form a slurry that can be applied to a metal object by dipping, painting or air-spraying. A low-temperature curing process follows, using a commercial Ruthenium-based catalyst that enables polymer cross-linking and dries the slurry to a green state.

The coated steel is then heated in air, nitrogen or argon at 700 to 900 degrees Celsius. The heat converts the green state layer into an aluminum diffusion/reaction layer that permeates surface of the steel and provides an aluminide surface coating on the steel.

According to PNNL Commercialization Manager Eric Lund, the diffusion reaction makes the coating so durable that it can’t be chipped or scratched off.

The reaction layer on the surface of the steel is much stronger than an external coating because it is an integral part of the steel, Henager said. This layer develops during use as the coating is heated at very high temperatures, such as those that occur with the heating of pipes in a process facility.

Unlike similar products, the liquid form of the coating can be applied with a spray gun. This feature makes the PNNL coating practical for protecting large areas, researchers said.

## **NEW SOLID OXIDE FUEL CELL ELECTRODE MATERIAL DEVELOPED THROUGH NANOSCALE ENGINEERING**

Researchers have discovered a new material which could lead to significantly more powerful solid oxide fuel cells (SOFC). The new electrode material not only promises more efficient direct utilisation of natural gas or biogas in SOFC but could also help achieve voltages up to 40% higher than currently achieved. A 40% increase in voltage would lead to a similar increase in electrical energy obtainable from a specific volume of natural gas or biogas.

The findings, carried out at the School of Chemistry in the University of St Andrews in collaboration with the University of La Laguna in the Canary Islands, are reported in *Nature* (2 February 2006).

Professor John Irvine of St Andrews University believes the findings illustrate a significant step forward in the development of fuel cells to reduce CO<sub>2</sub> emissions through the use of renewable fuels such as biogas that are close to CO<sub>2</sub> neutral in their environmental impact.

The scientists prepared a new perovskite material, lanthanum-substituted strontium titanate (La-SrTiO<sub>3</sub>). Careful processing was used to optimise size and distribution of chemical defects in the material's structure to achieve increased electrochemical activity. The new materials were developed through carefully controlled programme designed to manipulate their structure on the nanoscale – nanometre thick layers were introduced through control of composition and then the composition directed to the point where these layers became disrupted, but retained their activity.

The novel defect structure was found to dramatically improve fuel cell performance at 950°C. Results from initial experiments show higher activity for methane oxidation at high temperatures. Measurements of the resistance under mildly reducing conditions yielded a 100,000-fold increase in electrical conductivity.

## **SCIENTISTS UNLOCK SECRETS OF CRYSTAL FORMATION**

MINNEAPOLIS, April 19, 2006 - Using some of the most advanced microscopes available, a team of researchers has discovered some clues as to how zeolite crystals -- porous minerals used as filters and purifiers -- form. The knowledge may allow scientists to create zeolites with precisely the crystal sizes and shapes needed in molecule-specific applications such as chemical sensing and to even one day replace less efficient systems in optoelectronics, sensors and microreactors.

University of Minnesota chemical engineer Michael Tsapatsis, graduate student and lead author Tracy Davis and their colleagues reported their findings April 17 in the journal *Nature Materials*.

Zeolites are familiar to consumers as the white crystals in aquarium filters or the ion-exchanging ingredient in advanced detergents. But their real economic impact is behind the scenes, where they are critical for extracting various chemical components out of petroleum and its byproducts on an industrial scale, Tsapatsis said.

Zeolites accomplish this by trapping and removing specific target chemicals, which makes it easier for companies to purify chemicals. So the challenge for researchers is to tailor a zeolite for each application that traps just the right set of chemicals. Ultimately, their goal is to control the structure, size and shape of the crystals well

enough for zeolites to serve as sponges for hydrogen in fuel tanks, channels in next-generation sensors and separation membranes for chemical manufacturing, Tsapatsis said.

"Controlling the growth of a certain crystal structure is difficult because it is done by trial-and-error, or what some critics may call a 'mix, wait and see' approach," said Tsapatsis, adding that researchers have lacked a clear understanding of nucleation and growth processes that control formation of those zeolites and related organic-inorganic nanostructures. In an effort to improve that understanding, Tsapatsis and his colleagues have spent more than a year monitoring the growth of zeolites in a laboratory setting, where they could watch the crystal growth process in detail.

Using advanced tools that included a high-resolution transmission electron microscope purchased with National Science Foundation (NSF) support and a small angle x-ray scattering system on loan from Anton Paar GmbH of Granz, Austria, the researchers were able to observe changes on the scale of single nanometers (billionths of a meter). "These are complex structures containing hundreds of atoms per unit cell and their formation is determined largely by kinetics," said Tsapatsis. "Our approach is to slow down the kinetics and exhaustively study the evolution by all techniques available to us." Ultimately, the researchers hope to develop, validate and improve quantitative mathematical models that describe the complex systems, he said.

The study showed that the zeolites form in a step-by-step, "hierarchical" fashion, with silicon-oxygen nanoparticles forming first. Those particles then aggregate into larger, more complex structures, incorporating other atoms and molecules while still leaving substantial pores and tunnels. Based on their findings, the researchers developed

a set of mathematical equations that describe the nucleation and growth process.

"There are essentially unlimited opportunities for these crystals if we can control their pore structure and crystal shape, tailoring designs to specific applications ranging from catalysts to bio-implants," he said. While laboratory zeolites tend to exist as microcrystal powders, the researchers hope the new insight may help yield larger structures--even layers and thin films -- that are perfect for optoelectronics, sensors, and microreactors. "We are already attempting to prepare thin films of the materials to replace energy inefficient separations, like distillation, with membrane separations," said Tsapatsis.

For example, instead of purifying products by heating the starter liquid to a boil and distilling the desired chemicals, the new membrane sieves could achieve the same goal when the fluid simply passes through. "Membranes made by our current process will cost over \$1000 per square meter -- too expensive for widespread use in applications like hydrogen purification and hydrocarbon separations that need thousands of square meters of membrane," said Tsapatsis. "With the mechanistic knowledge we now have, we are designing one-step film formation processes that could cost one tenth that amount."

The research was supported by several NSF grants. For more information, visit: <http://www1.umn.edu/umnnews/index.php>

## IT'S THE LITTLE THINGS THAT MATTER FDA PLANS NANOTECHNOLOGY SAFETY MEETING

WASHINGTON, April 18, 2006 -- Anyone who believes that nothing big ever came of being small probably hasn't paid attention to controversies involving nanotechnology safety. But the US Food and Drug Administration (FDA) along with formidable research groups in the US and abroad has. The FDA announced last week it will hold a public meeting this fall to gather information about developments in uses of nanotechnology materials in FDA-regulated products.

Also this month, the Project on Emerging Nanotechnologies (a partnership between the Woodrow Wilson International Center for Scholars and the Pew Charitable Trusts), Rice University, the International Council On Nanotechnology (ICON) and Environmental Defense (a New York-based environmental research and advocacy nonprofit) co-sponsored a workshop on engineered nanomaterials and human health hazards. ICON, a coalition of academic, industrial, governmental and civil society organizations, is administered by Rice University's Center for Biological and Environmental Nanotechnology (CBEN).

At the workshop, a multidisciplinary group of more than two dozen scientists was asked to address two questions: "In light of the special physical, chemical, and biological properties of engineered nanomaterials, what information is needed to assess the human health hazards of nanomaterials that are currently in or likely soon to reach commercial production?" and "How can information needed to assess [such hazards] be obtained most expeditiously and efficiently?" A report with outcomes of the workshop will be published later this year.

Nanotechnology, a branch of science devoted to the design and production of extremely small matter, is described by the National Nanotechnology Initiative as "the understanding and control of matter at dimensions of roughly 1 to 100 nanometers (nms), where unique phenomena enable novel applications." (A nanometer is one billionth of a meter; a human hair is roughly 100,000 nms wide.)

**'Great Potential'** - According to an FDA statement, "Due to the small size and special properties of nanotechnology materials, they have great potential for use in a vast array of FDA-regulated products. These small materials often have physical or chemical properties that are different than those of their larger counterparts. Differences include altered magnetic properties, altered electrical or optical activity, increased structural integrity, and enhanced chemical and biological properties. These differences have the potential to lead to scientific advances. For example, nanotechnology could be used to create new drug formulations and routes of delivery to previously inaccessible sites in the body."

The need to improve understanding of nanomaterial hazards was highlighted by the reports that Magic Nano led to more than 100 calls over a 10-day period to poison control centers in Germany, Switzerland and Austria and to the product maker from people experiencing respiratory problems.

Magic Nano was recalled by the manufacturer, Kleinmann GmbH (a subsidiary of Illinois Tool Works) after BfR issued a product warning on March 31. Between March 27 and 30, 97 people who reportedly used the aerosol spray claimed to suffer from health problems from trouble breathing to six cases requiring hospital treatment in which water accumulated in the lungs (pulmonary edema).

The product was very quickly withdrawn from the market, and consumers were warned not to use it. An alert sent out by Germany's Federal Institute of Risk Assessment (BfR, for Bundesinstitut für Risikobewertung) said, "The relevant regional authorities and toxic control and treatment centers of the federal states have issued warnings about two products which were sold in Penny stores, according to the manufacturers. The distributors have launched a recall and advised against using the sprays. As the exact cause of the health disorders still has to be established, BfR advises all consumers who have already purchased nano-sealing sprays on a propellant base, not to use them in confined spaces." The BfR said, "The distributors of the two sealing sprays were unable to supply the full formulations because information was missing from their upstream suppliers. A definitive toxicological assessment of the acute pulmonary disorders following use of the two products was not, therefore, possible in the scientific discussions."

**Droplet Size is Key** - Experts do not rule out the possibility that "the toxic effects observed in connection with the application of the two nano-sealing sprays containing a propellant during the period in question may have been caused solely by application as an aerosol spray. As it is not known whether nanoparticles in the aerosol also reached the patients' lungs and damaged the alveolar tissue, a possible involvement of these particles has to be elucidated."

Andrew Maynard, science advisor to the Project on Emerging Nanotechnologies, is an internationally recognized expert on airborne particles. According to Maynard in a press release from the project, aerosol sprays can produce respirable particles a few µms in size that can remain airborne for long periods of time and can reach the sensitive deep lung if inhaled. Once deposited, there is the possibility that

chemicals or nanoparticles (if present) in the droplets can cause damage.

Last month, the Project on Emerging Nanotechnologies issued the first public, online inventory of more than 200 consumer products that manufacturers claim are made with nanomaterials or that use nanotechnology ([www.nanotechproject.org/consumerproducts](http://www.nanotechproject.org/consumerproducts)). Ten products in the inventory are described as "sprays," but most are pump-action sprays. Magic Nano is the only known, maker-identified nanotechnology product available to consumers in the form of an aerosol can. "Pump-action sprays typically form droplets that are much larger than those from aerosol cans," said Maynard. "These are less likely to reach the sensitive deep lung when inhaled."

**'Wakeup Call,' Nano or No** - Irrespective of whether the "nano" here is the root of the health problem, a contributing factor or a false lead, Maynard said, he sees this incident as a wakeup call. "Other companies using or hoping to use nanotechnology should take note: Without greater transparency on what nanomaterials are being used, how their safety is being evaluated and appropriate research into nanotechnology's potential human health and environmental impacts, it is difficult for consumers and policymakers to separate the responsible companies from the less responsible ones, and the safe nano-products from the potentially harmful ones."

Andreas Hensel, president of the BfR, said, "These incidents have demonstrated that the introduction of new technologies in consumer products must be coupled with an assessment of the possible risks arising from their use. It is incumbent on science to communicate this message to consumers, as well."



International Conference and Exhibition  
**Materials and Austceram**  
4th - 6th July 2007, Sydney, Australia



## Materials and Austceram - About the Conference

### About the Conference

The Institute of Materials Engineering Australia trading as Materials Australia and the Australasian Ceramics Society (ACS) invite you to attend the biennial International Conference on Materials and Austceram (Austceram), MC2007, to be held in Sydney from July 4 - 6, 2007.

Materials Australia and the Australasian Ceramics Society biennial Materials and Austceram conference is Australia's largest interdisciplinary technical meeting for the communication of the latest advances in materials science, engineering and technology. It is a meeting place for researchers, academics and industry practitioners, who originate from all disciplines and sectors. It is an opportunity to showcase innovation, practical application and cutting edge research, and to network, share ideas and interact with colleagues.

In 2007, the Advanced Materials and Austceram Conference will be held in Sydney in July, providing a balance between established, vital materials fields and emerging areas. We aim to present a highly stimulating and productive conference, where the program will include:

- plenary lectures given by prominent figures in the Materials and Austceram field, including some highly regarded international speakers;
- well-balanced technical symposia consisting of oral presentations with appropriate invited speakers;
- poster sessions conducted with both dedicated time for discussion with the authors at the posters and prizes for the top poster presentations;
- an exhibition held in conjunction with the conference, featuring exhibitors from different sectors of the materials science and engineering communities, where attendees may learn about the latest advances in Materials Technology directly from industry representatives, manufacturers and suppliers.
- Opportunities for focus groups to meet and convene discussions on the status and future directions of their fields. These might involve researchers from ARC networks, Major National Research Facilities (MNRF's), Centres of Excellence or Cooperative Research Centres (CRC's). These could also involve policy groups or foresighting exercises on particular topics.
- A social program, providing an opportunity for introductions, catching up, networking and exchanging ideas.

Strong communication links are essential across an increasingly interdisciplinary Materials community, and the vision of Materials Australia is for the biennial Materials Conferences to become known as Australia's premier domestic, interdisciplinary Materials and Austceram event.

## Exhibition

There will be an exhibition held in conjunction with the conference. Enquires can be addressed to Materials Australia.

## Call for Papers - Austceram 2007

### Instructions to Authors:

Abstracts should be no more than 250 words and in Microsoft Word. They should be sent by e-mail: [erv@ansto.gov.au](mailto:erv@ansto.gov.au) by 15th September 2006.

Members of the Technical Committee and other experts will referee abstracts and completed papers. Scientific papers will be peer reviewed and published in the Journal of the Australasian Ceramic Society.

### Important Dates

**Abstracts Due:** 15th September 2006

**Paper Due:** 1st December 2006

## Technical Focus

Suggested streams and technical champions are:

- **Advanced Ceramics:** *Mark Hoffman, UNSW*
- **Advanced Characterisation Techniques:** *Simon Ringer, USyd*
- **Bioceramics:** *Besim Ben-Nissan, UTS*
- **Biomaterials:** *Hans Costel, USyd; Andrew Ruys, USyd*
- **Cements/Geopolymers:** *Grant Lukey, Siloxo Ltd*
- **Composites:** *Yiu-Wing Mai, USyd*
- **Computational Materials Science:** *Cathy Stampfl, USyd*
- **Energy-based Ceramics:** *Chris Sorrell, UNSW*
- **Electronic, Photonic and Magnetic Materials:** *Jim Williams, ANU; Shane Huntington, UMelb; Kiyonori Suzuki, Monash*
- **Functional Ceramics:** *John Bartlett, ANSTO*
- **Hybrid Ceramics:** *Yibing Cheng, Monash*
- **Industrial Ceramics:** *Cathy Inglis, Austral Bricks, Ltd*
- **Light Metals:** *Barry Muddle, Monash; Graham Schaffer, UQ*
- **Mechanical/Thermal Properties:** *Mike Swain, USyd*
- **Materials for Energy and The Environment:** *Chris Sorrell, UNSW*
- **Nano-materials:** *Michelle Simmons, UNSW*
- **Polymers:** *Gordon Wallace, UoW*
- **Processing:** *Phil Walls, ANSTO*
- **Raw Materials:** *Ian Stewart, Unimin, Ltd*
- **Surface Engineering/coatings and films:** *Marcela Bilek, USyd; Mark Hoffman, UNSW*
- **Technical Innovations in Steels:** *Elena Pereloma, Monash*

## VISIBLE CRYSTALS

*Janet Hamer outlines the new glazes of Avril Farley and describes how these sculptural crystal shapes are formed.*



We are all keen to make a mixture of minerals, take it to a temperature and wonder at transformations –or we should be. It is like pushing seeds into a garden and, with a bit of nurture, flowers open and spread their colours. Making crystals is like that: a lot of science, patience and beauty. Large crystals grown in a glaze even look like flowers. They often resemble lichens and three-dimensional fans and feathers.

Crystalline glazes are those in which the oxides in the melt reform in new associations as the glaze cools to give a glass with crystals visible at the surface. A mass of crystals too small to be seen individually can give opacity and matt surfaces. Larger crystals can be grown upwards of 15 cm, appearing to float in a glassy matrix. These wonderful shapes, of distinctly different colour from their background are the result of manipulating the glaze formula and the cooling rate of the kiln. This is the science and the patience. The beauty manifests itself magically from these processes.

Typical crystal shapes are soft flat rounds which may impinge on each other in clusters, modifying the symmetry. A central star or bundle of needles can be seen in a smooth area before a fibrous ring fans out as

a halo. Further haloes edge the shape where it meets the background glaze or matrix. The whole of this shape is coloured by the penetration of a colouring oxide into the crystal and is clearly seen against the background. There is often a delicate fringe of a slightly different colour where crystal meets matrix. The haloes can be deliberately placed centrally or around the border of the crystal. Where the glaze is thicker, as in the well of a bowl, the three-dimensional forms can be seen as fibrous fans filling the depth. Time is needed during the cooling of the glaze for crystals to form.

In the early stages of cooling, if the temperature is held around 1090°C for approximately two hours, the crystals begin as simple needle shapes. These can fan out at each end into ‘double-axehead shapes’. These attractive and intriguing crystals can be retained, frozen at this stage by cooling the kiln rapidly after this growing period. The fuller rounder shapes develop when the temperature is subsequently maintained for further crystal growing periods. These periods, or pauses, are programmed into the cooling graph of the kiln controller and may last from three to eight hours.

*Porcelain is often the choice of body for use with crystalline glazes. Bright colours show up well and there is little contamination from the body during the slow cooling. The main glaze constituent is a frit. This provides most of the glass which melts at the appropriate temperature.*

#### **Ferro frit 3110 analysis**

*Silica (SiO<sub>2</sub>) 69.8 Sodium oxide (Na<sub>2</sub>O) 15.3 Calcium oxide (CaO) 6.3 Aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) 3.7 Boron oxide (B<sub>2</sub>O<sub>3</sub>) 2.6 Potassium oxide (K<sub>2</sub>O) 2.3*

#### **Avril Farley glaze recipes:**

*1. Ferro frit 3110 47  
Calcined zinc oxide 23 Calcined china clay 3  
Flint 23 Titanium oxide 4*

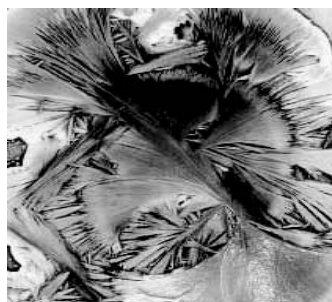
*2. High Alkaline Frit 2275 46  
Silica 18  
Zinc oxide 24  
China clay 40  
Titanium oxide 8*

*Oxides of copper, cobalt and manganese are added totalling a maximum of 8%.*

Each glaze component has a particular role but these are not single elements and their contributions overlap. The frit is designed to make the glaze melt quickly at top temperature. This presents a fully molten mix which is immediately ready for the new bondings to be formed. The rapid firing up to and down from the top temperature avoids the formation of a body-glaze layer which inhibits the forming of large crystals. Zinc oxide combines with flint and provides the zinc silicate for large crystals. The china clay gives stability and hardness to the final glaze. The flint is almost pure silica. It can be a different type from that provided by the frit for the main glassy ingredient and supplies nuclei for crystals. Titanium oxide contributes nuclei as 'seeds' for the initiation of crystals. It also brightens colours and assists the movement of colour in the glaze.

The oxides (or carbonates which lose their carbon and excess oxygen in the fusion) of copper, cobalt and manganese, colour the glaze matrix, or the crystals, or sometimes both in specific ways, according to their 'field strengths'.

Crystals grow in the cooling glaze by the isolation of particular oxides from the surrounding glaze. Zinc silicate is most often the material of large crystals. In the molten glaze the molecules of the glaze minerals are loosened from their original combinations giving a fluid mixture of individual molecules. In a normal glaze, as cooling begins, these molecules link together to form irregular chains. This creates the amorphous substance, glass. For crystals to develop, the temperature is held for those periods when molecules orientate into more specifically organised chains. They establish bonds which produce lattice structures which are the framework of crystals. The unsatisfied valencies existing in the melt link to sites where they form new combinations.



*Left: This complex crystal shows the fan-like growth and three-dimensional appearance in the depth of glaze. The blue staining of the crystal is incomplete due to the small percentage of cobalt oxide in the recipe. The pot was glazed first with a Ferro Frit-based glaze and over this a High Alkaline Frit 2275 base glaze. Each one contained 0.5% cobalt oxide and 3% manganese carbonate.*

Crystal formation is a selective process. As some constituents are precipitated, the remaining matrix is changed. The isolation of some of the constituents upsets the previous balance. Some of the remaining oxides can no longer remain unattached. They combine as larger molecules and stiffen the matrix. The matrix then sets quickly and crystals can no longer develop.

There are orders and preferences for how the molecules which jostle freely in the melt will re-bond into new lattice structures. Each element is characterised by a value number or valency. This number is based on the number of electrons in each atom and establishes its combining power. Valencies are balanced to match. For example, hydrogen is 1, oxygen is 2, therefore two hydrogen atoms are needed to match one oxygen, giving the familiar chemical symbol H<sub>2</sub>O (water).

The elements which are frequently used to colour the zinc silicate crystals are cobalt, manganese and copper. They have valencies of cobalt 2 and 3, manganese 2, 3 and 4, and copper 1 and 2. They have 2 in common with zinc and therefore compete for the same sites when new combinations are being formed. In the Periodic Table the colouring elements are grouped together as 'transition' elements. Other elements in this grouping have similar properties and are likely to be useful in a similar way. There are further rules which govern the selective process by which crystals are positively coloured, why blue on an ochre ground predominates whereas green can be subtly combined. The electrons of the atoms, which are negatively charged, exert forces of attraction or repulsion on others which are in close proximity. This activity is referred to as an energy field. Colour separation is explained in the following

extract from the section on crystalline glazes in The Potter's Dictionary:

*In order to colour the precipitating zinc-silicate crystals, the colouring oxides must be able to fit into the lattice structure. To enter the crystal, the metal colouring atom must be able to occupy one of the six sites otherwise held by zinc in the zinc-silicate lattice. Cobalt, nickel, copper, iron and manganese are transition metals and are adjacent to zinc in the periodic table. They are polyvalent and can be divalent to match zinc. Their atom sizes are also similar to that of zinc. Therefore all these metals can enter and colour the crystals.*

The reason for the order of precedence is that they have different liquid-to-crystal partition co-efficients, or field strengths. Cobalt oxide and nickel oxide have high field strengths. Manganese oxide is intermediate and copper oxide is low. Zinc oxide has a higher field strength than does copper oxide and, therefore, copper oxide tends not to partition strongly but will stain both the matrix and the crystals at the same time.

Avril Farley's production consists of thrown plates, bottles and bowls. She prefers Limoges porcelain body, from Potteryworks. She uses a Mervyn Fitzwilliam Craftsman wheel. She does a small amount of turning to make neat footrims which accommodate the inevitable glaze run and grinding. The two 4 1/2 cu ft electric kilns are fired at night for economy with the use of two Cambridge 401+ controllers. She usually achieves two biscuit and one glaze per week, alternating with one biscuit and two glaze firings.



*This fringe-edged crystal is approximately 4 cm across. It appears in a glaze with 1.5% vanadium oxide ( $V_2O_5$ ) and 1.5% ilmenite in a Ferro Frit base glaze.*



*This glaze shows how copper oxide can give a green stain to both crystal and matrix. The oxide has 3% copper oxide and 3% barium carbonate ( $BaCO_3$ ). The barium carbonate shifts the colour towards turquoise.*

Glazes are brushed on, thicker above than below to allow for considerable glaze movement. Calcining the zinc oxide removes water and helps to avoid flaking of the glaze. A binder, 'CMC', is used to make the glaze less friable. Every pot is fired on a 'catcher' made to measure. Surplus run off glaze is contained by the 'catcher' which must be separated after firing. Glaze and foot are then ground smooth. This is a demanding process requiring specialised grinders for the particular shapes and a skilled operator who is efficiently clad in protective clothing, goggles and helmet. Every firing contains tests. New shapes show their effect on glaze run and positioning of crystals. The permutations seem infinite. Variations of amount and combinations of colouring oxides are studied in glazes with The diagram shows how feldspar, Alkaline Frit 2275 or Ferro Frit 3110, sometimes layered cobalt oxide can replace zinc together. Firing is usually to between 1245°C and 1265°C with many crystal-oxide, being the same size, growing pauses in the cooling cycle. The first at 1080°C for 30 minutes may be and fit into the lattice followed by a pause at 1060°C for 30 minutes, then a rise to 1080°C again. structure of a growing crystal There may be as many as six pauses but Farley also likes to vary the timing of of zinc silicate. these

periods to give more interestingly placed haloes.

Farley declares her approach to ceramic chemistry was instinctive. From a nonscientific early career she is now developing a firm understanding of chemistry through methodical practice and application. She enjoys the discipline which the creation of crystalline glazes demands. In a detailed directive to herself, 'The Learning Curve', she stipulates every practical rule steering a controlled course through trial and error progress.

Record keeping is unquestionable. Glaze making is precise and meticulous with thorough attention to care of equipment. Firing records include identification of all tests, positions in the kiln, weather (for its influence on cooling rates), temperature readings and digital pictures are stored. Suggestions for variations on every aspect of the making follow with practical guidance for control of glaze fusion, and ending with warnings against impatient kiln opening. Avril Farley is currently experimenting with more materials based on elements from the lanthanoid series sometimes called 'rare earths'.

## **BATHROOM, CLEAN THYSELF**

Cleaning bathrooms may become a thing of the past with new coatings that will do the job for you. Researchers at the University of New South Wales are developing new coatings they hope will be used for self-cleaning surfaces in hospitals and the home.

Led by Professor Rose Amal and Professor Michael Brungs of the ARC Centre for Functional Nanomaterials, a research team is studying tiny particles of titanium dioxide currently used on outdoor surfaces such as self-cleaning windows.

The particles work by absorbing ultraviolet light below a certain wavelength, exciting electrons and giving the particles an oxidising quality stronger than any commercial bleach. These nanoparticles then kill microbes and break down organic compounds. And because surfaces coated with titanium dioxide have another property called 'superhydrophilicity' - meaning droplets do not form - water runs straight off the surface, washing as it goes.

Presently, titanium dioxide can only be activated by the UVA present in sunlight. But the UNSW team is working on ways to activate titanium dioxide with indoor light. The team is modifying titanium dioxide nanoparticles with other elements such as iron and nitrogen so they can absorb light at longer wavelengths.

Lab trials show that glass coated with the new nanoparticles can be activated by visible light from a lamp to kill *Escherchia coli*. "If you've got this on tiles or shower screens you don't need so many chemical agents," says Professor Amal. So far the team has been working at laboratory scale. "It's probably a year before we can talk to industry and test outside the lab," says Professor Amal.

## **MIND THE NANOGAPS**

RESEARCHERS at the University of Pennsylvania have developed a method of creating tiny gaps between electrodes, which could lead to the creation of nanoscale electronics.

A number of people have proposed nanoelectronic devices that use nanogaps, but nobody has been able to create nanogaps reliably in practice," explained Marija Drndic, an assistant professor in Penn's Department of Physics and Astronomy. "For the first time, we were able to make the world's smallest and cleanest nanometre gaps that can be imaged directly with atomic resolution. These nanogaps can be used to electrically connect small objects, such as individual molecules."

Drndic said the ability to hook individual molecules – whether they are the product of nanotechnology or biotechnology – to electronic circuits is the goal of many researchers. Such systems will have applications in medicine, robotics, materials science and security. In addition, electronics on the nanoscale will be used to create denser, faster storage devices and microprocessor chips, she said.

To create these gaps, Drndic and graduate student Michael Fischbein used electron beam lithography on thin layers of silicon nitride. But instead of breaking small wires to create nanogaps, the Penn researchers made the gaps directly. "Contrary to many expectations, the thin layer of silicon nitride helped minimise the amount of electron scattering to the point where we could make clean gaps," Fischbein said.

Already, the researchers have used nanogaps to measure electrical charge through several coupled nanocrystals, which are also referred to as quantum dots.

## **CERAMITEC 2006 SHOWS THE TRENDS IN THE POWDER METALLURGY INDUSTRY**

Powder-metallurgical components are becoming increasingly popular in many areas of technology, especially thanks to their cost effectiveness and functional flexibility. PM components are characterized by a high degree of shape preciseness - this can often be achieved without reworking for complex geometric shapes - a large range of very different varieties of alloys as well as a wide range of thicknesses from extremely porous to high density.

Numerous new PM components have been developed for industry branches such as automobile, aerospace, mechanical engineering and electronics over the past decade. This include, for example, high density and high-tensile sintered parts made of iron and steel, oil-containing porous bearings, sintered filters, friction materials, highly complex injection molded parts (MIM), sintered hard metal for cutting tools and wear parts with additional hard material layers, ultra-hard diamond tools as well as PM semifinished products such as high-speed steel-heavy metals, super alloys and coated diamond tools for circuit paths.

Powdered metal injection molding has especially become more widespread over the past years. Increase rates of more than 10 percent per year are realistic for it. The threshold of one billion euros in sales was surpassed long ago. Manufacturing of high-performance components made of aluminum with PM technologies is also increasing. Engineers value the good properties of this material and the measurement and shape preciseness of PM parts on an aluminum basis. The area of magnets produced using powder metallurgy (e.g., rare earth magnets on the basis of neodymium-iron-boron [Nd-

Fe-B]) also continues to grow. Especially these materials have resulted in many improvements in the areas of communication technology, control processes, drive technology, vehicle manufacturing, metrology and medical diagnostics.

All of these applications have contributed to powder metallurgy's growth contrary to the trend in other technology sectors. Two-figure growth rates in many areas speak in favor of this highly innovative industry with a future. Annual global production of powder-metallurgical products (excluding ceramics) exceeds 30 billion euros. Hard metals have the greatest share of this with approx. 14 billion euros. PM parts on an iron basis are produced for more than six billion euros worldwide, approximately one-fourth of which in Europe. Germany has approximately a 29 percent share in the European market for iron-base PM parts. Compared to the market leader USA (40 percent market share), especially the Asian markets have grown strongly over the past three years (approx. 33 percent market share).

The PM industry is facing substantial upward pressure on prices given the drastic price increases for raw materials and energy since 2004. Based on the level of the first quarter 2004, raw material prices increased by approx. 15 percent for low-alloy powder and up to 50 percent for high-alloy powder. Further price increases for powder of up to 10 percent are expected in 2006.

The Powder Metallurgy Trade Association is going to exhibit the wide range of parts produced using powder metallurgy on an iron-base and a hard metal base at CERAMITEC 2006, 10th International Trade Fair for Machinery, Equipment, Plant, Processes and Raw Materials for Ceramics and Powder Metallurgy. CERAMITEC 2006 will take place from May 16 to 19.

Additional information and current press releases are available at [www.ceramitec.de](http://www.ceramitec.de).

About CERAMITEC CERAMITEC, 10th International Trade Fair for Machinery, Equipment, Plant, Processes and Raw Materials for CERAMICS and POWDER METALLURGY, will take place on the grounds of the New Munich Trade Fair Centre from May 16 to 19, 2006.

## **INNOVATION PROGRAM ROUND 2 OPENS THURSDAY 23 MARCH 2006**

The *Industry Cooperative Innovation Program* is a \$25 million grants program, offering project funding of \$50,000 to \$3 million. Applications are now being called for round two, which closes at 5pm AEDST on Thursday, 15 June, 2006.

The program supports business-to-business cooperation on innovation projects that enhance the productivity, growth and international competitiveness of Australian industries. The program will support projects focused on meeting strategic industry needs, with particular focus on those identified through an Action Agenda.

Action Agendas are a key part of the Australian Government's policy and place particular emphasis on identifying the actions an industry itself will take to realise its full potential. The *Industry Cooperative Innovation Program* requires a consortium to be formed from a minimum of three entities to cooperatively conduct a project on behalf of an industry. Successful applications are selected on merit and compete for limited funds.

Some positive changes to the eligibility criteria which broaden the range of entities

CERAMITEC has developed into the world's leading trade fair for the ceramic industry since its premier in 1974. The comprehensive supporting program provides an ideal overview of current trends and innovations in the ceramic market. Approximately 765 exhibitors from 41 countries and 25,000 visitors from 106 countries came in 2003.

that can apply have been made for round 2 of the program and customers are encouraged to visit the AusIndustry website for more information.

The *Industry Cooperative Innovation Program* will be delivered by AusIndustry which is the Australian Government's business program delivery division. Contact an AusIndustry customer service manager, via the AusIndustry hotline to discuss your eligibility for the program, program requirements and the application process.

For more information about the *Industry Cooperative Innovation Program* <<http://fims.com.au/sb/redirect.cfm?id=0B270B&redirect=http://www.ausindustry.gov.au/content/level3index.cfm?ObjectID=91F9C943-E61A-4075-BB6CE9989586B143^L2Parent=AEB901E5-7CB8-4143-A3BF33B2423F9DA6>> or to subscribe to the AusIndustry e-bulletin <<http://fims.com.au/sb/redirect.cfm?id=0B270B&redirect=http://ausindustry.insitec.com.au/utilities/subscriptions/subscribe.php?eid=48>> or to 'email updates' about specific AusIndustry products, visit [www.ausindustry.gov.au](http://www.ausindustry.gov.au) <<http://fims.com.au/sb/redirect.cfm?id=0B270B&redirect=http://www.ausindustry.gov.au>> or call the AusIndustry hotline on 13 28 46 for more information.

**THE 4<sup>TH</sup> INTERNATIONAL  
CONFERENCE ON  
ADVANCED MATERIALS  
& PROCESSING  
(ICAMP-4)**

**DECEMBER 10-13, 2006  
HAMILTON, NEW ZEALAND**

**THE SCOPE OF ICAMP-4**

The 4<sup>th</sup> International Conference on Advanced Materials and Processing will be held December 10-13, 2006, in Hamilton, New Zealand, on the most beautiful university campus in New Zealand.

This conference follows the previous conferences on advanced materials processing held in:

- Rotorua-New Zealand (2000)
- Singapore (2002)
- Melbourne-Australia (2004)

The conference is focused on synthesis, development and properties of advanced materials and development of novel materials processing technologies. The conference aims to provide an international forum for scientists and engineers to present and discuss new findings from their research. There will also be keynote lectures and invited talks by leading materials scientists and engineers.

The contributed presentations will be expected to be on the following topics:

**Advanced metallic materials**, including light alloys (especially magnesium alloys and titanium alloys), nanostructured and ultrafine grained metals and alloys, nanostructured metal matrix composites and bulk metallic glasses.

**Advanced polymers and composites**, including natural fibre reinforced composites and particulate composites, sustainable and biodegradable



polymers/composites, as well as interfacial engineering.

**Advanced ceramic materials**, including structural and functional ceramics as well as synthesis/processing techniques.

**Advanced functional materials**, including biomaterials, mesoporous materials and nanoparticles.

**Novel materials processing technologies** including severe plastic deformation, mechanical alloying, powder metallurgy, semi-solid processing, laser processing and surface engineering.

**Conference Location**

The conference will be held in the Academy of Performing Arts situated on campus at The University of Waikato, Hamilton, New Zealand. Hamilton is a beautiful city with a population of about 150,000. It is located ~10km from the Hamilton International Airport, ~120km south of the Auckland International Airport and Auckland City, and ~100km north of Rotorua which is an internationally famous tourist city.

**Abstract Submission**

Authors intending to present papers at ICAMP-4 are invited to submit abstracts of approximately 250 words to the conference secretariat as Microsoft Word (or MS Word compatible) file attachments via e-mail, or through the conference website. Instruction for submission of abstracts through the

conference website will be available on the conference website by February 28, 2006.

### Conference Proceedings

Papers to be presented at ICAMP-4 will first be reviewed by the organising committee and the selected papers will be included in a conference proceedings ready for the conference. After the conference, papers in the proceedings will be further reviewed by referees and selected for publication in special volumes of a refereed journal (or journals). Details of the journal (or journals) will be available at the conference website by March 2006.

### Important Deadlines

Abstract submission: May 31, 2006  
Abstract acceptance: June 30, 2006  
Manuscript submission: September 1, 2006  
Early bird registration: October 27, 2006

### Registration Fees

Early bird registration: \$750  
Standard registration: \$850  
Student registration: \$450  
(Registration fees are in NZ dollars)

### Conference Website

<http://mape.waikato.ac.nz/icamp>

### Conference Secretariat

c/o Department of Materials and Process Engineering, The University of Waikato  
Private Bag 3105, Hamilton New Zealand  
e-mail: [icamp@waikato.ac.nz](mailto:icamp@waikato.ac.nz)  
Fax: 64-7-838 4835

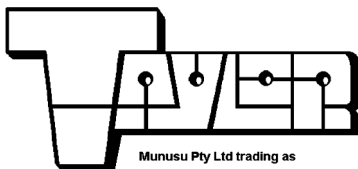
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## THE 2ND INTERNATIONAL SYMPOSIUM ON FUNCTIONAL MATERIALS

The 2nd International Symposium on Functional Materials will be held in Hangzhou, the most beautiful city in China. The symposium attempts to share in the latest innovations, advances and future multidisciplinary research and development in functional materials with primary focus on the connection between fundamental science, engineering applications and commercialization of the materials. The Conference aims to assess the current status and to identify future priority and directions in research, design and applications of ferroelectric and ferromagnetic materials, magneto-optical materials, thermoelectric materials, shape memory materials, fuel-cell and battery materials, and other related advanced functional materials.

This conference provides an ideal platform and excellent opportunity for researchers and experts in advanced functional materials from around the world to exchange research ideas and practical experiences.

English is the official language of the symposium.

### Scope:

#### Materials

- Ferroelectric and multiferroic materials
- Ferromagnetic materials
- Energy storage materials
- Magneto-optical materials
- Optoelectronic materials
- Shape memory materials
- Thermoelectric materials

### Science, technology and applications

- Computational science of functional materials
- Design and modeling
- Size effect of ferroelectric properties
- Domain structures and engineering
- Innovation in micro and thin solid batteries
- Processing technologies of nanostructures, and nano- tubes and rods
- Thin film science and technology
- Advanced laser processing
- Application in data storage, sensors and actuators
- Application of functional materials in micro- and nano-technologies

### Key Dates:

|   |                 |
|---|-----------------|
| Abstract due                            | 1 October 2006  |
| Notification on acceptance of abstracts | 1 November 2006 |
| Full paper due                          | 1 March 2007    |

### Registration

|                            |                  |
|----------------------------|------------------|
| Early bird registration by | 28 February 2007 |
| Standard registration from | 1 March 2007     |

### Contact

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- The site administrators receive a revenue share of 30%.
- This revenue share will apply throughout the on-line published life of the individual article or paper.

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The International Foundation for the Advancement of Technology (AD-TECH) is a not for profit organisation based in Sydney Australia and publisher of "Advances in Technology of Materials and Materials Processing Journal"



[www.azom.com](http://www.azom.com)

**AZoM's Mission**

The aim of AZoM is to become the primary materials information source for the engineering and design community worldwide. It also aims to be the primary publicist of news, views and developments within the materials science community. However, unlike many other materials related organisations AZoM is totally focussed on the needs of the end users of materials. To achieve this aim, all of the educational, informative and news content on AZoM is easy to access and search and is provided on a free of charge, no subscription, no charge per article, totally free basis.

## CALENDAR OF EVENTS

### **CIMTEC 2006**

*June 4-6 Acireale Sicily Italy*

### **FIRST INTERNATIONAL CERAMIC CONGRESS (ICC),**

*June 25- 29, 2006, Toronto Canada. ([www.ceramics.org/meetings/icc](http://www.ceramics.org/meetings/icc))*

### **COLORADO CONCRETE 2006 - Nanotechnology of Concrete**

*November 5-9, 2006, Denver Colorado. ([k.sobolev@gmail.com](mailto:k.sobolev@gmail.com))*

### **4<sup>TH</sup> INTERNATIONAL CONFRERENCE ON ADVANCED MATERIALS AND PROCESSING (ICAMP-4)**

*December 10 – 13, 2006, Hamilton, New Zealand. (<http://mape.waikato.ac.nz/icamp>)*

### **2<sup>ND</sup> INTERNATIONAL SYMPOSIUM ON FUNCTIONAL MATERIALS**

*May 16 – 19, 2007, Hangzhou China. . (<http://serve.me.nus.edu.sg/isfm2007>)*

### **MATERIALS AND AUSTCERAM INTERNATIONAL CONFERENCE AND EXHIBITION**

*July 4 – 6, 2007, Sydney Australia.*

## CORPORATE MEMBER PROFILE



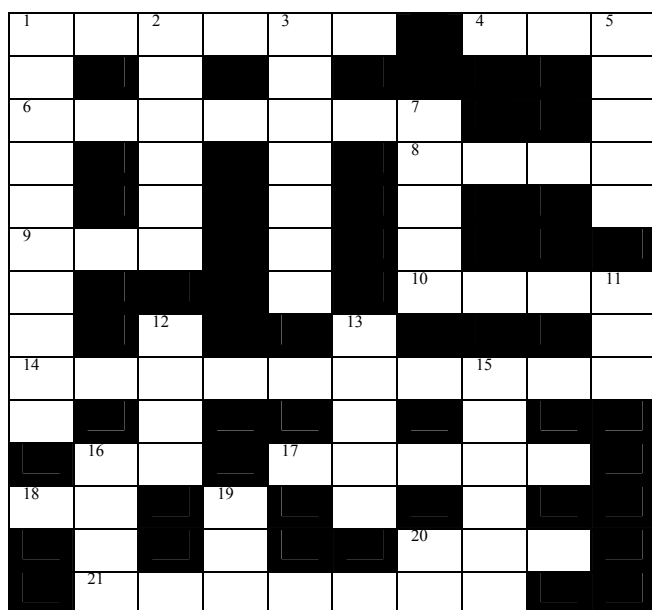
Doral Mineral Sands Pty Ltd was established in 2001 to acquire, mine and process heavy mineral sands near Dardanup and at Picton, respectively about 20km and 10km east of the coastal City of Bunbury in Western Australia.

The company is a wholly owned subsidiary of Perth-based Doral Mineral Industries Limited, itself an unlisted public company owned by Iwatani International Corporation of Japan. Iwatani is a major industrial company listed on the Tokyo, Osaka and Nagoya stock exchanges. Its main business areas are energy and housing, industrial gases, machinery and materials. Iwatani has been a major trader of zircon, one of the

products produced from Dardanup, for over 30 years.

In June 2001, Doral committed over \$A30 million to the Dardanup Mineral Sands Project. This involved the acquisition of the mineral rights, mine site, exploration and support and administration facilities. This was completed and continuous 24 hours a day open cut mining and processing began in mid-2002. The first zircon shipment to customers in India and China left through the Port of Fremantle in August 2002. The first ilmenite shipment left from Bunbury Port the following month. Doral Mineral Sands produces about 110,000 tonnes of ilmenite per annum, 10,000tpa leucoxene and 10,000tpa zircon, all for export.

## CRYPTIC CROSSWORD



### ACROSS

- 1 Shiny or not it's about desire (6)
- 4 Pipe player back after a sleep (3)
- 6 If in attempt after six goes glassy (7)
- 8 Electrical units in the mosh pit (4)
- 9 Science network in Las Nueves (1,1,1)
- 10 Hard bits are rummy (4)
- 14 They cover everything in a glassy sort of way (10)
- 16 Identification is not about ego (2)
- 17 Non-reactive in finer type (5)
- 18 Pal loses soft metal (2)
- 20 Boy is alternative to 19 down (3)
- 21 A hundred fast with a party for a green glaze (7)

### DOWN

- 1 A vile git, no separating the fine from the coarse (10)
- 2 South African act is out of this world (6)
- 3 I won bar colourfully (7)
- 5 Viscosity measure has deportment (5)
- 7 His modulus isn't old (5)
- 11 Droop up for an atmosphere (3)
- 12 Heavy metal doesn't follow (4)
- 13 Silica nodule can start a fire (5)
- 15 The Industrial Relations Commission is in the area with no east for a hard mineral (6)
- 16 I lack a thousand for this lab accreditation mob (1, 1, 1, 1)

- 19 The power of a ringing instrument less 50 (3)
- 20 Sulphur, Oxygen It's just a story (2)

First correct entry opened receives a \$20 book token from Angus and Robertson.

Send your entries to the editor

Ms C. Inglis  
PO Box 6550  
Wetherill Park  
NSW 1851

Congratulations to our last winner:

Lou Vance

### Last Editions Answer

|   |   |   |   |   |   |   |   |   |   |   |   |   |  |  |
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| S |   | I |   | N |   | O |   | E |   |   |   |   |  |  |
| O | R | T | H | O | C | L | A | S | E |   |   |   |  |  |
| S |   | R |   | R |   | E |   | T | U | N |   |   |  |  |
| T |   | O |   | T |   |   |   | K |   | T |   |   |  |  |
| A |   | G |   | H | A | L | I | D | E |   |   |   |  |  |
| T |   | E |   | I |   |   |   | L | O | C | H |   |  |  |
| I | G | N | I | T | I | O | N |   |   | T |   |   |  |  |
| C |   |   |   | L | E | A | D |   |   | H | I | P |  |  |
|   | T |   |   | A |   | E | I | S |   |   |   | C |  |  |
| B | A | R | C | H | A | N |   |   |   |   |   |   |  |  |

## CORPORATE MEMBERS

ALCOA Australia Ltd  
Applecross



Austral Bricks  
Wetherill Park



Australian Fused Materials  
Rockingham



AZoM.com.P/L Sydney  
NSW 2000



Carpenter Advanced Ceramics  
Clayton  
VIC 3168



Engineered Materials for a Changing World

Ferro Corporation Australia P/L  
Moorabin



Holmesglen Institute of TAFE  
Chadstone



Iluka Resources Ltd  
Perth WA



ILUKA

Mowatt Refractories  
Rockingham

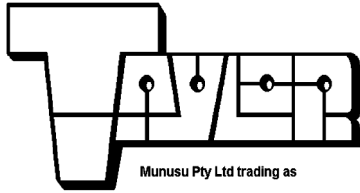


Rojan Advanced Ceramics  
Spearwood, WA

Selkirk Brick P/L  
Ballarat



Taylor Ceramic Engineering  
Mortdale



Tiwest P/L  
Muchea



Unifrax AUSTRALIA LTD  
Thomastown



Unimin Australia LTD  
Parramatta



Warman International Ltd  
Artarmon



GFC Kilns

Dandenong Vic

J C Smale  
Mount Waverley Vic



Pyrotek  
Auckland NZ



Imerys  
Auckland NZ



KC Industries  
Croydon NSW

K.C. Industries PTY LTD

Bisley & Co  
Chatswood NSW



James Hardie Research  
Rosehill NSW



Doral Mineral Sands Pty Ltd



# THE AUSTRALASIAN CERAMIC SOCIETY

## THE SOCIETY

The Australasian Ceramic Society is an organisation that works towards furthering all aspects of ceramics - science, industry, research, trade and in art. The society aims to bring together all those interested and involved in ceramics for mutual cooperation and the exchange of knowledge and ideas.

## FEDERAL COUNCIL OFFICERS

The Society has a Federal Council comprised of representatives from the member branches. These are in New South Wales, Victoria and Western Australia and each operates autonomously with its own Committee. There are corresponding Secretaries in Queensland, South Australia and New Zealand.

## ACTIVITIES

### Meetings

Regular meetings are held by the member branches. The meetings are usually comprised of informal social gatherings and lectures by invited speakers. Occasionally, there are joint meetings with kindred societies.

### Conferences

The Society holds its AUSTCERAM conferences every two years. Since 1988, the AUSTCERAM conferences have become events on the international conference agenda. The conferences cover all aspects of the ceramic area and present both new work and reviews.

### Scholarships & Prizes

Several Society scholarships and prizes are given to students undertaking courses in ceramics at tertiary level.

### Awards

The Australasian Ceramic Society Award is given every two years to a person who has made a major contribution to ceramics in Australasia. The award encompasses all fields of ceramics. Eligibility is not restricted to Society members. There are also other awards, as determined by the Council.

## Excursions

Visits are regularly organised to ceramic research establishments, manufacturing plants, raw material deposits and so on, often in conjunction with Technical Meetings.

## PUBLICATIONS

### Journal

The Journal of the Society is circulated internationally with a particular concentration in the Australasian region. It contains papers on original ceramic research and industrial development as well as review articles. It is published twice annually and is sent free to members. The Journal may be subscribed to independently of Society membership.

### Newsbulletin

The Newsbulletin is the Society's vehicle for news, information and comment. It contains notices, reports of Society activities and other events, letters, articles, opinions, news of members, industry news and other items of interest and concern. It is published four times a year and is sent free to members. Advertising in the Newsbulletin is available to members and others.

### Conference Proceedings

Conference proceedings contain the papers presented at the AUSTCERAM conferences and are a comprehensive record of progress and developments in ceramics both in the Australasian region and internationally.

### FASTS

The Australasian Ceramic Society is a member of The Federation of Australian and Technological Societies (FASTS). FASTS represent the interests of some 60,000 scientists and technologists in Australia.

FASTS works to influence the formulation of science and technology policy to the economic, environmental and social benefit of our nation.

## MEMBERSHIP INFORMATION

Membership is open to all individuals, companies and associations. There are five categories of membership.

### Member

Benefits of Membership include automatic subscription to the Journal, receipt of the Newsbulletin, and notices of Society activities.

### Corporate Member

Corporate Members may nominate two representatives as members and receive free advertising space in a Society publication on one occasion.

### Honorary Life Member

This is an honour awarded by the Federal Council to members who have given long and distinguished service to the Society.

### Retired Member

Persons who have retired from their profession may apply for Retired Membership at a reduced fee. Retired members receive all the benefits of members.

### Student Member

Full time students are entitled to Student membership at a reduced membership fee. Student members receive all the benefits of Membership.

## CURRENT ANNUAL MEMBERSHIP FEES

|                        | Cost     | GST     | Total    |
|------------------------|----------|---------|----------|
| One time joining fee   | \$10.00  | \$1.00  | \$11.00  |
| MEMBER                 | \$80.00  | \$8.00  | \$88.00  |
| CORPORATE MEMBER       | \$200.00 | \$20.00 | \$220.00 |
| RETIRED MEMBER         | \$40.00  | \$4.00  | \$44.00  |
| STUDENT(no journal)    | \$15.00  | \$1.50  | \$16.50  |
| STUDENT (inc. journal) | \$25.00  | \$2.50  | \$27.50  |

\*No GST for overseas members



## NEWSBULLETIN ADVERTISING CHARGES

The costs for 1/4, 1/2 and full page advertisements in the *Newsbulletin* are \$400, \$600 and \$940 respectively. In addition to this full page colour advertisements cost \$1400. Advertisements are published in the *Newsbulletin* for one year (4 issues).

Companies which advertise in the *Newsbulletin* receive an automatic link to their homepage in the website of the Australasian Ceramic Society.

Please contact the Editor of the News Bulletin if you are interested in advertising in the *Newsbulletin* and receiving a link to your website.



# Australasian Ceramic Society

ABN 81 000 468 708  
C/o ANSTO, PMB 1 Menai, NSW 2234, Australia

## Membership Form

### Member Details:

|                      |  |
|----------------------|--|
| Title                |  |
| Surname              |  |
| First Name           |  |
| Company/Organisation |  |
| Street Address       |  |
| Town/Suburb          |  |
| State                |  |
| Post Code / ZIP      |  |
| Country              |  |
| Phone (Business)     |  |
| Phone (Home)         |  |
| Email                |  |
| Fax                  |  |
| Membership Type*     |  |

\*(Member, retired member, corporate member, student member)

### For Corporate Members Only, Please State Company Nominees

|          |  |      |  |
|----------|--|------|--|
| 1. Title |  | Name |  |
| 2. Title |  | Name |  |

### Cost for Membership

|                                 |               |
|---------------------------------|---------------|
| One-time Joining Fee:           | AUD \$11.00   |
| Membership Fee (Including GST): | AUD \$        |
| Donation to Scholarship Fund:   | AUD \$        |
| Postage**                       | AUD \$        |
| <b>TOTAL AMOUNT DUE:</b>        | <b>AUD \$</b> |

\*\* (Outside Australia or New Zealand add \$15 for airmail postage, otherwise surface mail)

Please tick:  I wish to receive the Journals

### Method of Payment

Please tick:  Cheque enclosed (Please make cheques payable to the Australasian Ceramic Society)  
 Credit card  
 Money Order enclosed  
 A receipt is required

### Credit Card Details

Charge the following credit card:  VISA  MASTERCARD  BANKCARD  
 Card No.: \_\_\_\_\_ Valid until: \_\_\_\_\_ Today's Date: \_\_\_\_\_  
 Name on Card: \_\_\_\_\_ Signature of the cardholder: \_\_\_\_\_

**Post or FAX with your Payment to:** Dr D. S. Perera ACS Federal Secretary  
 C/o ANSTO PMB 1, Menai  
 NSW 2234, Australia  
 Ph: +612 9717 3477  
 Fax: +612 9543 7179  
 Email: dsp@ansto.gov.au



**NEWSBULLETIN**  
of  
**THE AUSTRALASIAN CERAMIC SOCIETY**