Cooperative Research Centre for Polymers
Solutions for a better world

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News from the CRC for Polymers

June 2008

Welcome

"Collaborative research …provides a very effective path to timely solutions for complex problems."

in this issue

CRC AUSTRALIA

Established and supported under the Australian Government's Cooperative Research Centres Program

Collaborative research delivers advanced polymeric materials

Drs Ezio Rizzardo (left) and Simon Harrisson, Leader and Deputy Leader of the *Advanced polymeric materials* research program

The Australian Government is conducting a review of the National Innovation System. This has generated considerable discussion about the benefits of collaborative research and the best mechanisms for encouraging greater intensity for this type of research in Australia.

Collaborative research, where world-competitive teams are assembled by bringing together the complementary skills required to develop a given technology from a range of different organisations, is a very effective way to provide timely solutions to complex problems.

For companies in the Australian polymer industry, this can mean collaborating with product end users, including collaborating with those in different sectors of the economy. It can also mean leveraging off Australia's excellent skills and infrastructure for research and innovation which reside in our universities and government research organisations.

The Cooperative Research Centre for Polymers has been very effective at undertaking collaborative research between companies and research providers. It was established and is supported under the Australian Government's Cooperative Research Centres Program. It brings together 24 organisations, including nine companies, ten universities, two Government research organisations (CSIRO, ANSTO) and the Australian Stem Cell Centre to undertake research targeted at delivering major commercial outcomes.

The research is conducted in four research programs and this issue of Polymer News primarily describes the research conducted in the program on *Advanced polymeric materials*. This program is providing the advanced polymeric materials required to

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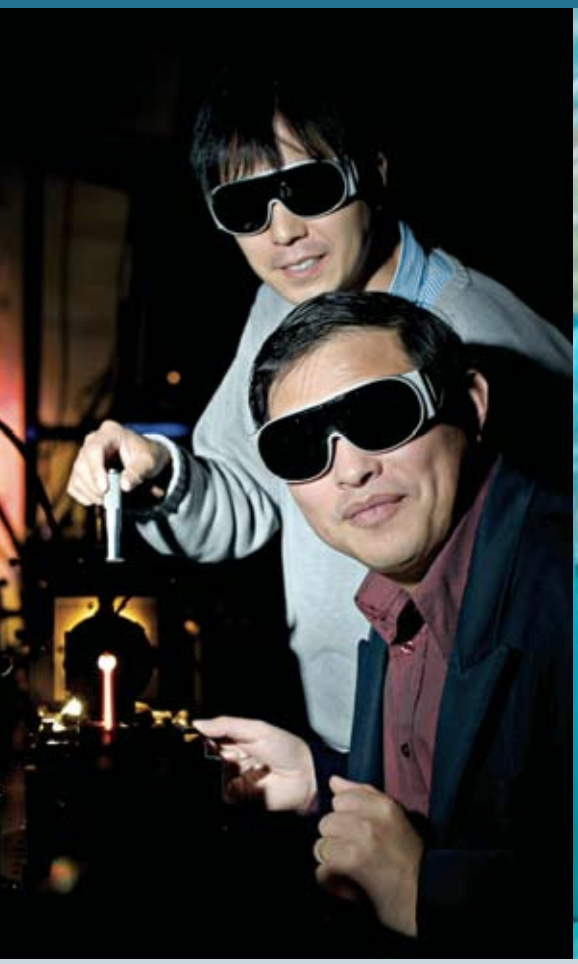
Growing an Australian polymer technolo



Members of the CRC-P team carrying out research with Advanced Polymerik: (left image) Dr James Chon and Professor Min Gu; (right image, from left) Dr Nino Malic, Ms Fran Ercole, Dr Richard Evans and Ms Kirsty Cleland

Advanced Polymerik Pty Ltd is a company that has been set up to commercialise Australian polymer research, and is conducting research through the CRC for Polymers (CRC-P) in the field of nano-engineered photoactive polymer materials.

Advanced Polymerik currently has a portfolio of 8 polymer-based technologies, most of which were developed within the CRC for Polymers during its previous funding period (1999-2005), and has commercial and licensing relationships with a number of companies including Olex, Moldflow, Visy and Ciba. As reported in the April Issue of Polymer News, Moldflow has incorporated Advanced Polymerik technology into its injection moulding software for the predictive design, and optimisation of structural performance, of injection moulded parts. Olex Australia (a Nexans Company) licenses ceramifying polymer technology from Advanced Polymerik for its fire performance Pyrolex™ Ceramifiable® single core products and the soon to be released Pyrolex™ Multicore Ceramifiable® power cable range. Ciba is currently evaluating applications for Advanced Polymerik's polyolefin nano-composite technology. Furthermore, Advanced Polymerik is working with the polymer processing and extrusion expertise of CSIRO, and in particular Dr Graeme Moad and Mr Lance Nichols, to commercialise its processing technology for the clean production and recycling of polyolefins.

Through research conducted in the previous CRC-P, Advanced Polymerik has technology for the fast switching of photochromic dyes for ophthalmic lenses, which is currently the largest market for photochromic dyes. One of the limitations in using photochromic dyes in other products is the short performance lifetimes, of around 3 years. Advanced Polymerik is currently undertaking a CRC-P project with CSIRO scientists, Dr Richard Evans and Dr Nino Malic, to improve the "lightfastness" or lifetime of photochromic dyes, with a view to broadening the potential applications for these materials.

Within the CRC-P, Advanced Polymerik has also been collaborating with CSIRO and the Centre for Micro-Photonics at Swinburne University of Technology, to develop next generation data storage technology, including the development of high density, low distortion holographic data storage materials, and a new optical drive design. Advanced Polymerik CEO, Kirsty Cleland notes, "Because of our focus on photoactive, or light-responsive materials, it has been great to be able to bring together the polymer materials expertise of CSIRO, with the optics and photonics expertise at the Centre for Micro-Photonics (CMP)."

"At the CMP, we have been working with the Centre Director, Professor Min Gu, and Dr James Chon. We also plan to work with Dr Daniel Day on a new project to develop an improved multi-colour laser-marking technology. This project would also involve Dr Simon Harrison at CSIRO, and Professor Graeme George at the Queensland University of Technology."

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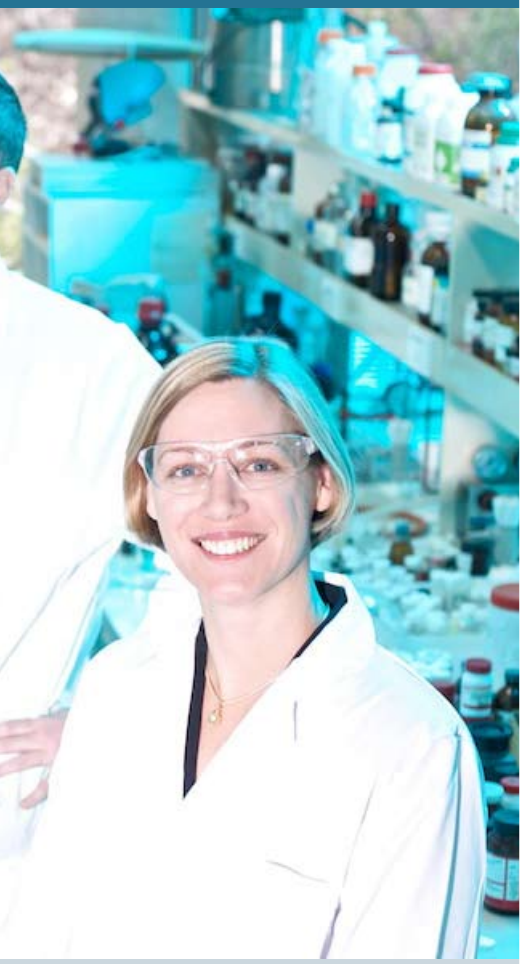
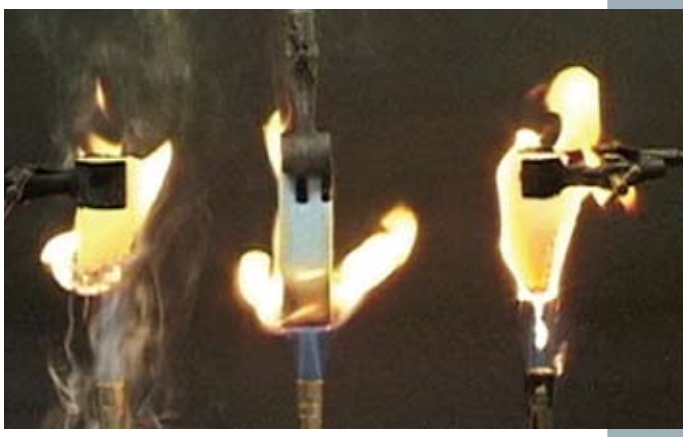


In relation to their participation in the CRC, Kirsty states, "As a start-up company, we benefit enormously from having access to some of the world's best polymer chemists and inventors. The CRC funding allows us to further develop our intellectual property, and to conduct innovative research that would not otherwise be possible."

"We now have longstanding relationships with inventors such as Dr Richard Evans, Dr Ezio Rizzardo and Dr Graeme Moad from CSIRO Molecular & Health Technologies. These scientists work with us from the point of conception of an invention or research project, conduct the research, devote significant time towards patent prosecution, and then work with us to trial and optimise the technologies with industry partners. The CRC facilitates this relationship over the lengthy research-to-product lifecycle."

Ceram Polymerik develops high performance foam fire barrier

Ceram Polymerik has developed a novel lightweight flexible polyurethane foam which, on exposure to fire, turns into a ceramic barrier that stops the propagation of the fire from one compartment of a building to the next. This technology is the result of ground-breaking research conducted at the interface of several disciplines and was conducted with the CRC for Polymers. Ceram Polymerik identified the need for the technology and is playing a critical role in the development, scale up and commercialisation of the technology. The laboratory research was conducted collaboratively between researchers in the Polymer Science Research Group at RMIT University, lead by Professor Robert Shanks and involving Dr Susan Wong, and two ceramics researchers, Professor Yi-Bing Cheng and Dr Don Rodrigo, in the Department of Materials Engineering at Monash University. Expertise in the laboratory assessment of fire performance was provided by Dr Christopher Preston from CSIRO Materials Science and Engineering.



Comparative fire performance of three polyurethane foams (from left): standard furniture foam, Ceram Polymerik ceramifying foam, and standard fire resistant foam. Fire quickly destroys the other foams, but the Ceram Polymerik foam provides a barrier material that survives for several hours.

The CEO of Ceram Polymerik, Ray Purcell, notes: "The technology developed in this collaborative research provides a very efficient way to make both flexible and rigid polyurethane foams. It has been remarkable that these light weight foams form ceramics with good dimensional stability and very desirable fire barrier properties. Now that the new technology has been protected by a patent application, we are providing foams to several companies that are keen to evaluate them. The foams have a wide range of potential applications in the passive fire protection systems of buildings."

Other technology for producing ceramifying polymers was developed in the CRC for Polymers during the period 1999-2005 and has been successfully commercialised by Olex Australia (www.olex.com.au) as insulation for their Pyrolex® Ceramifiable® high performance fire cable. Ceram Polymerik is a spin off company from the CRC-P and is commercialising the technology in non-cable applications.

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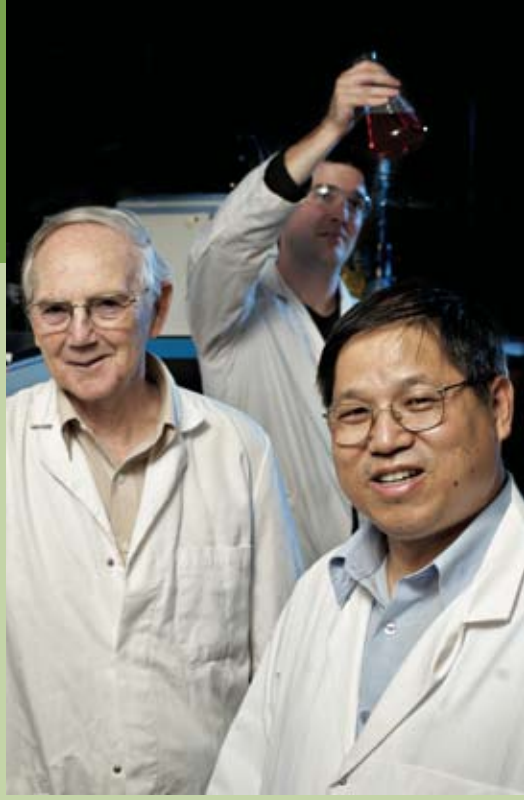
underpin growth in well-established areas of industrial and economic activity. It consists of projects developing ceramifying polymers, nanoengineered materials and polymeric additives for improving mineral processing.

The *Advanced polymeric materials* Program is led by Dr Ezio Rizzardo who is a CSIRO Fellow at CSIRO Molecular and Health Technologies and one of the longest serving members of the CRC, being its inaugural CEO from 1992-1994. Dr Rizzardo and his collaborators at CSIRO are recognised within the international scientific community as the pioneers and world leaders in developing the chemistry required to better control the synthesis of polymers by free radical polymerisation. Dr Rizzardo is the co-inventor of two of the main free radical living polymerisation methods: nitroxide mediated polymerisation and reversible addition fragmentation (RAFT) polymerisation. These two patents were in the top ten of the world's most cited patents for the period 2000-2005.

Research to boost Australia's nickel exports

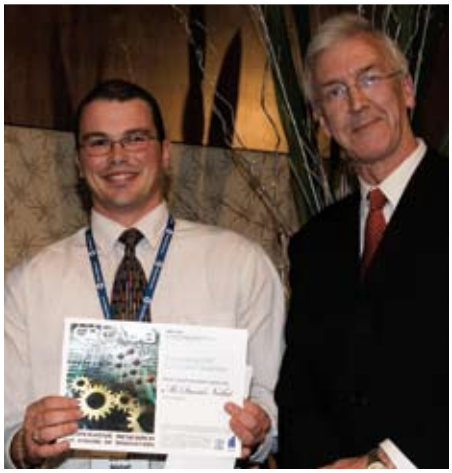
The CRC-P is conducting a collaborative project involving researchers at the University of Melbourne and BHP Billiton which is seeking to develop additives for improving the recovery of nickel ores that contain talc. The tendency for talc to float reduces the efficiency of many nickel extraction processes. The effect can be reduced to some extent by adding natural polymers such as guar gum. The process would be more easily controlled if guar was replaced by a chemically well-defined synthetic polymer with a structure optimised for changing the surface properties of talc selectively to aid its separation during the nickel extraction process.

The research conducted at the University of Melbourne is being carried out in the Polymer Science Group within the Department of Chemical and Biological Engineering by a team led by Associate Professor Greg Qiao and Professor David Solomon. Greg's research interests are in the area of synthetic polymer science and engineering. The Polymer Science Group is one of the largest university-based polymer research centres in Australia and undertakes research on various polymerisation techniques, including controlled free radical polymerisation, to synthesise novel polymeric architectures, and biodegradable and functional polymers. The novel polymers prepared by the team are designed as replacements for guar and they are being evaluated by BHP Billiton in laboratory floatation tests to identify materials suitable for larger-scale trials.



Members of the team developing additives to improve nickel recovery. From left: Professor David Solomon, Dr James Whiltshire and Associate Professor Greg Qiao

CRC-P PhD student wins major national award



PhD student David Nisbet receives his award from CSIRO Chief Executive, Dr Geoff Garrett

The annual conference of the Cooperative Research Centres Association (CRCA) was held at the Australian Technology Park, Sydney, in May 2008. The conference brought together over 300 people who are involved in the establishment, management and operation of CRCs in Australia. Every year, a plenary session is devoted to showcasing outstanding CRC early career scientists who are given the opportunity to present on their work.

This year, eight early career researchers, from a field of contending postdoctoral fellows and PhD students from more than 30 CRCs, were selected to present at the conference by a specialist panel. The panel considered written material submitted by the scientists and judged their ability to communicate effectively about their research achievements to a non-specialist audience.

David Nisbet, a PhD student with the CRC for Polymers, won the CRC Early Career Scientist Award for the best long presentation. David is undertaking his research in the Materials Engineering Department at Monash University. He presented his research on *New stem cell strategies for nerve regeneration*. David and his supervisor Dr John Forsythe have constructed a biodegradable polymer scaffold that supports neural stem cells and provides important signals to assist nerves to regrow. This technique has the potential to revolutionise nerve regeneration and provides a boost for research into Parkinson's Disease.

David explained, "The polymer-based scaffold functions in a similar way to the temporary scaffolding in building construction. After it has served its purpose, it degrades away leaving the cells to exist in their own natural matrix. My scaffolds are also being investigated by colleagues at the Howard Florey Institute and the Mental Health Research Institute of Victoria. Within these institutes I am currently investigating the performance of these nanomaterials within the body and the preliminary results are encouraging. We have demonstrated an ability to control inflammation once the materials are introduced into the body, and have managed to encourage native nerves to extend and grow through the scaffold."

David was presented with his prize – a $2,000 cheque – at the CRCA Innovation Gala Dinner by Dr Geoff Garrett, Chief Executive of CSIRO.