Cooperative Research Centre for Polymers
Solutions for a better world

polymernews
News from the CRC for Polymers

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## Welcome

***"…polymer science and engineering…will assist in transforming the use of land, water and energy resources…"***

## in this issue



CRC AUSTRALIA

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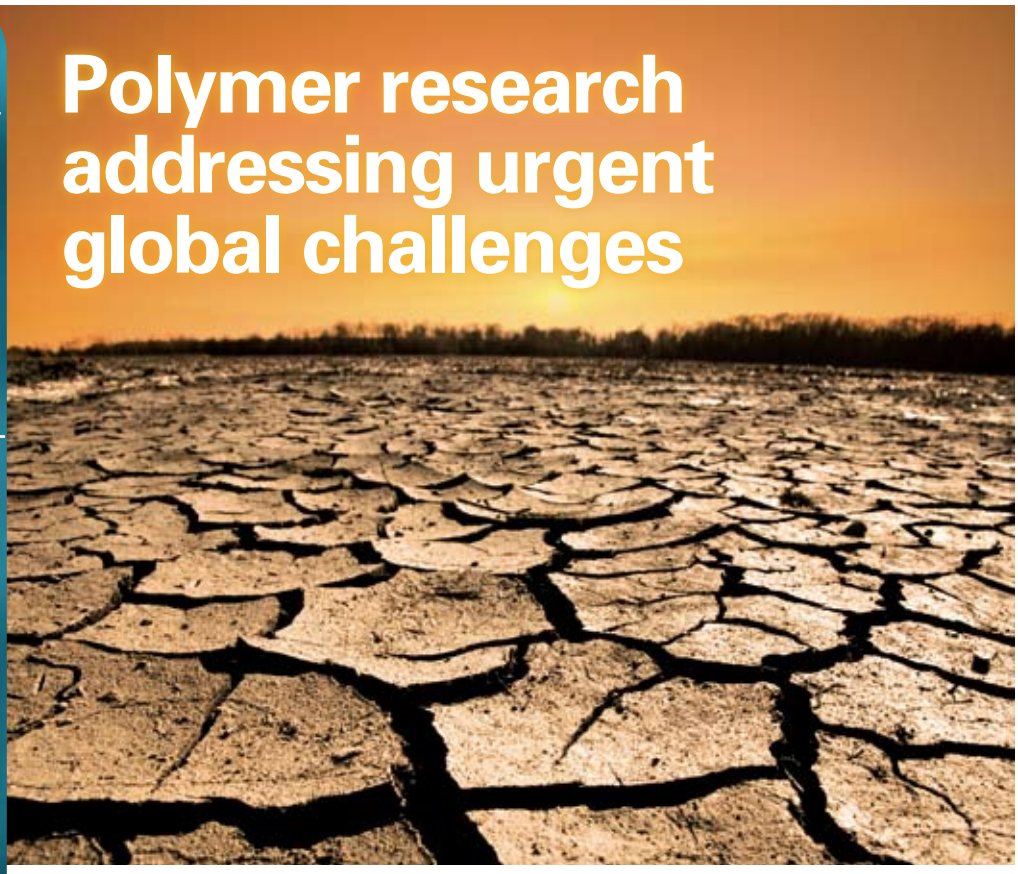
# Polymer research addressing urgent global challenges



Polymer science and engineering is playing a very important role in finding sustainable solutions to the urgent challenges facing the global community that include: meeting the food and energy needs of the planet's ever increasing population, developing technologies to reduce green house gas emissions in energy generation and transport, assisting farmers to mitigate the impacts of climate change, and ensuring adequate supplies of potable water.

The Cooperative Research Centre for Polymers (CRC-P) addresses these challenges through its research program on *Polymers for sustainable development,* and the research activities in this program are featured in this issue of Polymer News. This program aims to deliver products based on polymer science and engineering that will assist in transforming the use of land, water and energy resources, so that they can be used in a more sustainable way.

The program is led by Emeritus Professor Graeme George from the Queensland University of Technology. Professor George serves on the editorial boards of several polymer journals, is internationally renowned for his research on polymer degradation, and is a former President of the Royal Australian Chemical Institute (RACI).

"We are in a period of great technological change that requires scientists and engineers with diverse skills to collaborate and urgently find new and sustainable technical solutions," observes Professor George. "Our research program in the CRC-P exemplifies this approach and is leading to a wide range of technologies that will provide major benefits to Australia. The outcomes will be low-carbon energy production from cost-effective flexible solar cells, the wider use of biodegradable packaging derived from renewable resources, and technologies that allow adaption to climate change by making better use of water in crop production and by reducing evaporation losses from water storages."


Emeritus Professor Graeme George, QUT, Program Leader of the CRC-P's *Polymers for sustainable development* research program

# Degradable polymer film for agriculture saves water and improves crop yield

An Australian company, Integrated Packaging, has pioneered a technology that shows great promise in assisting the producers of some agricultural and horticultural crops to adapt to climate change.

At the time of seed planting, the crop is covered with a thin polymer film which forms a temporary green house, trapping in soil moisture and transpired water and raising the soil temperature for the period of 4-8 weeks that it is in place. The film then photodegrades in sunlight to allow the plants to breakthrough.

The benefits are many: higher germination rates, rapid establishment and early growth, the ability to plant the crop earlier or grow the crop in different regions, increased yields and, most importantly, more efficient use of water in crop production. Farmers in Ireland have been using Integrated Packaging's technology for many years to dramatically increase their yields of maize. In the image above, the maize crop on the right side was grown under degradable polymer film.

The CRC-P has a project that is focused on improving control of the degradation of the thin polymer film, so that the technology can be used more widely in agricultural and horticultural crop production in Australia. This will allow local producers to realise the benefits this technology can provide. The project is jointly led by Professor Peter Halley from the University of Queensland and John Cerini, CEO of Integrated Packaging. The project team members also include collaborators from the Queensland University of Technology, ANSTO and the Birchip Cropping Group.

John Cerini notes, "The CRC Program funding has allowed us, with the CRC-P, to assemble a team with the wide range of skills necessary to deliver this important new technology to the agricultural sector of the economy. The farming community is showing great interest, and successful field trials with a variety of crops have already been conducted in several states. The technology is also showing great promise for enhancing the revegetation of native plants from seed."

Degradable, thin plastic films for agriculture are being improved using the polymer expertise of Queensland scientists working in the CRC-P (from left) Greg Cash, Emilie Gauthier, Graeme George, Pete Halley and Karina George

# New materials and technologies for solar cells

At the release of the *World Energy Outlook 2008* report, the Executive Director of the International Energy Agency stated that "Current trends in energy supply and consumption are patently unsustainable – environmentally, economically and socially", stressing the need for an energy revolution that included the use of low-carbon energy sources such as solar.

The CRC-P is developing improved materials and technologies for use in the construction of cost-effective flexible solar cells. The cells are complex, multi-layered photovoltaic devices which contain a combination of materials, including polymers, that work together to convert light into electricity. Technical issues being addressed include improving efficiency and longevity, and decreasing the cost of production.

To address this challenge the Centre has assembled a multidisciplinary project team comprised of collaborating scientists from ANSTO, CSIRO, the University of NSW, Swinburne University of Technology, and the University of Wollongong. The project being led by Professor David Officer, from the University of Wollongong, who, in earlier research, has achieved major developments in the field that include designing and synthesising improved light harvesting dyes to raise the efficiency of certain types of solar cells. He notes that, "The project team is developing a deep understanding of the factors that limit efficiency, and using this knowledge to generate new materials and technologies that significantly improve the performance of flexible solar cells."

New materials for flexible solar cells are under development in the CRC-P: (from left) Mervyn Deborniol, Gerry Triani, Attila Mozer and Gordon Wallace

# Biodegradable packaging from renewable resources

Australia is well placed to become a producer of polymers derived from renewable resources. Technology for converting starch into packaging materials has been developed and successfully commercialised by Plantic Technologies, an innovative Melbourne-based bioplastics company.

Plantic and the CRC-P have recently developed a new high performance degradable plastic called Plantic® HP1. Launched this year at the Interpack 2008 trade fair held in Germany, the starch-derived material is based on non-genetically modified, high amylose corn starch and is a completely biodegradable alternative to conventional plastics derived from crude oil.

The novel bioplastic, protected by patent applications, has the superior properties necessary to expand its use into new markets. Plantic's CEO, Mr Brendan Morris, said, "This high performance sheet grade is another material in our suite of sustainable, renewable and competitively priced alternatives to conventional plastics." The advantages of higher impact resistance, smoothness and clarity mean HP1 can be used in packaging designed to showcase and display consumer products such as Easter eggs, cosmetics, razors and electronic goods like USB sticks. "Plantic® HP1 will provide our customers with another grade of material that can be used in high performance markets. It allows our environmentally conscious customers to incorporate the technology into additional markets and applications, without sacrificing on function and performance."

The CRC-P is working with Plantic Technologies to expand its suite of biodegradable plastic packaging made from sustainable, renewable resources

The development has been the culmination of several years of collaborative research within the CRC-P by scientists from RMIT, CSIRO and Plantic. The composite material has been fully characterised by various analytical methods, and significant effort has been devoted to technology transfer and production trials. With the HP1 success under its belt, this project team will continue to explore new methods to improve the properties of starch materials. Future new products and processes emerging from this CRC-P project's activities are on the horizon, and these should allow the industry participant, Plantic, to expand the use of renewable materials into more packaging applications.

# Polymer scientists design monolayers for evaporation mitigation

Climate change has resulted in substantial declines in rainfall in many regions of Australia, and growing concerns about water security and declining levels of water stored in reservoirs and farm dams. This has led to renewed interest in technologies for reducing evaporation, since in many parts of Australia these losses can be in the range of 1-2 metres per annum and are potentially avoidable.

One attractive solution is to restrict the transfer of water into the atmosphere by the application of environmentally acceptable chemicals which quickly and efficiently spread across the surface of the water to form an ultra-thin layer or monolayer. Products of this type on the market today have been shown to have variability in evaporation reduction due to wind disruption, difficulties in monitoring their presence, and the need for frequent replenishment.

The CRC for Polymers has collaborated with the Irrigation Futures CRC and the Cotton Catchment Communities CRC to advance the development and implementation of an improved monolayer technology. This activity has brought together all the skills necessary to develop the improved technology, solve the challenges of distributing, monitoring and maintaining the monolayer, and obtaining end user evaluation to determine the cost-benefits of the technology.

Researchers apply a monolayer to a trial site to observe evaporation reduction, photo courtesy of the CRC for Irrigation Futures

The research on developing the improved monolayer technology is being conducted within a CRC-P project led by Professor David Solomon from the University of Melbourne. Professor Solomon's previous achievements have included the development of the world's first plastic banknote. Professor Solomon is very optimistic about the potential of the technology, "The research is at an early stage and has already resulted in major improvements in performance. This technology can make a major contribution towards solving the looming water crisis, so there is a real urgency to accelerate its development and make it available to Australia," Prof Solomon said.

# 10th AUSTRALASIAN POLYMER SUMMER SCHOOL
## 18th-21st February 2009

**Book your place now for this outstanding opportunity to learn from the experts in their field**

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Registration costs: (prices include GST)

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| Undergraduates | $250 |
| Postgraduates | $400 |
| Postdoctoral/Other | $500 |

Visa/MasterCard preferred

The registration fee includes bus transfers from Sydney Airport, all meals and 3 nights accommodation (twin share).

**A comprehensive program is scheduled with planned topics:**

- **Introduction to polymer science and engineering, Professor Robert Burford**
- **Structure-mechanical relationship properties in polymers, Dr Rohan Truss**
- **Polymer ionic gels for electrochemical applications, Professor Maria Forsyth**
- **An introduction to plasma polymerisation, Professor Robert Short**
- **Mechanical actuation in polymers, Professor Geoff Spinks**
- **Functional biopolymers, Dr John Forsythe**

**10APSS Convenor, Professor Wayne Cook**

**Further information, including the registration form, are available at www.crcp.com.au or contact Amy De Hey at the CRC for Polymers 03 9518 0408, amy.dehey@crcp.com.au**

# Injection moulding project team presented with Chairman's Award

At the Centre's 2008 Annual Meeting in October, Dr Peter Coldrey, CRC-P Chairman, awarded the *CRC for Polymers Chairman's Award* to the members of a project team that developed technology incorporated in the Moldflow WARP-P software module. The module was launched earlier this year.

The technology was developed in the previous CRC-P funding period (1999-2005) by a multidisciplinary team from Moldflow, University of Sydney, Monash University and ANSTO. The successful commercialisation of this technology was managed by Advanced Polymerik, a spin off company created to complete the commercialisation of CRC-P technologies. The resultant software was tested, implemented and verified in the marketplace – a critical process which took several additional years beyond the original CRC-funded research, highlighting the importance of having access to mechanisms for the commercialisation of technologies that flow from CRC's.

Some members of the project receiving the Chairman's Award (from left): Prof Roger Tanner, Dr Peng-wei Zhu, Ms Kirsty Cleland, Dr Peter Coldrey (CRC-P Chairman), Dr Peter Kennedy, and Dr Rong Zheng (absent: Dr Robert Knott, Assoc Prof Graham Edward, and Prof Xijun Fan)

# Funding support for postgraduate students

Scholarships are currently on offer for leading-edge research in the areas of polymer chemistry, polymer physics, materials science, materials engineering, chemical engineering, biomedical engineering, and related disciplines.

Further information on the application process is available at www.crcp.com.au and enquiries can be made to the Education Program Manager: Associate Professor Graham Edward on 03 9905 4928, graham.edward@eng.monash.edu.au.


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