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Industry Engagement at ANSTO's Australian Synchrotron

ROBERT ACRES
INDUSTRY SUPPORT & OUTREACH SCIENTIST - ANSTO

ABSTRACT

This article describes how physicists, such as I am, and an exceptional piece of technology that is often thought of as a 'physics machine' – a synchrotron light source – has an impact across many areas. ANSTO's Australian Synchrotron located in the south east of Melbourne has been operating for over a decade and has enabled thousands of experiments. In addition to the traditional academic user base, the synchrotron also provides valuable insights for industry clients from Australia, New Zealand and around the world through a dedicated Industry Engagement Team. The market strategy of the Industry Engagement team is certainly not physics, but its application relies on physicists and a physics machine to deliver impact. I will explore two examples.

INTRODUCTION

ANSTO is an Australian Commonwealth Government research organization and operates some of the country's landmark research infrastructure including the Australian Centre for Neutron Scattering, National Research Cyclotron, the Centre for Accelerator Science, and the Australian Synchrotron - one of the most significant investments in scientific infrastructure in Australia's history.

The Australian Synchrotron, a 3 GeV national radiation facility which opened in 2007, is located in the heart of Melbourne's south-east innovation precinct adjacent to CSIRO, Monash University, the Melbourne Centre for Nanofabrication and the Monash Centre for Biomedical Imaging.

Operational now for over a decade, the facility has more than 6,000 registered research users and has supported thousands of experiments. The majority of these experiments are for academic researchers applying through a competitive process for instrument time, but since its opening the Australian Synchrotron has offered paid access for industry clients – supported by a dedicated industry engagement team.

INDUSTRY ENGAGEMENT- MARKET STRATEGY

Having completed studies in physics in 2010, I did not anticipate at that time that I would now be part of the ANSTO Industry Engagement team based at the Synchrotron, combining my academic qualifications with the business skills I have learned to assist companies to solve their technical problems, improve existing processes and bring new products to market.

Our team's approach to delivering benefit to industry is to have a clear understanding of our targets and generate awareness among stakeholders in the Australian Government's priority sectors – those industries the government has confirmed are of national importance i.e. advanced manufacturing, biotechnology and human health, agriculture and food, and geoscience and resources. In addition, we are focused on those industries for which we offer a unique scientific capability (investigative techniques not available elsewhere in the country or region); techniques with which ANSTO has solid experience, rather than those that are more academically challenging (and should utilise the merit access route); projects that can be delivered in a timely and relatively cost-effective manner to industry.

One of the challenges of my current role is to qualify suitable projects and clearly manage client expectations against the deliverables that can realistically be achieved by the scientific teams.

Single year usage statistics (2017):

- 5,177 researcher visits
- 34,000 hours of delivered beam time
- 517 academic papers
- Assisted 24 companies across the spectrum of small to medium sized businesses to multinational companies.

CASE STUDIES - DELIVERING IMPACT AND VALUE TO INDUSTRY, RESEARCH AND THE COMMUNITY

The compelling narratives we generate from successful industry engagements provide us with excellent case studies that we can present to potential clients. Industry clients can 'see themselves' in the case study examples and this helps to demystify ANSTO and clearly show that our capabilities can provide real-world applied solutions, building trust and breaking down barriers to engagement.

Two such examples are:

1. LaserBond

Based in Sydney, LaserBond Limited accessed the Australian Synchrotron through a NSW-government-funded industry access scheme in August 2015 to conduct a detailed comparative analysis of both an existing and a new form of laser-bonding.

ANSTO's industry scientists took real-life samples of industrial equipment coated in LaserBond's metallic repair product – one coated using their standard method and a second using a newly-developed method – and imaged them in the facility's X-ray Fluorescence Microscopy beamline (XFM), mapping elements within the metals and providing LaserBond with unprecedented visual evidence that their new method was far superior to what had been used previously.

The XFM analysis confirmed the new method for laser-bonding provides a higher quality wear-resistant deposit with very low iron migration, making the overall product more efficient and durable for long-term performance.

LaserBond was able to use the highly detailed images produced by the XFM beamline to demonstrate the superiority of the new method to customers.

Executive Director, LaserBond, Mr Greg Hooper, who has a mechanical engineering background and founded LaserBond with his parents 23 years ago, explained the benefit of utilising synchrotron techniques:

'Before using the Synchrotron, we had done the work

using both the standard and a new method of laser-bonding and we could see the new method, which we invented, was producing excellent results with regards to the dilution with the base material and the decomposition of hard phases.

'The Synchrotron was able to confirm visually how much difference there was between the two methods.' (See Fig 1).

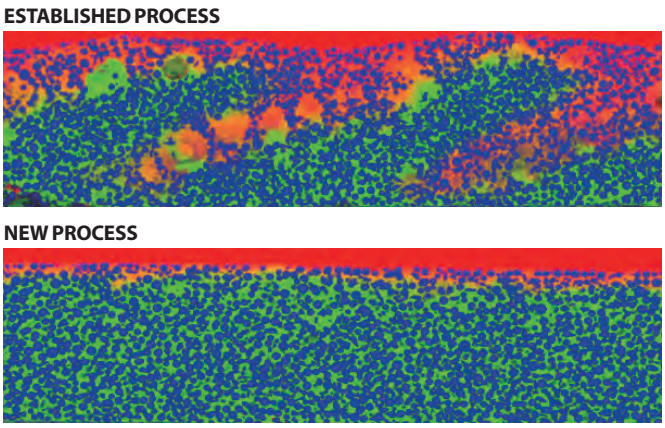

Fig.1: X-ray Fluorescence Microscopy images revealing high iron migration in the established process (above) compared to low iron migration in the new process (below). Color scheme: Red – Fe, Green: Ni, Blue: W

2. Stentrode™

Researchers at The University of Melbourne have created a small, malleable electrode, Stentrode™, that can be inserted into blood vessels in the brain to translate thoughts into assisted movement in people affected by paralysis. The first endovascular neural interface, the Stentrode™ is a minimally invasive implantable brain device that can interpret signals from the brain for patients with paralysis. Implanted via the jugular vein, the Stentrode is placed inside the brain in the command-control center, known as the motor cortex, but without the need for open brain surgery.

The research team used the Imaging and Medical Beamline (IMBL) to clearly observe and understand the crucial process of endothelialisation, in which the 'stentrode' (trademarked as STENTRODE™) is enclosed in cells within blood vessels, to ensure it is not rejected by the body. The developers are preparing for pilot clinical trials of the Stentrode™ to evaluate the safety and efficacy of this breakthrough technology [1].

LOOKING FORWARD

Although not the career path I expected when I completed my PhD and started out in the traditional postdoctoral academic path, working in the Industry Engagement Team has been personally very rewarding, opening up new challenges and opportunities that I wouldn't have been exposed to otherwise.

Recently, Science and Technology Australia established the STEM Ambassador program to foster evidence-based, science-informed policy in government, a program in which I am proud to have been selected to participate. As a STEM Ambassador I will be drawing on my experience as an industry support scientist to develop a long term relationship with local politicians and advocate for the greater role of science in informed policymaking, and the role of innovation in Australian industry's future.

There have been a number of exciting developments at the facility since I joined the Industry Engagement team. For example, in December 2015, the Australian Cancer Research Foundation (ACRF) awarded $2 million in funding for a new detector that provides faster protein analysis on the Australian Synchrotron's Micro Crystallography (MX2) beamline. The ACRF Detector, a Dectris Eiger 16M, enables the shape and function of proteins to be analyzed in a fraction of the time taken previously, providing a ten-fold increase in capacity. The enhancement, which is crucial to accelerating cancer drug development, is available to medical researchers across the country.

We have a number of commercial clients from Australia and around the world who access this beamline, supported by our expert team. The increase in throughput capacity enabled by ACRF's investment means we can help more researchers and companies to develop groundbreaking new treatments for a range of diseases.

The investment in the future of the Synchrotron doesn't stop there, however, with major expansion and growth currently underway via the BR—GHT Program.

Such is the value of the facility to Australia's science and innovation ecosystem, that each of the existing beamlines is oversubscribed. Furthermore, with constant advances in scientific methods, researchers and industry partners require access to a broader suite of techniques than those currently available.

Following the Federal Government's substantial $520 million contribution to secure the future of the facility to 2027, ANSTO has now also secured further capital investment for the Australian Synchrotron. This investment will facilitate the design and installation of eight additional beamlines, enabling the facility to meet the needs of Australian researchers and industry partners and continue enabling ground-breaking research well into the future.

Expanding the facility provides new opportunities for physicists and engineers in the design, construction and operation of the new beamlines which will ultimately enable new experiments and outcomes that will impact both academic and industry based research.

Bringing these new capabilities to industry, finding new partners and new ways to use ANSTO's existing capabilities to solve real-life problems is our team's next challenge, as we continue to use physics to deliver tangible benefit to both Australian and international communities, particularly in the Asia-Oceania region.

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References

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An industry support scientist with ANSTO, based at the Australian Synchrotron, Dr **Robert Acres** collaborates with industry partners to improve products and processes within small to large enterprises and across sectors.
Dr Acres helps Australian industries innovate by tailoring the uniquely specialised analytical capabilities of the ANSTO to meet the specific needs of clients.
Before joining the Australian Synchrotron in 2014, Dr Acres worked as a scientist at the Elettra synchrotron facility in Trieste, Italy. Originally from Adelaide, he completed his PhD in Applied Science at The University of South Australia in 2010 and his honors degree in Nanotechnology at Flinders. University in 2005.