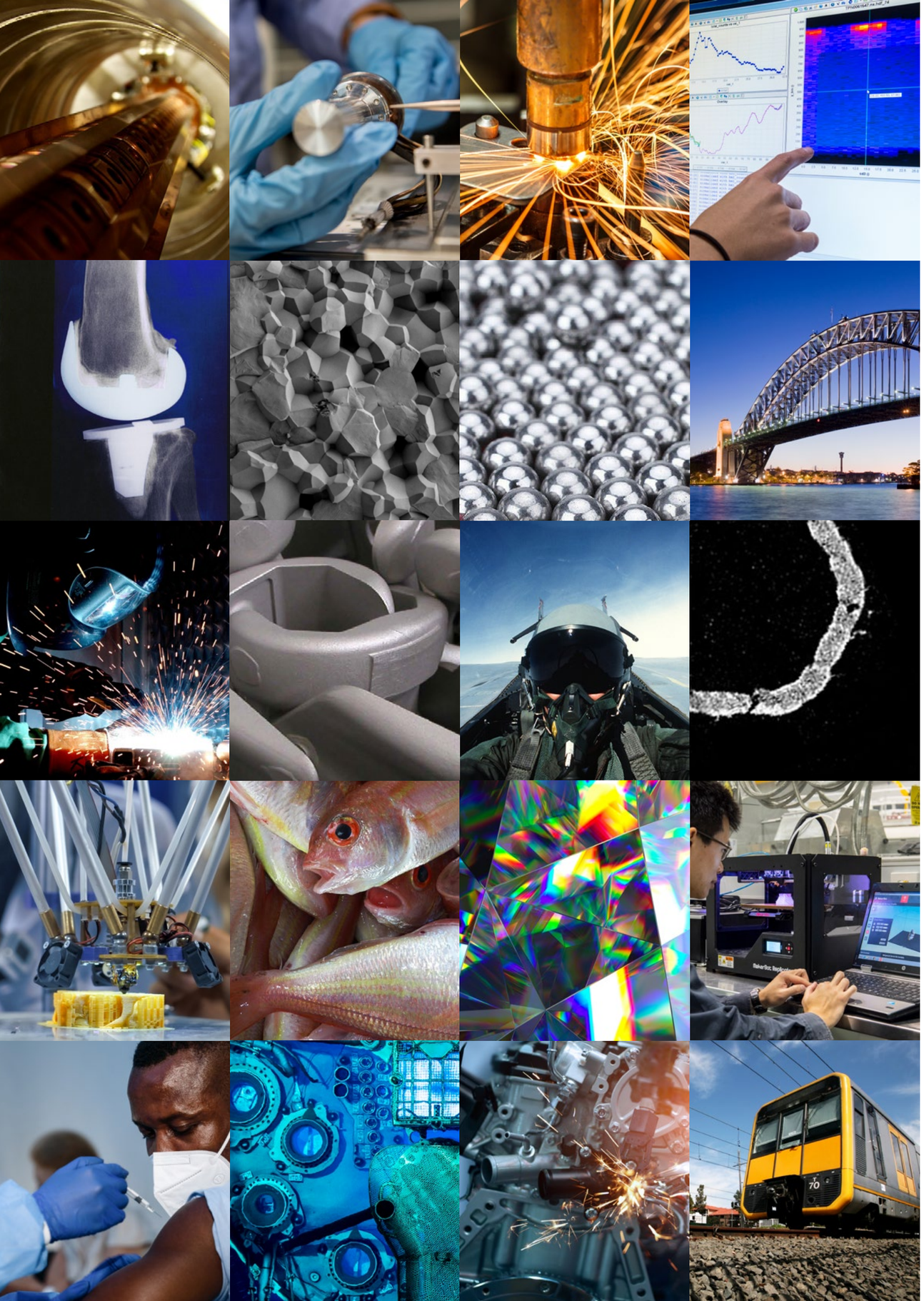
Australian Government

ANSTO

Advanced manufacturing

Science. Ingenuity. Sustainability.



We help national and international industries and research partners solve complex problems, making industry more competitive, economical, reliable and safe.

Australian Government | ANSTO

Your high tech partner.

About ANSTO

ANSTO is home to of Australia's most important landmark research infrastructure – with a total value of more than $1.3 billion. Our unique capabilities are used by thousands of Australian researchers, industry partners and academic users every year.

Drawing on more than sixty years of materials, engineering, and environmental research since the days when it was known as the Australian Atomic Energy Commission, ANSTO has developed a unique set of facilities and expertise that support the requirements of the advance manufacturing and materials sector.

ANSTO landmark infrastructure

OPAL multi-purpose reactor

Australian Centre for Neutron Scattering

Centre for Accelerator Science

Australian Synchrotron

National Research Cyclotron Facility

Gamma Technology Research Irradiator

Our people include expert scientists, engineers and technicians who are actively engaged with industrial and translational research, collaborating with the best and brightest of Australia. Collaboration and connection is key to the best translational research outcomes. ANSTO has strong academic and commercial connections with all the publically funded research organisations currently supporting the delivery of goods, services and advice to the defence sector in Australia.

Characterisation

Defect imaging, investigating texture and condition as well as dimensional tolerances

Process development

Residual stress measurements, *in-situ* studies of thermo-mechanical properties

Materials development and optimisation

Materials testing and simulation in extreme and challenging environments, welding, cladding, coating and root cause analysis

Structural analysis and assessment

Computational modellings for design review, modification and research, creep fatigue and corrosion

Testing for safety

Testing for Safety is a vital consideration when building essential infrastructure and, in the context of manufacturing, is a capability that ANSTO can offer through the use of its critical infrastructure.

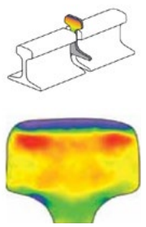
Keeping our railways safe and reliable

CHALLENGE:

Welded joints are a consistent manufacturing problem as well as the maintenance and repair of squats or cracks in rails.

SOLUTION:

Detailed residual stress measurement studies undertaken by ANSTO in the weld and heat-affected zone provide valuable data for fatigue analysis. The integrity of rails is key to increasing reliability of infrastructure and reducing maintenance costs in the railway industry.



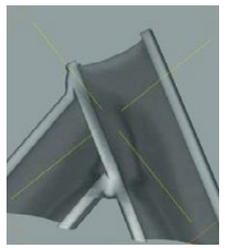
Welding inspection

CHALLENGE:

How to determine the structural integrity of welds over time in samples which are difficult to analyse internally.

SOLUTION:

DANSTO's welding simulation group can verify all measurements from imaging and strain scanning. The energy selective neutron imaging of welds has the capability of visualising the microstructure of the weld material.



Removing corrosion in confined spaces

CHALLENGE:

Owners and operators of older bridges, such as the Sydney Harbour Bridge, face challenges when maintaining the safety of the asset. Whilst laser cleaning to remove paint and corrosion is available, there are concerns that it may cause fatigue cracks to propagate in ageing steel.

SOLUTION:

The residual stress and fatigue strength properties were tested by ANSTO to determine the safest and most efficient way of cleaning the bridge using neutron techniques.

Understanding stress distributions in granular materials

CHALLENGE:

Granular materials are a unique form of matter that can behave as a solid, liquid or gas depending on the environmental conditions, in some cases being able to both flow and support shear stress. The complex nature of these materials presents a number of challenges in conducting such experiments..

SOLUTION:

ANSTO's neutron diffraction can be used to develop and verify numerical models for the behaviour of such granular materials, which in turn may be used to optimise industrial processes from steelmaking to pharmaceutical production.

Extending aircraft lifespan – stress and fatigue

CHALLENGE:

Residual stress relaxation can significantly influence the fatigue behaviour of aircraft repaired components.

SOLUTION:

The results from this project will significantly improve current understanding and knowledge of the residual stress relaxation in the cold-spray repaired components under fatigue loading. This work is an important milestone for supporting the certification program of aircraft structural repair technologies for the Royal Australian Air Force fleet.

Additive manufacturing

Additive manufacturing allows the production of complex parts that would not be possible using traditional methods. ANSTO's infrastructure is able to image and inspect the internal structure of parts non-destructively in high resolution.

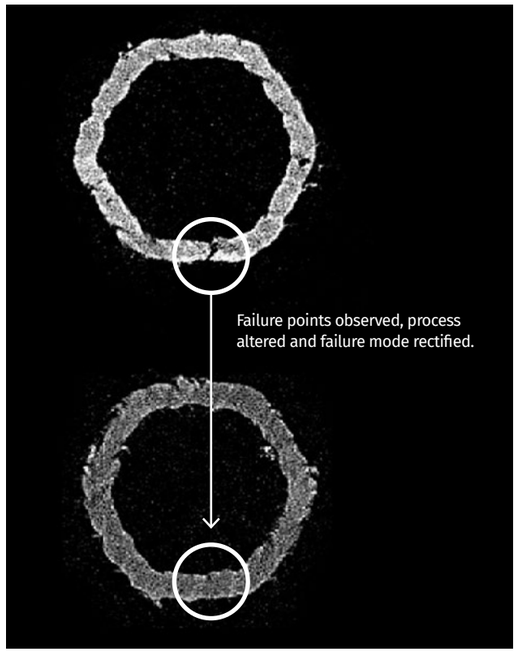
Improving the efficiency of additive manufacturing processes

CHALLENGE:

Conflux Technology uses additive manufacting to manufacture high performance heat exchangers for use in demanding applications such as aerospace, automotive, oil and gas, defence and industrial and more than 90% of their production is exported overseas. Because of the complexity, small feature sizes and large number of production variables, quality control and failure analysis can be challenging.

SOLUTION:

Using the Synchrotron in their quality control, Conflux is able to identify defects in their parts and optimise their production variables to eliminate those defects. Conflux are also using the Synchrotron for R&D on new part designs and to understand how changes to their processes affect the microstructure of their parts and to optimise the manufacturing process.



Advanced metal and ceramic components

CHALLENGE:

Many manufactured parts made from powdered, forged, or cast metal, ceramics, or the emerging field of additive manufacturing often require post-production treatment to remove microscopic defects like fractures or voids in order to meet the quality and design parameters for the final part.

SOLUTION:

Hot Isostatic Pressing (HIP) uses high temperature and pressure to treat the part to reduce defects (ie internal pores) and refine the microstructure resulting in improved properties to meet targeted performance requirements.

Enhancing the sensitivity of temperature sensors

CHALLENGE:

A simple method for high sensitivity temperature measurement at the smallest possible dimensional scale in nanometre sized systems, is of the utmost importance for advances in fundamental science and applications ranging from nanotechnology to biophysics. Currently, they are insensitive to environmental magnetic noise that introduces bias in the temperature measurement.

SOLUTION:

ANSTO and collaborators from the University of Torino, Italy have developed a new simple continuous-wave lock-in-based method able to reach high sensitivity in temperature measurement at microscale or nanoscale volumes. This new method because of its simplicity and high sensitivity could boost developments in the field of quantumassisted temperature sensing and it has foreseeable applications in high-sensitivity nanoscale thermometry and, thanks to the biocompatibility of diamond, in biosensing.

Materials

Materials at the most basic level, define what a component can do and how long it will last. The Australian Centre for Neutron Scattering and the Australian Synchrotron provide tools that can help solve materials-based problems when more conventional testing techniques are not enough.

Carbon fibre manufacturing

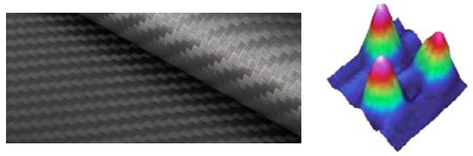
Carbon Nexus
Deakin University

CHALLENGE:

Improve pre-carbonised fibre.

SOLUTION:

Australian Synchrotron infrared data allows maps of chemical composition to be generated which give insights about the chemical bonding within and around the carbon fibres. This in turn relates to the mechanical performance of the carbon fibre composite and can be used in the development or quality control of these materials.



Laser cladding material surfaces

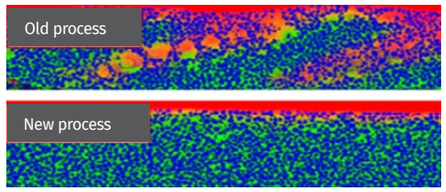
Laserbond®

CHALLENGE:

Assess a new form of laser-bonded metal coating.

SOLUTION:

Australian Synchrotron conducted a detailed comparative analysis of both an existing and a new form of laser-bonded metal coating.



Complex 3D metal printing

Conflux Technology

CHALLENGE:

Improve 3D print reliability.

SOLUTION:

Australian Synchrotron X-ray, capital X imaging at micron resolution for non-destructive internal inspection.

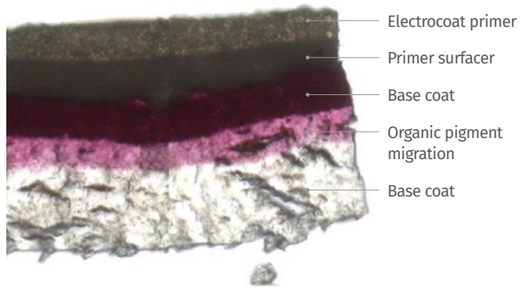
The composition of automotive paint

CHALLENGE:

Investigate interlayer components.

SOLUTION:

Composition of coats vary across different makes of car, can determine the effectiveness of the cross-linking of additive – melamine.



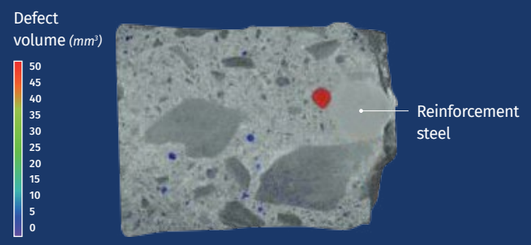
Porosity analysis and visualisation of concrete

CHALLENGE:

Concrete is a three phase system: aggregate, sand and cement paste, and in normal concrete the packing of the phases is optimized to infill voids and to save cost by minimizing the amounts of relatively more expensive cement component of the paste. In practice mismatches of different sized aggregates and problems with compaction can result in moderately sized voids in concrete which can act as weak points on stress loading or as channels for transport of water.

SOLUTION:

Neutron tomography has been proven to be an excellent tool to analyse concrete cores. In particular, when reinforcement steel is present, neutron radiation is beneficial because of its high penetration depth in metals.



Ion beam engineered Graphene Oxide (GO) membranes

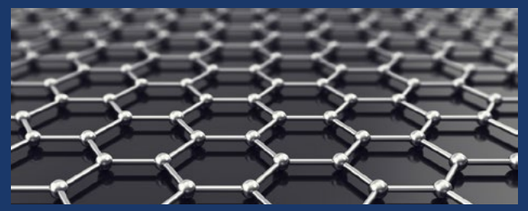
For applications such as batteries, biosensors, gas separation and water desalination. Graphene oxide (GO) is considered to be more attractive than graphene for the fabrication of large-scale separation membranes because of its lower cost and enhanced properties.

CHALLENGE:

The fabrication of nanoporous GO membranes with high selectivity continues to be challenging, as there are very few effective approaches that can achieve precisely controlled nano-sized pores.

SOLUTION:

Ion beam irradiation involving carbon ions was used to create atom-scale holes (also known as defects) in GO membranes. This process is a facile post-treatment for GO membranes that creates nanopores in a controlled manner and does not require a long processing time.



Materials characterisation for additive manufacturing

CHALLENGE:

Additive manufacturing produces parts with properties dependent on the unique parameters used. Porosity and micro-cracking is a major hurdle when manufacturing materials. For example, in laser melt tungsten.

SOLUTION:

ANSTO can provide a suite of tools for the assessment of product integrity ranging from material Certificates, Finite Element (FEA), modelling of processes and Design-Life Assessment. Precursor materials can also be fully characterised and optimised.

Friction stir processing of copper

CHALLENGE:

Large differences in the coefficient of thermal expansion and melting point makes fabrication of Copper-Tungsten and Copper-Steel composites a challenging engineering problem. High localized heat is pivotal for intimately bonding a thermally conductive material like copper.

SOLUTION:

Friction Stir Technology based thermo-mechanical bonding techniques are being developed for the fabrication of architecturally hybrid composites of copper. Neutron strain scanning and imaging were measured for residual stress and deflect assessment to accurately determine the ideal bonding for Cu-W composites.

Health

Health products manufacturing is at the heart of our capabilities at ANSTO. As such we leverage an array of expertise for improving processes as well as the health and wellbeing of all Australians.

Novel preparation of influenza vaccines by gamma irradiation

CHALLENGE:

Conventional seasonal influenza vaccines are prepared by chemical inactivation and detergent disruption. Such vaccines do not provide immunisation beyond the current influenza season.

SOLUTION:

A collaborative research team from Gamma Vaccines, the University of Adelaide and the Australian Nuclear Science and Technology Organisation (ANSTO) has developed a next generation influenza vaccine comprised of whole inactivated virus. ANSTO's GATRI has been critical to the successful delivery of accurate and precise radiation doses to viruses enabling R&D and further product manufacture.

3D graphene scaffolds in bone generation

CHALLENGE:

As the cases of bone disorders and injuries grow, there's an increased need for alternative replacement tissues and materials towards improved osseointegration of implantable devices in the field of orthopedics.

SOLUTION:

Using the cranial defect model, radioisotope and imaging capability, we have created unique approach towards imaging bone recovery and potentially optimise the way in which implantable devices are manufactured.

Food provenance

More than ever before consumers, manufacturers and regulators want to know where their food comes from and how it is produced, known as its provenance.

CHALLENGE:

Is there a way to trace the origins of our seafood to reduce the risks in the supply chain?

SOLUTION:

Wherever your food comes from it picks up trace elements from the local environment; from the soil crops grow in, from the plants animals eat, from the water fish live in. ANSTO is developing a tool that will allow producers and regulators to determine the provenance of food. With this new highly accurate tool producers and regulators have the ability to confidently identify the provenance of seafood, including geographic origin and the difference between wild and farmed seafood. It uses the abundance of certain elements in the seafood to gauge quality.

Collaboration

Collaboration with industry and academia is fundamental to our vision and mission and keeps us relevant. As an example, industry partners can tap into our expertise in materials development to accelerate their technology readiness to realised application.

nandin, the heart of the Innovation Precinct is home to a community of researchers, students and startup companies dedicated to a number of challenges relevant to the defence sector. To complement this, the newly-formed ANSTO Graduate Institute will further assist early career talent in Australia by co-developing graduate project proposals with Australian Universities and other partners. Opportunities for student scholarships and joint supervision of student projects exist.

nandin

nandin members

AMENTUM DEFENCE AND SECURITY | bioair. | CRYPSES | Cyntropy | EVISUALS

ENWARE | ecko WORKS | HYRON Scientific | MAS MANAGEMENT SYSTEMS | MIRIAD technologies

Ouranos Systems | SVSR | SensaWeb | workM8.io

Security

Security and intellectual property protection is a vital component of business operations and is a core principle of all ANSTO activities.

ANSTO enjoys the best of both worlds – secure and ISO accredited research sites, as well as long-standing collaboration with DST, CSIRO and Australian Universities. ANSTO can also accommodate work requiring AGSVA clearances.

AFP AUSTRALIAN FEDERAL POLICE | arpansa | NATA | INTEGRATED MANAGEMENT SYSTEM ISO 9001:2015 ISO 14001:2015 ISO 45001:2018

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Australian Government

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