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ANSTO Tour and Site Visit

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Abstract
On 9 September 2016, Materials Australia New South Wales members gathered at the Australian Nuclear Science and Technology Organisation (ANSTO) for a tour of some of the country's most advanced, scientific infrastructure. After almost two years, this is the second time we were escorted around ANSTO's Lucas Heights site.

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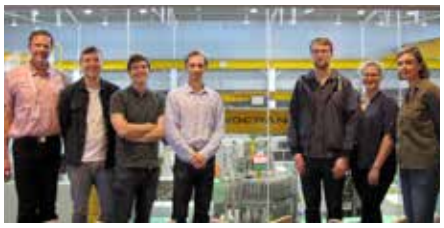
On 9 September 2016, Materials Australia New South Wales members gathered at the Australian Nuclear Science and Technology Organisation (ANSTO) for a tour of some of the country's most advanced, scientific infrastructure. After almost two years, this is the second time we were escorted around ANSTO's Lucas Heights site.

Members were received at the ANSTO Discovery Centre by their education officers, who provided an overview of ANSTO and an introduction to radiation. The exposition hosts one of only three Cloud Chamber displays in Australia. The Cloud Chamber is the only way to see the invisible background radiation that surrounds us, as trails of small particles are made in a cloud of alcoholic vapour.



Materials Australia visit ANSTO, pictured with the neutron guide hall of the Australian Centre for Neutron Scattering. L to R: Professor Klaus-Dieter Liss, Bernd Schulz, Domingo Jullian Fabres, Dr Andrii Kostryzhev, Felix Theska, Carina Lesermüller, Dr Sophie Primig.

Visitors were transported around the site on a shuttle bus. The first stop was the Electron Microscopy Centre where ANSTO is conducting globally significant research on the effects of radiation damage on materials used in nuclear reactors. This work has a critical role in helping the world design a new generation of reactors that are even more efficient and safe.

The recently-opened, wooden-structure minimises disturbing electromagnetic fields. This technology is built on vibration-isolated foundation slabs. Temperature in the large cathedral-like rooms is stabilised by tempered walls with fresh air diffusing in smoothly. The suite of instruments comprises scanning electron microscopy, focused ion beam milling and transmission electron microscopy.

An impressive demonstration on in-situ plastic deformation, recorded in a movie, was shown at the scanning electron microscope, where failure of a tensile specimen differs considerably before and after radiation damage by 5 MeV alpha particles. Atomic resolution can be achieved under the transmission electron microscope and orientation maps can be recorded by electron backscatter diffraction. With this facility, ANSTO hosts one of the most modern electron microscopy units in Australia.

Layout of the Australian Centre for Neutron Scattering. The green shielding to the right contains the nuclear reactor, producing neutrons which are distributed along the beamlines to the instruments. Bilby and Quokka are to the left, Kowari in the centre, Wombat to the top centre, Dingo at the reactor face.

The tour moved to the reactor exposition area and the neutron guide hall of the Australian Centre for Neutron Scattering, the former Bragg Institute. Following a brief introduction to the reactor, we viewed the suite of instruments. Directly in front of us was the Wombat high intensity powder diffractometer, which is a world-competitive instrument for time-resolved in-situ studies.

Catching the eye because of their size are the small-angle neutron scattering instruments Bilby and Quokka at the far end, which allow the study of both soft and hard condensed matter materials on the nanometer scale. There is a comprehensive array of 13 operational instruments, encompassing spectrometers for inelastic scattering, the engineering strain scanner Kowari, the single crystal diffractometer Koala and the imaging beamline Dingo (in an enclosed area of the reactor hall). With these state-of-the-art of instruments, ANSTO is a major world player in neutron scattering, attracting over 1,000 national and international users from all over the globe each year.

Antares – one of the accelerators at ANSTO.

The concluding stop on the tour was at the Centre for Accelerator Science. Four particle accelerators are used for accelerator mass spectrometry and ion beam analysis, analysing trace isotopes across materials, geology and environmental sciences. Impressive outcomes are studies of the accumulation of greenhouse-effect gases with industrialisation, where researchers recovered and analysed air bubbles from different eras, stored at different depths of Antarctica's ice sheets.

Our Education Officer, Dr Stephanie McCready explained how scientists using these accelerators are helping solving big environmental issues such as climate change, health of waterways and air quality. Being a former environmental scientist, Stephanie could provide detailed insights as to how ANSTO uses nuclear techniques for these environmental purposes.

Other applications are ion modification of surfaces and near-surface regions of materials by defects engineering or doping, characterisation of surfaces and near-surface regions by depth profiling, characterisation of thin films and interfaces, and mono-energetic neutron production. The radiation-damaged electron- microscopic specimen has been irradiated here by 5 MeV alpha particle bombardment.

Materials Australia would like to thank ANSTO, and their staff at the Discovery Centre and at the facilities.