Bragg Peaks > for neutron users
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OPAL news

The OPAL Reactor and its cold neutron source performed well during the period July to September 2011, with an overall reliability of 78% availability with respect to the published schedule. Our 5 thermal-neutron instruments used 84% of this beam time for user experiments, while the two cold-neutron instruments used 69%.

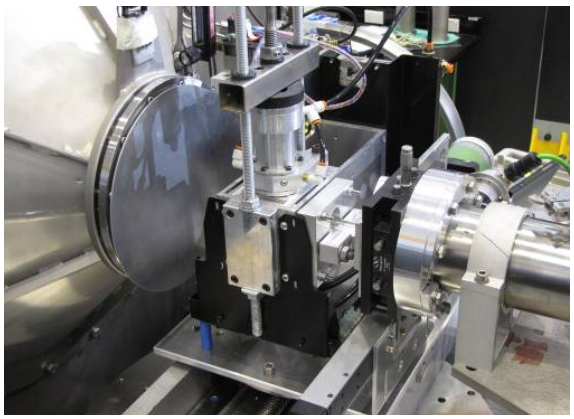
Bragg Institute news

There has been much progress on the procurement for the Neutron Beam Expansion Project, with EMU's detectors, Doppler drive and Vacuum Vessel been ordered, and contracts placed for the CG-2 Guide contract placed (with Swiss Neutronics), DINGO's shielding and most components on Bilby (vacuum vessel, choppers and detectors). Well done to the team! The CG-2 Guide will likely be installed in the final quarter of 2102, and this will necessitate a long shutdown of the reactor after October 2012.

Around the instruments

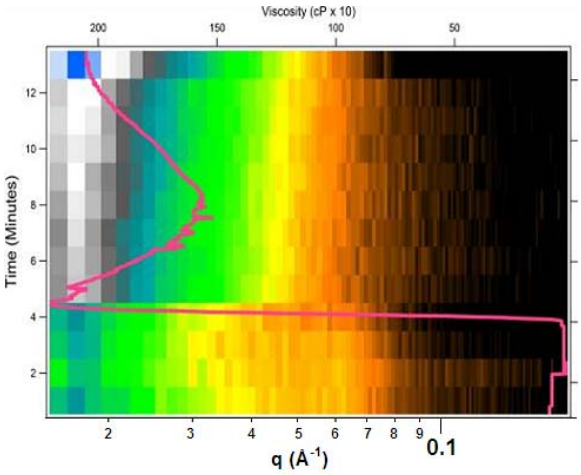
Quokka *(SANS)*

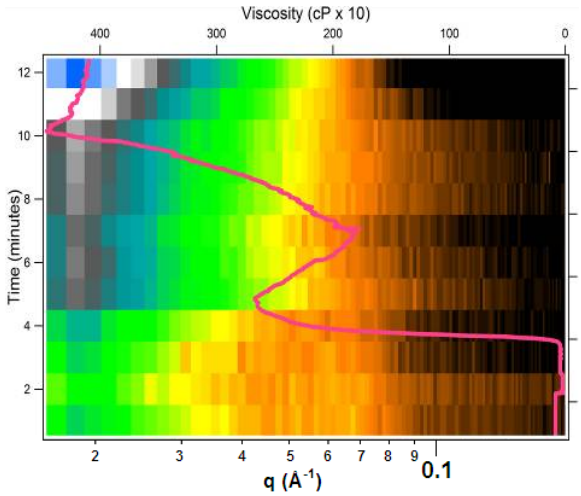
We have successfully completed commercial experiments on QUOKKA to investigate the change in scattering during the cooking of starch, as a food-relevant industrial process. In collaboration with Perten Instruments, we have modified a cooking and stirring viscometer device known as a Rapid ViscoAnalyser, which is widely used by food manufacturers to measure the thickening properties of different starches.



The Rapid ViscoAnalyser and sample in the QUOKKA beam.

We adapted the Rapid ViscoAnalyser to allow the neutron beam from Quokka to penetrate into the mixing chamber where the starch is heated and stirred in water, and scattering data were recorded during a typical industry standard heating and stirring cycle on a wide variety of different starches, for the first time. The scattering data were analysed to provide details as to how starch structure at the nanometre scale affects viscosity and what structural changes occur during cooking and processing.

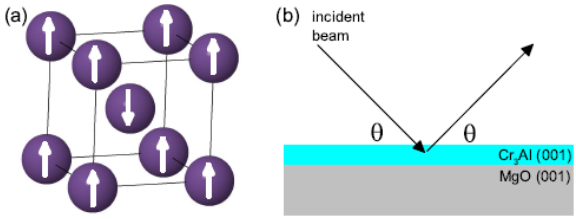




Simultaneous SANS (coloured background) and Rapid ViscoAnalysis (pink line) for two starches.

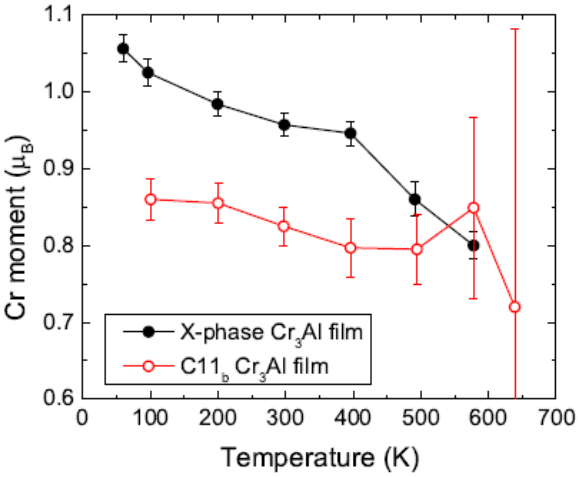
The Rapid ViscoAnalyser is on permanent loan to ANSTO and will be introduced into the user programme. In addition, the New South Wales State Government contributed a $15K grant through its TechVouchers Program.

Taipan *(thermal 3-axis spectrometer)*



a) Commensurate spin-density wave (simple antiferromagnetism) on the bcc lattice. B) Experimental setup for x-ray and neutron diffraction experiments.

In collaboration with University of California, Berkeley, and University of Western Australia, we have investigated the the relationship between semiconductivity and magnetism in films of Cr_3Al. Two films were grown on MgO, under different conditions to achieve different types of chemical ordering and electronic properties: one X-phase structure (semiconducting) and one $C11_b$ structure (metallic).



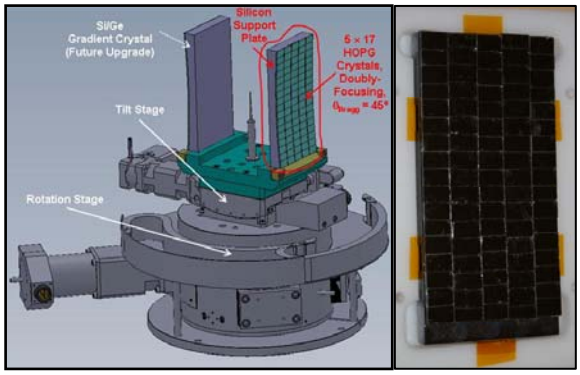
Magnetic moment vs. temperature from neutron dirraction of the X-phase and $C11_b$ Cr_3Al films.

Antiferromagnetism and chemical ordering have both been suggested as causes of the observed semiconductor-like behavior in Cr_3Al. It was observed that both films show commensurate antiferromagnetic order, with a high Néel temperature >578K, showing that the antiferromagnetism in Cr_3Al is quite robust. Density functional theory calculations were performed, and it was shown that the well-known antiferromagnetic pseudogap in the density of states occurs for all types of chemical ordering considered. The conclusion of these studies is that the antiferromagnetism causes a pseudogap in the density of states which is a necessary condition for the semiconductor-like transport behavior; however, that antiferromagnetism is seen in both metallic and semiconducting Cr_3Al samples shows that antiferromagnetism is not a sufficient condition for semiconducting behavior. Chemical ordering is equally important.

Kookaburra (USANS)

The KOOKABURRA Optical Table and Motion Stages during Factory Acceptance Testing

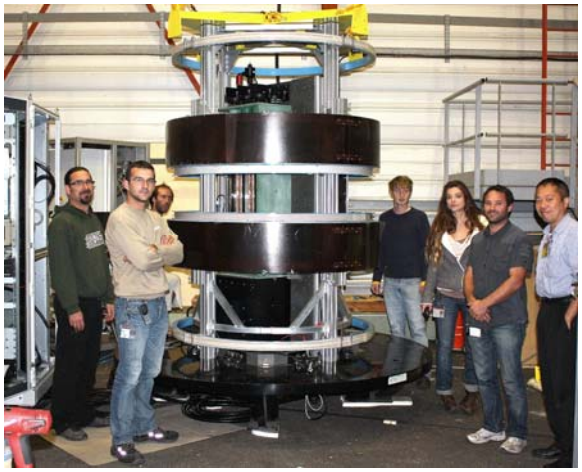
We received the first major component of our KOOKABURRA Ultra-Small-Angle-Neutron Scattering (USANS) instrument, its assembled doubly focussed pyrolytic-graphite premonochromator which will deflect the beam out of OPAL's CG-3 guide, upstream of the PLATYPUS neutron reflectometer. X-ray and neutron measurements confirm that the assembled premonochromator crystal performance is according to specifications.



The KOOKABURRA premonochromator, which is composed of 85 crystals mounted on a machined perfect-silicon back-plate.

Factory Acceptance Testing of the Optical Table and Motion Stages is now in progress, the helium-3 detector tubes have been delivered, and the 4 silicon ingots formed from which the channel-cut analysers will be machined.

Helium-3 Polarisation Station



The team at the ILL who constructed the Helium-3 polarisation station; Hal Lee at right.

In early October our colleagues at the Institut Laue Langevin in Grenoble, France, completed the construction of our new Helium-3 polarising station. The ILL team has for the past several weeks been doing commissioning work on individual components: the gas flow system, the electronics, the control program, the laser optics, and mechanical test fitting the various components. The field coils had previously been tested to yield a highly uniform magnetic field for the job.

Construction of the polarisation station is now complete. The focus will now be continuing the commissioning work of the system, moving towards the goal of highly polarising Helium-3 gas for use in polarisers and analysers for six of our instruments: WOMBAT, PLATYPUS, QUOKKA, TAIPAN, SIKA and PELICAN.

SAFARI-1 Staff IAEA Training at ANSTO

Rudolf van Heerden was granted fellowship training by the IAEA for the upgrading of the neutron beam facilities at the NECSA SAFARI-1 research reactor. Rudolf's training at the Institute is in preparation for operating and servicing sample environments to support neutron scattering experiments at SAFARI-1.

Helping our Friends from Japan

Two teams of visiting researchers from Japan with James Hester, Echidna Instrument Scientist.

In the last three cycles, Echidna has hosted 5 user groups from Japan with one scheduled early next cycle, while Kowari, our strain scanner has hosted two such groups. Each group had originally had time scheduled at Japanese facilities which are now offline due to the March earthquake. The researchers successfully collected data from a broad range of materials including crown ethers in polymer films, Li-ion battery materials, ceramic ferroelectrics, antiferromagnets and weld joints. The groups made good use of our extensive sample environments, using two types of low-temperature cryostat as well as the air and vacuum furnaces, with the 7T magnet scheduled for the remaining group. The ECHIDNA and KOWARI beamline scientists enjoyed the chance to interact with their Japanese colleagues and hope to see them here again.

Announcements

The 2012-2 Proposal Round is now open, for beam time between July and December 2012 and access to all 7 initial neutron-beam instruments plus the National Deuteration Facility. Proposals should be submitted online by **15 March 2012** via https://neutron.ansto.gov.au.

Workshop: Current State and Future of Neutron Stress Diffractometers

A workshop on the Current State and Future of Neutron Stress Diffractometers will be held at ANSTO 10-12 January 2012. The deadline for abstract submission is 1 Nov 2011. For details, please visit: **http://www.ansto.gov.au/nsd.**

New Faces

Arrivals

Anna Paradowska joins us as an instrument scientist on KOWARI, our residual stress diffractometer. Anna arrives from ISIS, England, where she was an instrument scientist on ENGIN-X. The main scope of her research activities is to examine residual stresses using non-destructive testing methods and to relate them to manufacturing procedures and integrity requirements for various types of components.

Daniel Hsu is an assistant researcher at the Center for Neutron Beam Applications at the National Central University, Taiwan, and instrument scientist for the PLATYPUS neutron reflectometer. His research interests include magnetism, superconductivity, ferroelectricity, spintronics, multiferroics, and the epitaxial growth and characterization of multifunctional materials.

Sam Duyker is a new postdoctoral researcher with the Institute's Energy Project. Sam recently completed his PhD at the University of Sydney, and will be using neutron diffraction to understand the gas adsorption behaviour of porous metal-organic frameworks toward applications such as gas separation, hydrogen storage and CO_2 capture and conversion.

Bob Aldus joined us in a joint postdoc position with ANSTO's Institute of Materials Engineering with the aim of observing changes in magnetic properties of metals and oxides used in the construction of electricity generation facilities. Bob recently completed his PhD and further research at University College London in neutron scattering from rare-earth pyrochlore magnets.

Lisa Thoennessen has begun a PhD at the University of Wollongong under the joint supervision of Klaus-Dieter Liss. Lisa will be studying the thermomechanical processing of titanium and will investigate the kinetics of the phase transformations in some titanium alloys using neutron-scattering techniques.

The Institute welcomes Norman Booth from the University of Technology, Sydney where he worked for 19 years, ultimately as a Professional Officer in the Microstructural Analysis Unit, and where he also obtained his PhD in Materials Science. Norman is responsible for testing, commissioning and putting in operation all capital equipment for sample environments.

Marcus Hennig is a postdoctoral researcher and at the Institute will be focussed on developing analysis software for quasi-elastic and inelastic neutron scattering data, and has an interest in modelling the behaviour of proteins in crowded conditions. Marcus recently completed his PhD in Physics at the University of Tübingen, Germany and Institut Laue-Langevin, Grenoble, France.

Departures

We congratulate James Taylor, a postdoc in the Institute, who has taken up a position as co-responsible on the D22 SANS instrument at the Institut Laue-Langevin in Grenoble, France.

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