Bragg Peaks > for neutron users
ISSUE 11 | August 09

OPAL news

In the period April - June 2009, the OPAL Reactor and its cold-neutron source ran extremely well. The user program is in full swing on Echidna and Wombat, with 75% and 60% of days available used for formal user experiments since the beginning of 2009, and it has commenced on Kowari, Koala and Platypus. In the third and latest call for proposals, the user program has been opened up on Quokka, Taipan (subject to getting the operating licence from our regulator) and the bio-deuteration facilities with the National Deuteration Facility (NDF), and beam time allocations have been sent out for time commencing in September.

Unfortunately, the OPAL reactor has experienced some significant scheduling difficulties in July and August, and we are still awaiting the transition to a flexible fuel management strategy, which will allow operations to adhere to a predictable calendar schedule, even if OPAL experiences unforeseen short shutdowns. In August we experienced a failure of one of two main compressors for the cold-neutron source, but we expect this to be fixed by the end of August 2009.

Bragg Institute News

The major news is the announcement by the Commonwealth Government of an extra $37M in capital funds, as part of its May 12th Budget, for a new split cold neutron guide on CG2, 3 extra instruments (a 2nd SANS, a backscattering spectrometer, and neutron radiography) and some new sample-environment apparatus. We are now in the process of hiring new staff to implement this decision, and will run a workshop on 27-28 August to scope the capital project in more detail. All interested parties are welcome to attend. This new capital project will be led by Frank Klose.

Finally, the National Deuteration Facility was merged into the Bragg Institute on July 1st, and we formed a new Soft-Matter Group comprising the soft matter scientists doing small-angle scattering and reflectometry (with both neutrons and x-rays) together with the NDF staff, all under the leadership of Peter Holden.

3rd Proposal Round

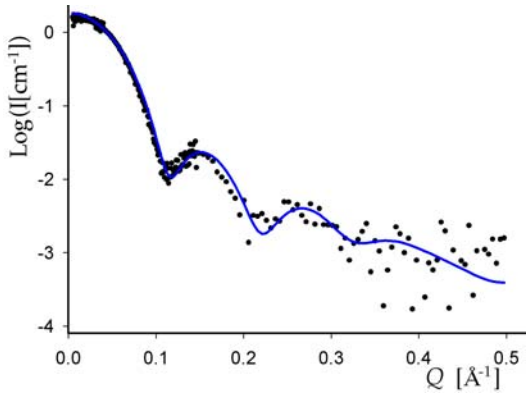
The May proposal round was heavily subscribed, with over 150 proposals received for the neutron beam instruments and the NDF. Program Proposals, where multiple beamtime allocations can be requested for up to 3 years, were offered for the first time and 20 such proposals were submitted. Program proposal allocations are limited to 25% of the total time on each instrument, so a maximum of one program was available on each instrument.

We experienced good demand across all instruments and the NDF, with particularly heavy demand on Quokka (>400% of the available time) to the point that many excellent proposals cannot be run in the coming round. There was also strong overseas demand, with 36% of proposals coming from outside Australia.

The Program Advisory Committee met to consider the proposals on July 20 and 21 and recommended that 3 program proposals, 102 normal proposals and 7 NDF proposals be approved. Unsuccessful program proposals were also considered for one-off allocation along with the normal round proposals.

Around the instruments

Quokka *(small-angle neutron scattering, SANS)*
A number of advanced commissioning experiments have been run on Quokka in the last 2 months. One of the most significant was a demonstration of Quokka's capability to measure dilute protein solutions.



The data above shows reduced scattering data on solution of glucose isomerase, with fit values

consistent with the existing literature on this standard sample.

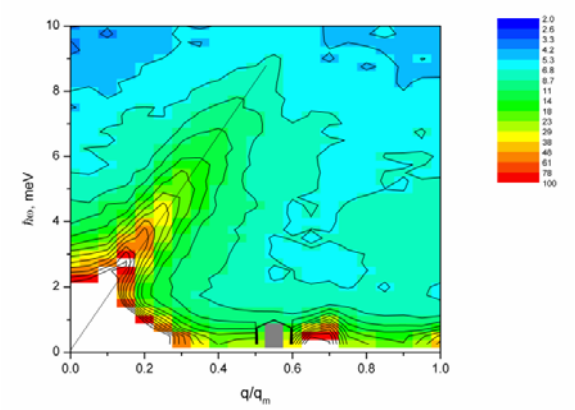
Quokka's "demountable" window titanium cells have also arrived. Shown in the photo these are designed for easy to assembly, disassembly, cleaning and can hold gel, melt, powder and liquid samples. The cells have spacers to set sample path thicknesses of 1, 2 or 4mm. A sample volume of about 0.5ml is required per mm of thickness. "Zero" path length cells are also available, where the thickness may be set by a thin gasket spacer.

Finally, August saw the installation by Mirrortron of Quokka's spin-flipper – the last physical component of the polarization system, which completes the instrument's project base design.

Taipan *(thermal three-axis spectrometer)*

While we have yet to submit Taipan's operating license to the regulator, and cannot commence user operations until it is approved, some test experiments have been performed, for example on super-ionic conductors. These are materials that allow the macroscopic movement of ions through their structure, leading to exceptionally high (liquid-like) values of ionic conductivity in the solid state. Potential applications include miniature, high-power-density lithium batteries for heart pacemakers, mobile phones etc to high-capacity energy storage devices for next-generation electric vehicles.

Recently a previously studied ionic conductor, $Cu_{1.85}Se$, which exhibits a super-ionic α-phase at room temperature, has been studied on Taipan.

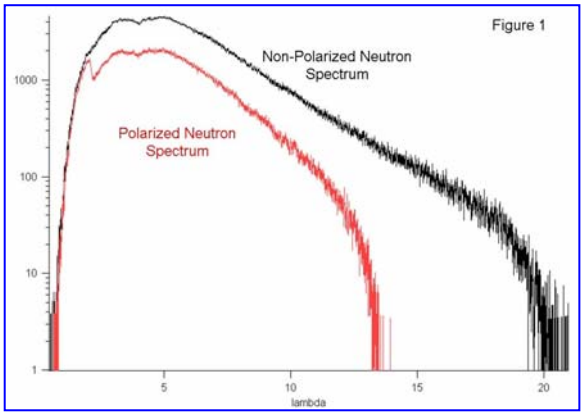


The figure above shows measured phonon dispersion curves: these are important clues to understand the ionic diffusion mechanism in these materials.

Platypus *(reflectometer)*

The first polarised neutron beam at OPAL has been observed using our Platypus time-of-flight neutron reflectometer. The polarised neutron beam is prepared using a (m=4) Fe/Si super-mirror in transmission mode installed in the collimation system. Neutrons reflected from this super-mirror are captured within the collimation system and do not strike the sample under study.

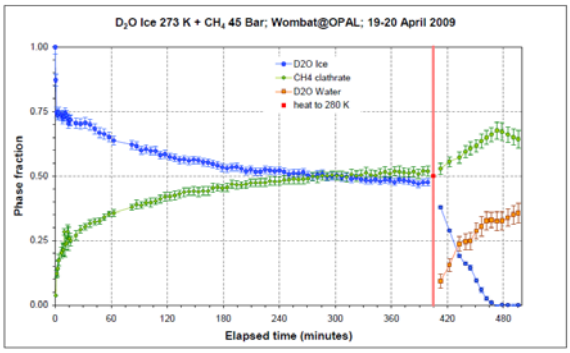
The figure below shows a comparison between the (spin-down) polarised and the standard non-polarised neutron spectra for Platypus in the absence of a magnetic guide field. The effective bandwidth available for use in future polarized neutron reflectivity experiments is 2.5 Å to 13 Å.



The main application for this method is for the study of thin magnetic films and multilayers, like those found in magnetic recording applications, for instance in computer hard drives and the associated read-heads.

Wombat *(high-intensity powder diffractometer))*

Wombat has been used by CSIRO to study the high-pressure formation of methane clathrate hydrate, in which methane is encapsulated in a cage of water molecules. Clathrates can form in natural-gas pipelines at high pressure on the ocean floor and can initiate the formation of ice plugs, completely blocking the pipeline, and an understanding of the early stages of their formation is critical to prevention of these blockages. The figure below shows the time evolution of high-pressure clathrate formation in D_2O ice, with a marked increase as the ice is melted, and demonstrates Wombat's ability to resolve changes over 1 minute time intervals



Announcements

Scoping workshop for New Guides, Instruments and Sample-Environment Apparatus at OPAL, 27-28 August

In the Australian Government's latest Budget of 12th May 2009, it was announced that ANSTO will receive $37M of new capital funding for a new split cold guide at the OPAL Reactor, along with three new instruments (SANS, high-resolution spectroscopy and neutron radiography/tomography/imaging) and further sample-environment apparatus.

A 2-day scoping workshop will be held at the Bragg Institute on 27-28 August 2009, to bring together the Australian/ New Zealand user community and selected international experts to discuss the details of the instruments to be installed. All interested parties are welcome to attend. AINSE will support travel and accommodation for up to two attendees from each member university.

Please visit:
http://www.ansto.gov.au/research/bragg_institute/current_research/conferences_and_workshops/workshop_on_instruments_2009
for more details and to register for the workshop.

Echidna Mail-in Service

Our new "mail-in" neutron powder diffraction service has been launched on our Echidna high-resolution powder diffractometer. This service accepts proposals at any time. It is intended for users who require high-quality data for a limited number of samples, for new users, or for users wishing to check samples prior to applying for a normal instrument time allocation. Powder diffraction data will be collected at room and/or liquid-helium temperatures using a selection of wavelengths. It is not available for experiments requiring temperature scans or other sample environments: these must still go through the normal proposal system. Short turnaround time (within 1-3 weeks after sample shipping) may be expected, as proposals will be reviewed for technical feasibility and safety only. Details may be found on the Bragg Institute web page or by contacting the instrument scientist or our User Office.

Faces

Newcomers:
Jitendra Mata, previously at the Australian National University in Prof. John White's group, joined us as part of our team working on Food Science, in partnership with CSIRO.

Samantha Mickle has joined us as head of of our Scientific Operations Group. Prior to joining us Samantha was with the National Medical Cyclotron in Sydney and before that the Australian Synchrotron in Melbourne.

Kathleen Wood joined us as the third instrument scientist on our Quokka SANS Instrument. Kathleen did her PhD at the Institut Laue Langevin, and joins us from the University of Groningen in the Netherlands. Her interests are primarily in structural biology.

Joel Bertinshaw, currently at ANSTO as part of the Nuclear Graduate program, will commence a PhD investigating magnetic thin films using polarised neutrons on Platypus, supervised by Frank Klose and Clemens Ulrich.

Jessica Veliscek Carolan, a student at Sydney University, has begun a 6 month stay at Bragg Institute under the Nuclear Graduate program. She is working on bacterial surface layers and the Be filter project with Anton Stampfl.

The National Deuteration Facility team joined the Bragg Institute in July. From left, Agata Rekas, Greta Moraes, Karyn Wilde, Paramjit Bansal, Marie Gillon, Anthony Duff, Rob Russell, Peter Holden and Rob Robinson.

Contact us
Bragg Institute – User Office, Building 87
ANSTO
PMB 1, Menai, NSW 2234, Australia
T +61 2 9717 9458, F +61 2 9717 3606
E bragg-user-office@ansto.gov.au
www.ansto.gov.au/research/bragg_institute.html