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Soft X-ray Micro-characterization Beamline 06B1-1 (SXRMB)

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Beamline Overview

Status	Operational – accepting proposals (XAFS); Commissioning (other techniques)
Source	Bending Magnet
Monochromator	Fixed Exit Double Crystal InSb(111), Si (111)
Spectral range	1700 – 10000 eV
Flux	XAS: $>10^{12}$ ph/s Microprobe: $>10^{9}$ ph/s
Brilliance	XAS: $>2.5\times10^{13}$ ph/s/mm^2 Micro. $>1.3\times10^{14}$ ph/s/mm^2
Resolving power	InSb (111): up to 3700 Si (111): up to 10000
Spot size	XAS: 0.5 x ~1 mm Micro. ~10 x 10 µm

Introduction

SXRMB was designed and built to provide users with access to the "intermediate" photon energy range between what is defined as "hard" and "soft" X-rays. Two sets of crystals are used to cover the designed energy range: InSb(111) 1.7-4 keV; Si(111) 3-10 keV. In doing so, this beamline follows the tradition of the Canadian Synchrotron Radiation Facility (CSRF) DCM beamline at the Synchrotron Radiation Center in Wisconsin, while at the same time delivers much improved performance in brightness and energy resolution, and expands the energy range and the scientific capabilities to include microprobe and hard X-ray photoelectron spectroscopy.

Science

The main focus of the science on this beamline falls in the "intermediate" photon energy range (between 1700 and 4000 eV). Covering the K, L, and M-edges of many main group elements such as P, S and Cl, and transition metals, this beamline will find wide application in a number of fields including but not limited to: materials science, life science, environmental science, geo- and soil science, and tribology. This beamline will be attractive to both academic and industrial users.

Beamline Instrumentation

The following endstations are planned and/or are under construction for this beamline:

- Solid state X-ray absorption station (in vacuum)
- Standard XAFS station for transmission and fluorescence measurements
- Microprobe and Micro-XANES station
- Hard X-ray photoelectron system
- Transmission / Gas Phase Spectroscopy

The standard XAFS endstation has been fully commissioned and it is capable of measuring total electron, fluorescence and transmission yields. It is now operational and has produced the first publication from the Phase II beamlines. The XAFS station is open to general users. The samples can be run in vacuum or in inert gas atmosphere. The microprobe station is being installed and its commissioning will commence in early 2010. A science associate has been hired to work on the hard X-ray photoelectron system.

Layout

Figure 1 shows the schematic layout of the beamline. The primary optical enclosure houses the white beams slits, vertical collimating mirror, double crystal monochromator, and post-monochromator focusing and collimating mirrors. The second optical enclosure (experimental hutch) houses an in-line ionization chamber and two back-to-back endstation areas, one modular and the other dedicated to microprobe.

Performance

The commissioning of the beamline has progressed well, particularly with the Si(111) crystals. Thicker and stiffer InSb(111) crystals were installed recently. Together with the new crystal holder design and the improved crystal mounting, significant improvement in the flux using InSb(111) crystals has been obtained (Figure 2).

Beamline Design and Beamline Teams

Yongfeng Hu	CLSI	Beamline Scientist
Qunfeng Xiao	CLSI	Research Associate
Chris Regier	CLSI	Engineering Lead
Glen Wright	CLSI	Controls / Instrumentation Lead
Ru Igarashi	CLSI	Controls
T.K. Sham	UWO	Beam Team Leader

Conclusion

The SXRMB beamline optics are in good order with both the InSb(111) and Si(111) monochromator crystals. The XAFS station is now open to general user experiments while we continue to build and commission other endstations of the beamline.

Acknowledgements

The SXRMB team would like to acknowledge the contributions of the University of Western Ontario, Ontario Innovation Trust, Canada Foundation for Innovation and Western Economic Diversification to this project.

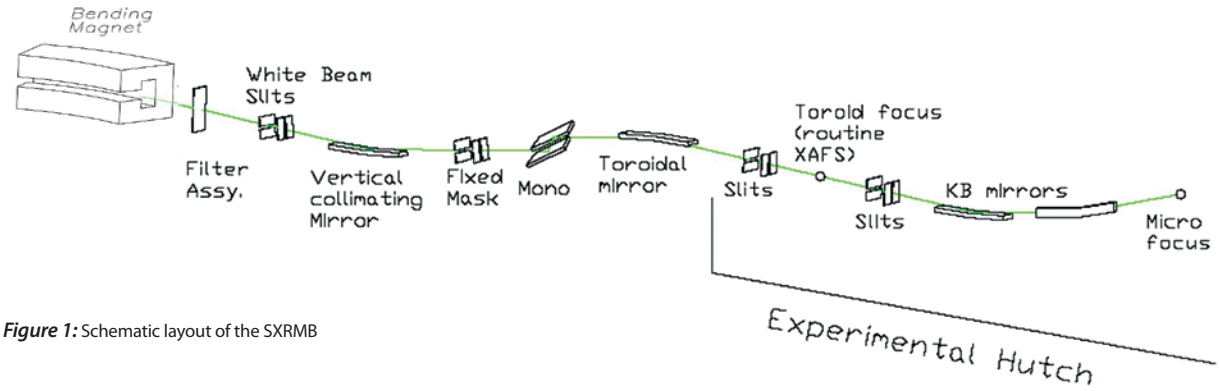

Figure 1: Schematic layout of the SXRMB

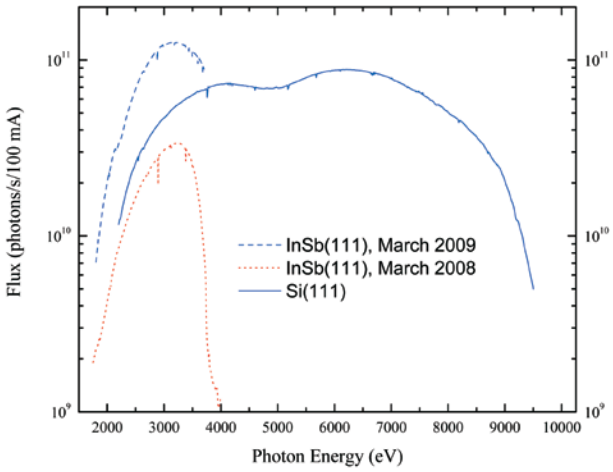

Figure 2: Photon flux measured by an AXUV-100 Si photodiode, normalized to 100 mA ring current.