

Variable Line Spacing Plane Grating Monochromator (VLS-PGM) Beamline 11ID-2

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Beamline Overview

Status	Operational
Source	185 mm planar undulator
Monochromator	Variable line spacing plane grating
Spectral range	5.2-250 eV
Flux	10^{12} photons/s (50x50 μm)
Brilliance	10^{16} photons/mm ² /mrad ² / 0.1% bandwidth
Resolving power	$>10^4$
Spot size	0.5 x 0.5 mm ²

Introduction

The VLS-PGM beamline covers a soft X-ray energy range of 5.2–250 eV by using three variable line spacing plane gratings. It has met or exceeded the designed performance with excellent resolution and flux [1,2]. It has been operational since the summer of 2006 and it is accepting general user proposals.

Science and Research Activities

The VLS-PGM beamline is ideal for high resolution, low energy spectroscopic studies of materials of both fundamental and applied nature. Equipped with a number of endstations, such as a solid state absorption chamber, photoemission electron microscope (PEEM) endstation, photoemission spectrometer with Scienta analyzer, and gas phase-based endstations, users can perform experiments using techniques such as X-ray absorption spectroscopy, spectromicroscopy, photoelectron spectroscopy, resonant Auger and Auger electron spectroscopy, and X-ray excited optical luminescence spectroscopy.

The VLS-PGM attracted many groups of users nationally and internationally in 2007 (Table 1). The majority of the user activities on the VLS-PGM have focused on the X-ray absorption studies of environmental, geological, and material research using the solid state absorption chamber [3,4]. Taking advantage of the high resolution and low photon energy of the VLS-PGM, there is strong interest in combining PEEM imaging ability with Ultraviolet and X-ray photoelectron spectroscopy studies (UPS/XPS) for of various materials. Other research activities with VLS-PGM have involved high resolution gas phase spectroscopic studies of atoms and small molecules using the gas cell and the Time-of-Flight endstation. Together with Tim Reddish (U. of Windsor), a toroidal photoelectron spectrometer is being set up to expand the gas phase research capabilities at the CLS.


A high resolution photoemission system is being developed. This system, based on a Scienta SES-100 analyzer, will be dedicated to the UPS, XPS, and AES studies of various solid state materials, such thin films and minerals.

References

1. Hu, Y.F., Zuin, L., Reiningger, R., Sham, T.K. 2007. AIP Proceedings for the 9th International Conference on Synchrotron Radiation Instrumentation, 879, 535-538.
2. Hu, Y.F., Zuin, L., Wright, G., Igarashi, R., McKibben, M., Wilson, T., Chen, S.Y., Johnson, T., Maxwell, D., Yates, B.W., Sham, T.K., Reiningger, R. 2007. Rev. Sci. Instrum., 78, 083109(1-5).
3. Xu, D., Peak, D. 2007. Environ. Sci. Technol., 41, 903-908.
4. Pratt, A., Zuin, L., Yiu, Y.M., Harmer, S. 2007. Can. J. Chem., 85, 761-766.

Table 1: User projects at VLS-PGM in 2007

PI	Proposal
Ikechukwuka Oguocha U. of Saskatchewan	Charge transfer in NiP alloys and reactivity in metal matrix composites
Frauke Godlinski Agriculture and Agri-Food Canada	Phosphorus speciation in manure and manure amended soils in Southern Alberta
Robert Schaut Penn. State University	Boron coordination at pristine and chemically altered oxide glass surface
Cassandra Schefe Department of Primary Industries, Victoria, Aus.	Speciation and distribution of Al hydroxides in soil when sorbed to phosphate and organic ligands
Grant Henderson U. of Toronto	B K-edge XANES studies for alkali borosilicate glass structure and radiation damage
Robert Blyth CLS	High resolution XANES of soil trace elements
Michael Bancroft U. of Western Ontario	Structure of Silicate Glasses from XANES
Federico Rosei INRS, Univ. of Quebec	Nanospectroscopic study of Si-Ge intermixing by two-step heteroepitaxial growth of Ge on Si(111)
Robert Blyth CLS	XEOL of organics
James Dynes U. of Saskatchewan	The effect of pH and Se Species on the nature of Aluminum-Selenium Precipitates
Pranesh Aswath U. of Texas at Arlington	Analysis of Tribofilms formed by Fluorinated Zinc Dialkyl Dithiophosphate using XANES
Wenhui Xiong U. of Saskatchewan	Investigation of the Reduction of Internal Phosphorus Loading using XANES and sequential Phosphorus Extraction



Stephen Urquhart U. of Saskatchewan	Examination of Organic and Inorganic Thin Films by UPS and XPS Imaging Modes in the X-PEEM microscope
Stephen Urquhart U. of Saskatchewan	Investigation of Embrittlement Mechanisms in Stainless Steel Alloys
Derek Peak U. of Saskatchewan	Soft X-ray spectroscopic studies of environmental samples
Cunhai Dong U. of Victoria	Core-shell structure on lanthanide fluoride nanoparticles determined by lanthanide 4d X-ray absorption
Peter Leinweber U. of Rostock, Germany	Speciation and quantification of inorganic and organic P forms in environmental samples by P L-edge XANES
Ajay Dalai U. of Saskatchewan	Catalyst Characterization for Applied Energy Research
Masoud Kasrai U. of Western Ontario	Characterization of tribofilms generated from oil additives using Si, P, S and B XANES spectroscopy
John Neville U. of New Brunswick	Double ionization and ionic fragmentation of the isomers propyne and allene
T. K. Sham U. of Western Ontario	XEOL and XAFS studies of light emitting materials and nanostructures
Peter Kruse McMaster University	X-PEEM study of corrosion inhibition of steel by aniline trimer
Tyler Roschuk McMaster University	XEOL and XAS studies of Si-nanostructures formed in silicon oxide, nitride, and oxynitride thin films