Synchrotron Laboratory for Micro and Nano Devices (SyLMAND) Beamline 05B2-1

V. Subramanian
Canadian Light Source, Inc.

70

BEAMLINE LEADER:

D. M. Klymyshyn
david.klymyshyn@usask.ca
1-306-966-5393
S. Achenbach
s.achenbach@usask.ca
1-306-966-5307

BEAMLINE SCIENTIST:

V. Subramanian
venkat.subramanian@lightsource.ca
1-306-657-3579

Beamline Overview

Status	Under Construction
Source	Bending Magnet
Energy range	1 – 15 keV
Beam power	700 W
Beam Size (Horizontal x Vertical)	150 mm x 15 mm

Introduction

The Synchrotron Laboratory for Micro and Nano Devices (SyLMAND) currently under construction at the Canadian Light Source (CLS) will be a unique microfabrication research facility in Canada. It will provide distinctive capabilities not currently available in Canada and be highly complementary to other existing and emerging facilities. SyLMAND will be dedicated to research in and fabrication of polymer microstructures using X-ray lithography (XRL) and deep XRL (DXRL).

The SyLMAND facility incorporates a dedicated bend magnet beamline in a cleanroom environment as well as adjoining resist wet chemical processing and metrology clean laboratories to run the individual process and analysis steps.

Facility Update

Design

The preliminary design of the beamline and the supporting facility was completed in April 2006. The detailed design of individual beamline components is complete and procurement of these components is nearing completion.

Facility Location and Cleanrooms

The SyLMAND facility was originally planned to be spread between the beamline on the CLS experimental floor and the supporting infrastructure in the CLS Phase II building expansion. Taking advantage of a reorganization of Phase II beamlines at the CLS, the SyLMAND facility integration was recently redesigned to now be one single facility on the CLS experimental floor. The beamline will be located at port 05B2 and use parts of the existing infrastructure and resources at the CLS facility. Therefore, all aspects of the cleanroom processing will be housed in one facility, simplifying the facility's concept and enhancing its capabilities. The design of the resist cleanroom (HVAC, architectural, mechanical, electrical) is now complete and construction is in progress. The cleanroom is expected to be ready for occupancy in spring 2008 and commissioning of the cleanroom and cleanroom equipment will begin immediately after. A sketch of the beamline and cleanroom layout is shown in Figure 1.

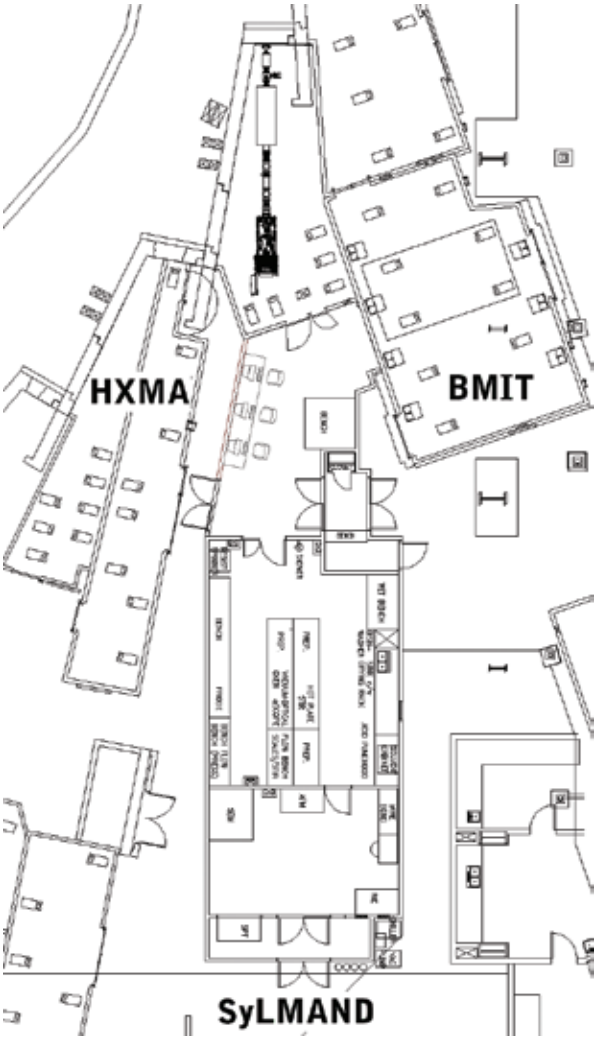

Figure 1: SyLMAND beamline and cleanroom layout

Hutch

The installation of the SyLMAND hutch (primary optical enclosure) was completed in summer 2007. The installation of all mechanical services for the beamline is also complete.

Endstation

SyLMAND will have a dedicated X-ray scanner as the

endstation component for full-wafer exposure under vacuum including capabilities for inclined and aligned exposures. The scanner was delivered to the CLS in October 2007. The tests on the vacuum tight beryllium window (100 µm thick, 160 mm x 85 mm) were successfully performed before installation inside the scanner. The scanner with the vacuum tight beryllium window was successfully installed in its final location inside the SyLMAND hutch using a temporary beamline setup in December 2007. All on-site acceptance tests for the scanner with the synchrotron beam were successfully performed.

Beamline Components

The detailed design of the main optical component (Double Mirror System) for the SyLMAND beamline is now complete and the delivery of the Double Mirror System is expected in late winter 2008. The detailed design of other beamline components namely the slits, vacuum isolation window and the wire beam position monitor is now complete and procurement is in progress. The installation of all remaining beamline components with the possible exception of the chopper are expected to happen in spring 2008. The commissioning of the beamline is expected to begin in summer 2008. The SyLMAND beamline layout is shown in Figure 2.

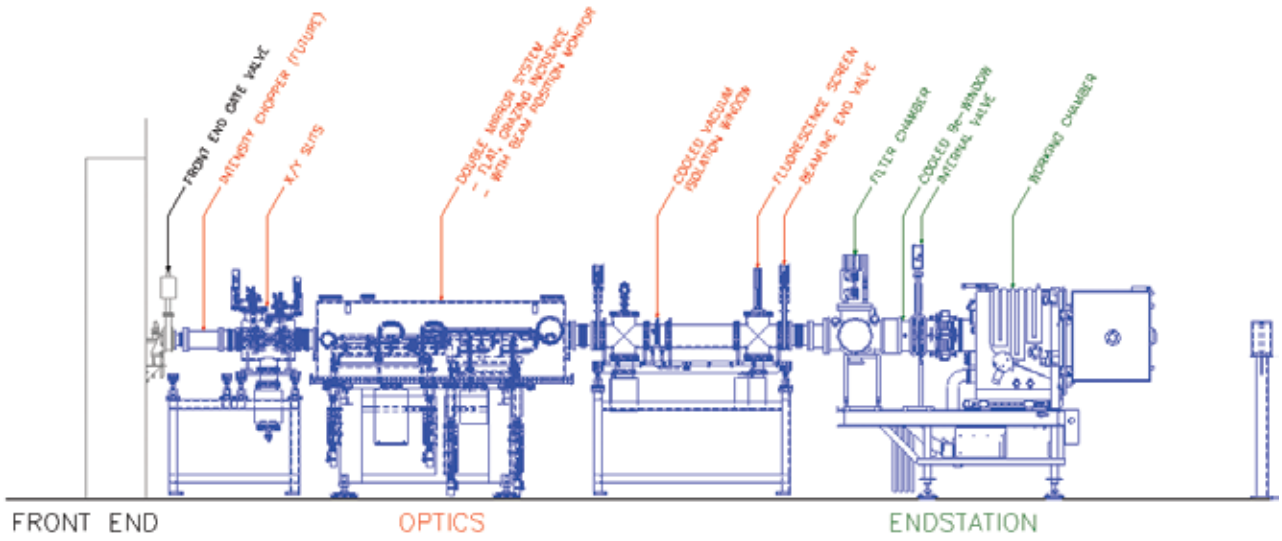

Figure 2: SyLMAND beamline layout

Research

The SyLMAND Research Group is actively involved in RF MEMS and biomedical research. Together with partners from Canada and overseas, first demonstrators have been designed, fabricated and published [1-4]. Once the SyLMAND facility is operational, comparable devices will be fabricated in Saskatoon. At that time, advantage can be taken of the unique capabilities of the SyLMAND facility, including beam size and beam tuneability.

Suggested Reading

Achenbach, S., Klymyshyn, D., Haluzan, D., Mappes, T., Wells, G., Mohr, J. 2007. Fabrication of RF MEMS Variable Capacitors by Deep X-Ray Lithography and Electroplating. Microsystem Technologies, Vol. 13, 3-4 ,343-348.

Fang, L., Klymyshyn, D., Dinh, A., Haluzan, D. and Achenbach, S. 2005. Phase Noise Performance Comparison between LIGA-MEMS and On-Chip CMOS capacitors for a VCO application.Proceedings of IEEE Canadian Conference on Electrical and Computer Engineering (CCECE 05), Saskatoon, SK, Canada, May 1-4, 2005. 0425-0428.

Klymyshyn, D., Haluzan, D., Börner, M., Achenbach, S., Mohr, J., Mappes, T. 2007. High Aspect Ratio Vertical Cantilever RF-MEMS Variable Capacitor. IEEE Microwave and Wireless Component Letters (MWCL), Vol. 17, Nr. 2, 127-129.

Ma, Z., Klymyshyn, D., Achenbach, S., Mohr, J. 2005. Microwave Cavity Resonators using hard X-Ray Lithography. Microwave and Optical Technology Letters, Vol. 47, 4, S. 353-357.