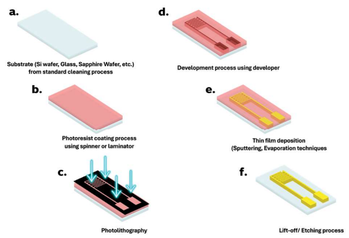
PRINCIPLE INFORMATION

The Microsystems & Microelectronics Laboratory and Beamline 6: Deep X-ray Lithography (DXL) provide advanced facilities, equipment, and engineering support in accordance with international standards. The laboratory specializes in microfabrication technologies, including photolithography, thin-film deposition, and etching processes—to support research, development, and innovation across a wide range of technological fields such as Semiconductor technology, Microelectronics & Nanoelectronics, Lab on a chip, Optoelectronics & photonics, Aerospace & defense technology etc.

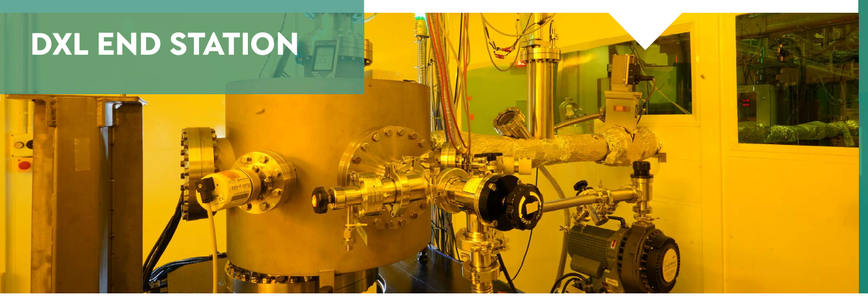
These facilities enable the development of cutting-edge technologies, such as sensor and actuator systems, quantum technologies, microfluidics, and semiconductor devices. The laboratory serves as a key infrastructure for both academic research and industrial applications. In addition, it offers hands-on training programs in microfabrication to develop a highly skilled workforce capable of supporting future high-technology industries.



Basic Principles of Photolithography

Photolithography is a microfabrication process used to transfer geometric patterns onto a substrate through light exposure. As a core technology in semiconductor and MEMS manufacturing, it works by selectively exposing a photoresist-coated substrate to light through a patterned mask. The exposed areas are then chemically developed to create precise micro-scale patterns.

DXL END STATION



DXL TECHNICAL SPECIFICATION

Category	Specification
Beamline	BL6: DXL/MES
Photon Energy Range	2 – 10 keV
Photon Flux (Full beam)	-
X-ray Beam Size	Horizontal: 90 mm Vertical (not bending mirror, P = 0.0 MPa): 5.35 mm Vertical (bending mirror, P = 0.6 MPa): 3.75 mm
Detector	-
Sample Requirement	Chamber must maintain a stable environment at 40–50% Relative Humidity (RH)

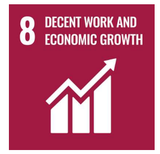
Main Process Steps

Substrate Preparation	Cleaning the silicon wafer.
Photoresist Coating	Applying a light-sensitive polymer layer and Soft Bake to removing solvents to stabilize the photoresist.
Exposure	UV or X-ray light passes through a photomask to define patterns.
Development	Exposed or unexposed areas are removed (depending on resist type).
Etching / Deposition	Pattern transferred into the underlying layer.
Resist Removal	Photoresist is stripped after processing.

SDGs SUPPORT



Enabling Sustainable Manufacturing through Micro-Scale Technologies.



Driving Economic Growth through High-Technology Innovation.



Advancing Innovation through National Microfabrication Infrastructure.



Enabling Sustainable Manufacturing through Micro-Scale Technologies.



Strengthening Collaboration for Sustainable Technology Development.

MES LABORATORY



OVERALL LABORATORY



MES Facilities for micro-nanofabrication

TRAINING AND WORKSHOP



Workshop and Training of microfabrication techniques for upskill/reskill

APPLICATIONS



Applications of MES and BL6 DXL facilities: Micromould, Lab on chip, Sensors, Semiconductor, Optical lens.

DXL & MES

MES FACILITIES

Photolithography

Machines	Specification
Clean room	Class 100,000 Class 10,000 Class 1,000





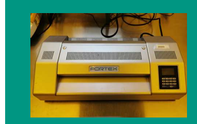
EVG 610 mask aligner (UV light source)	Alignment resolution: 0.5 µm Mask size: 5 inches Wafer size: 4 inches Lamp: Mercury500W Exposure Modes: contact, soft, hard, vacuum and proximity Alignment Modes: top-side (TSA), back-side (BSA),



Spin coating	Max Substrate: ≤ 4 inches Spin speed range: 0-10,000 rpm Acceleration: 100- 5,000 rpm/s Positive resists: AZ4620, AZ1512 AZ1518, 950PMMA A2, 950PMMA A4, 950PMMA A9 Negative resist: SU-8 2000.5, SU-8 2002, SU-8 2100 SU-8 3025, SU-8 3050, AR-N 7520.17 new



Laminator	Maximum working width: 325 mm (12.8") Minimum Material Thickness: 0.1 mm (0.003") Maximum Material Thickness: 3 mm (0.118") Temperature range: 0 – 150 °C (0-302°F) Lamination speed: 0 – 1 m/minute (3.2fpm) Variable in 6 stages

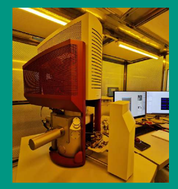


Maskless lithography

Machines	Specification
MicroWriter ML3	Maximum Writing Area: 195mm x 195mm. Maximum Wafer Size: 230mm x 230mm x 15mm. Minimum Feature Sizes: 0.6µm, 1µm, 2µm, and 5µm Exposure Wavelengths: 365nm and 405nm Acceptable File Formats:CIF, GDS2, BMP, TIFF, JPEG, PNG, GIF (OASIS, DXF, Gerber RS-274X via KLayout conversion).



TESCAN MIRA3 for Electron beam lithography	Electron beam energy: 200eV – 30keV Probe current: 2pA to 200 nA Maximum sample size: 2.5x2.5 cm Maximum write field size: 1 mm The error stage movement: ±2 µm Error of write field (WF) accuracy: 1% of WF size Designing software: DrawBeam and Clewin (.gds, .dxf, .dbp)



Physical (vapor) deposition

Machines	Specification
Electron beam evaporator	High Voltage Range: 4 kV to 9 kV Emission Current: 0-670 mA at 9 kV Filament power: 600 Wmax Sweep Lateral Coil: ± 1 A Sweep Longitudinal Coil: ± 1 A Crucible Volume: 4 pockets, 15 cc Base Pressure: 6.0X10-6 Torr Materials: Au, Pt, Ag, Cu, Ti, Ni, Al, ect



Vacuum thermal evaporator	High Voltage Range: 0-120 V Evaporation Boats: 4 boats (tungsten) Base Pressure: 6.0X10-6 Torr Materials: Au, Pt, Ag, Cu, Ti, Ni, Al, ect.



Sputtering	Power Source: RF/ DC/ DC Pulse Base Pressure: 6.0X10-6 Torr Materials: Pt, Au, Cu, Ag, Al, Si3N4, TiO2, ITO, Ni, Cr, Nb, PZT, WO3, HfO2, MnO, SnO2, ZnO, Fe2O3







Cleaning and Etching

Machines	Specification
DISC-ICP-601 type reactive ion etching	Gas for etching: SF6, CHF3, CF4, O2, Ar Vacuum chamber size: Ø 300mm × H300mm Etching workpiece table: Ø6 inch Ultimate vacuum degree: ≤ 2×10-4 Pa RF power supply (coupled): 1000W, 13.56MHz RF Power Supply (Bias): 600W, 13.56MHz



Plasma-Surface-Technology HF-Generators	RF nominal output power: 300 watts Frequency: 13.560 MHz ± 100 ppm Adjustable RF output power: 0 - 300 watts, continuous



Dicing

Machines	Specification
Dicing saw automatic DAD3221	Workpiece size: Ø6" Spindle: Rate output 2.0 at 40,000 min-1 Rate torque 0.48 Nm Resolution speed range: 3,000-40,000 min-1

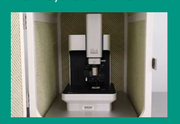


Surface Characterization

Machines	Specification
Optical surface profiler: Bruker ContourGT-K	Measurement Range: Sub-nanometer to 10mm. Software: Vision64 Operation and Analysis Software. Footprint: 492mm (W) x 534mm (D) x 754mm (H). Measurement mode: VSI and PSI Lens: 5X, 10X, 20X, 50X



Atomic force spectroscopy: Park Systems NX10	Z stage: 25 mm motorized travel range. Focus travel range: 15 mm motorized. XY stage: 20 mm x 20 mm motorized travel range. Sample Mount: Open space up to 100 mm x 100 mm, thickness up to 20 mm. Imaging Modes: Contact, non-contact, and tapping modes. Optics





DEEP X-RAY LITHOGRAPHY (DXL) AND MICROSYSTEM LABORATORY (MES)

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