

CEDT Equipment List: Nanofabrication Lab (Cleanroom)

Table of Contents

- [Critical Point Dryer \(Tousimis Autosamdri-815\)](#)
- [E-Beam Evaporator](#)
- [Fiber Optic Illuminator \(Dolan-Jenner Fiber-Lite 190\)](#)
- [Laminar Flow Cabinet - Locally Exhausted \(Canadian Cabinets\)](#)
- [Laser Lithography System \(Heidelberg \$\mu\$ PG 101\)](#)
- [Mask Aligner \(Karl Suss MJB3\)](#)
- [Optical Microscope \(Leica DMR\)](#)
- [Optical Table \(Newport RS2000 UCS\)](#)
- [PECVD Thin Film Deposition System \(Technics Micro-PD Series 900\)](#)
- [Plasma Etcher - ICP-RIE \(Oxford PlasmaPro 100 Cobra\)](#)
- [Plasma Etcher - RIE \(Technics Micro-RIE Series 800\)](#)
- [Scanning Electron Microscope \(SEM\) - Benchtop \(JEOL JCM-6000\)](#)
- [Spin Coater \(WS-650\)](#)
- [Sputter Deposition System \(Lesker PD500X3\)](#)
- [Stylus Profilometer \(KLA-Tencor P7\)](#)
- [Thin Film Stress Measurement System \(KLA-Tencor FLX-2320\)](#)
- [UV Ozone Cleaner \(UV-2\)](#)
- [Water Purification System - Deionization \(MilliporeSigma Milli-DI\)](#)

Nanofabrication Lab (Cleanroom) – JHE A306

Critical Point Dryer (Tousimis Autosamdri-815)

Description:

- Automatic supercritical point dryer for drying MEMS devices and small substrates using CO₂ and liquid solvent exchange.

Details:

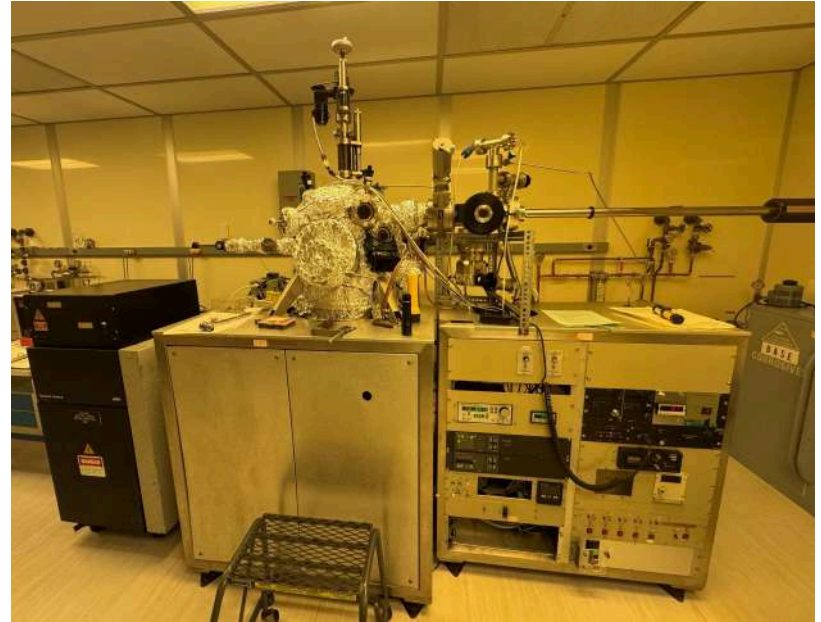
- Chamber dimensions: 1.25" inner diameter × 1.25" depth with a total internal volume of 25 mL
- Pressure monitoring range: 0–2,000 psi
- Temperature monitoring range: -30°C to 60°C
- Flow control uses fine metering valves with Vernier scales



E-Beam Evaporator [Custom-Made]

Description:

- E-beam deposition system for thin films under ultra-high vacuum (UHV) with load lock ($\sim 10^{-8}$ Torr). Capable of rotating and tilting samples.
- Compatible metals: Ni, Ge, Au, Ti, Pt, Cr
- Target size: up to 3" diameter



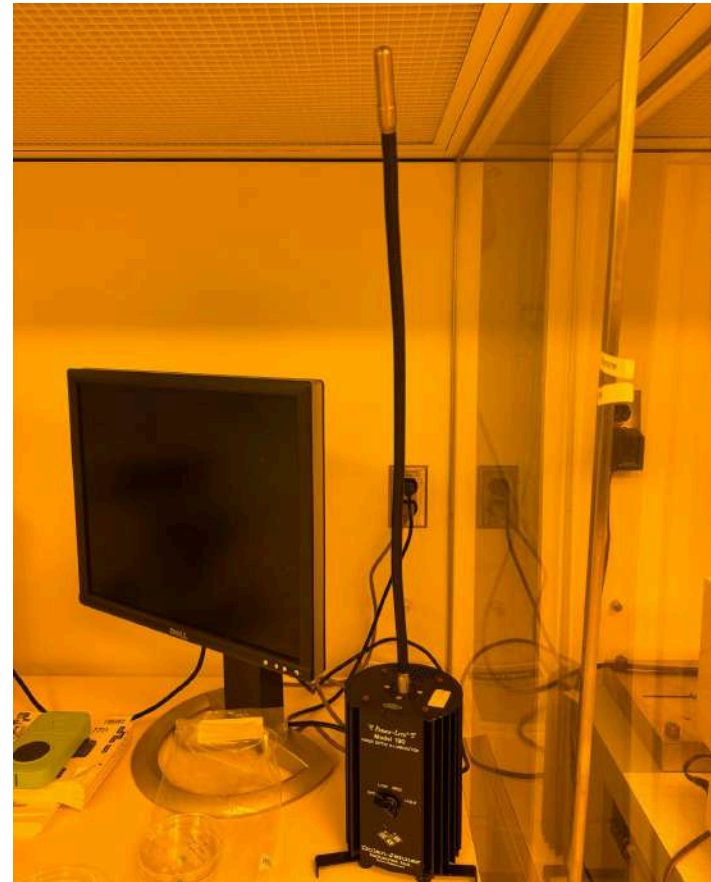
Fiber Optic Illuminator (Dolan-Jenner Fiber-Lite 190)

Description:

- High-intensity quartz halogen light source with flexible gooseneck fibre optic guide. Convection-cooled mechanism eliminates air particle generation, acoustic noise, and physical micro-vibrations.

Details:

- Illumination intensity: up to 10,000 foot-candles
- Color temperature: 3100 K
- Focal length: 28 mm
- Illumination spot diameter: 0.16"–2.87" (4–73 mm)



Laminar Flow Cabinet - Locally Exhausted (Canadian Cabinets)

Description:

- Total exhaust 5 ft wide laminar flow hood providing ISO Class 5 (formerly Class 100) cleanliness conditions via a self-contained HEPA fan filter module. Features a vertical-rising face shield and sealed LED light fixture.
- 1 in Cleanroom (for etching and cleaning), 1 in Compound Semiconductor Lab (for polishing)



Laser Lithography System (Heidelberg μ PG 101)

Description:

- Micro-pattern generator for direct writing applications and low-volume mask making. Supports grayscale lithography, manual alignment via an integrated camera system, and *in situ* design previewing using Exposure Wizard software.
- Applications: MEMS, bio-MEMS, integrated optics, microfluidics

Details:

- Structure size: down to $\sim 0.6 \mu\text{m}$
- Substrate size: up to 5" diameter; maximum thickness of 6 mm
- Design size: up to $90 \times 90 \text{ mm}$ (Mode I); $125 \times 125 \text{ mm}$ (Mode III)
- Write modes and focal lengths: Mode I (2 mm); Mode III (10 mm)
- Laser wavelengths: 405 nm baseline source; compatible with an alternative 375 nm laser diode for standard and UV resists



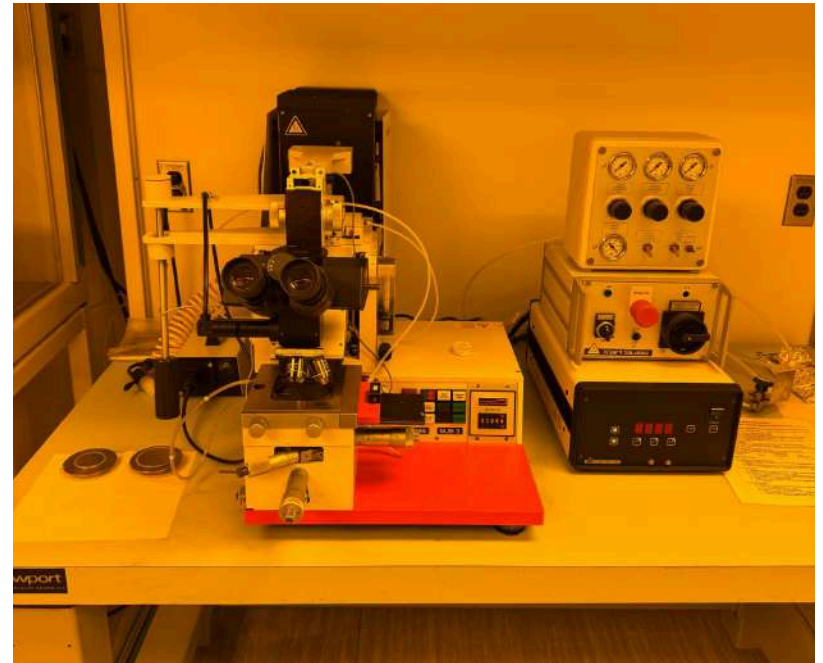
Mask Aligner (Karl Suss MJB3)

Description:

- Mask aligner for high-resolution UV photolithography and wafer alignment. Provides exposure options in vacuum contact, hard contact, soft contact, or proximity modes. Utilizes an optical system configured to reduce diffraction exposure effects.

Details:

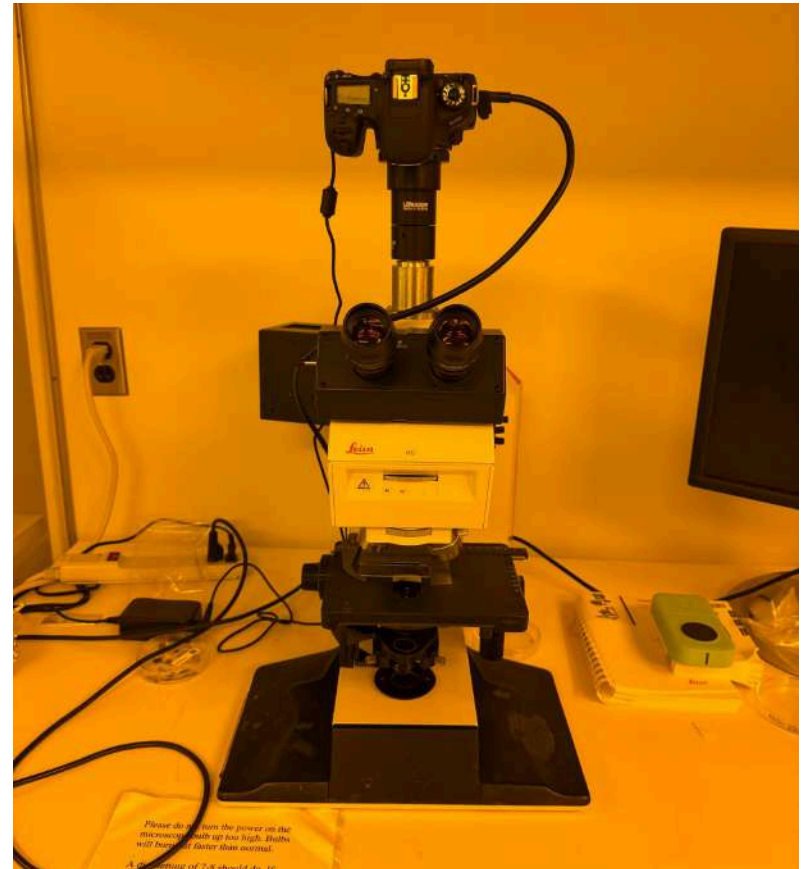
- Resolution: down to $\sim 0.6 \mu\text{m}$ line
- Alignment accuracy: down to $\sim 1 \mu\text{m}$ under optimal conditions
- Substrate size: from small parts less than 1 cm^2 , up to 3" diameter or square pieces
- Exposure source: 350 W mercury short-arc lamp
- Exposure wavelength range: 350–450 nm (broadband near-UV)



Optical Microscope (Leica DMR)

Description:

- Wide-field white-light LED illumination with objective lens up to 100x magnification. Equipped with 24 megapixel Canon 77D camera



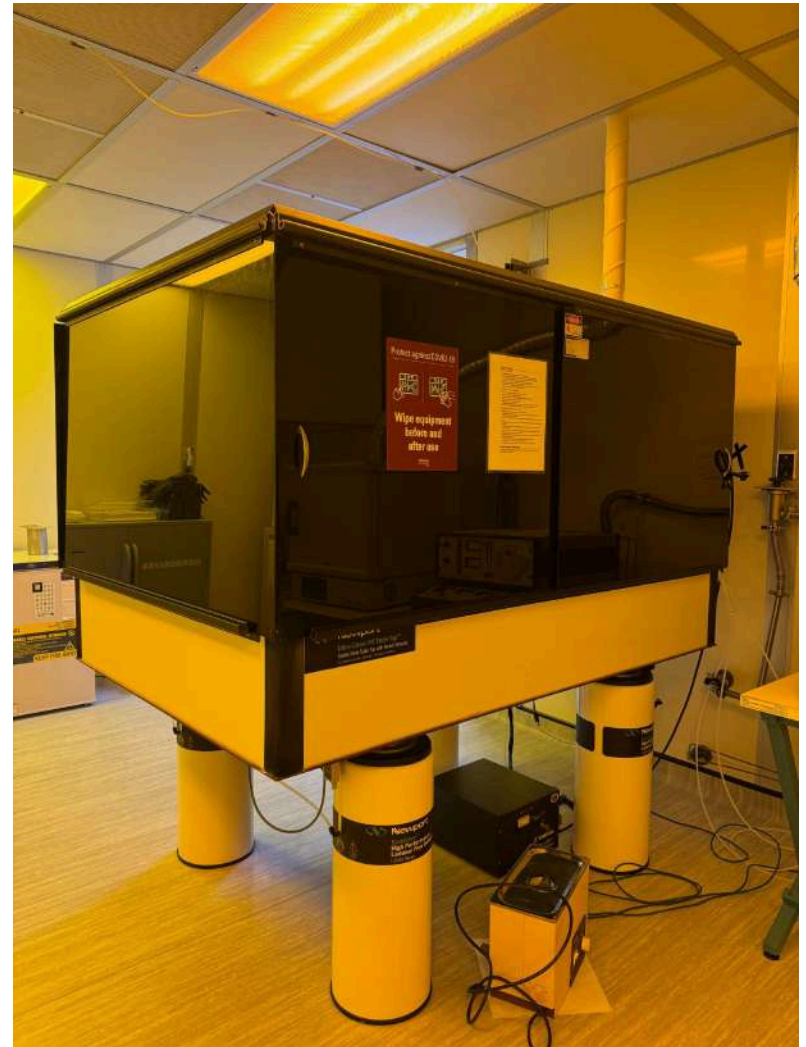
Optical Table (Newport RS2000 UCS)

Description:

- Broadband damped optical tabletop engineered for vibration-sensitive optical and imaging experiments. Incorporates three tuned mass dampers, a constrained-layer damping core, and a damped ferromagnetic stainless steel work surface to suppress structural resonance and minimize relative motion during high-resolution measurements and long-exposure experiments.

Details:

- Table length: 6 ft
- Surface flatness tolerance: ± 0.004 " (0.1 mm) over 2 ft²
- Top and bottom skin thickness: 3/16" (4.8 mm) with integrated damping layers
- Maximum dynamic deflection coefficient: 0.4×10^{-3}
- Maximum relative motion: 3.0×10^{-9} " (7.6×10^{-8} mm)
- Deflection under load: 5.0×10^{-5} " (1.3×10^{-3} mm)
- 1 in Cleanroom, 1 in Characterization Lab



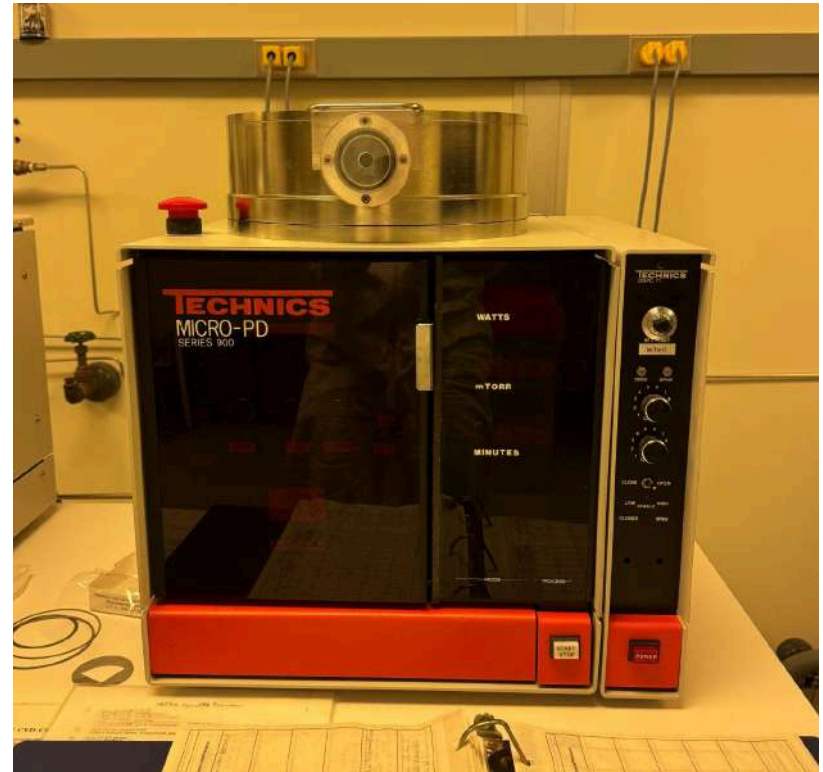
PECVD Thin Film Deposition System (Technics Micro-PD Series 900)

Description:

- Plasma-enhanced chemical vapour deposition (PECVD) system for depositing SiN, SiO₂, and amorphous Si thin films. Features automated recipe execution and supports up to five independent gas inputs across a variety of substrate materials.

Details:

- Substrate size: up to 3" diameter wafers; 9" water-cooled substrate holder
- Chamber geometry: 10" diameter stainless steel process chamber
- Process temperature range: typical operation between 250–350°C
- Deposition rates (at 300°C): 165 Å/min for SiN and 414 Å/min for SiO₂
- Uniformity: ±2% for SiN and SiO₂; ±4% for amorphous Si
- Substrates: Si, GaAs, ceramics, metals, plastics, glass
- Gases: silane in Ar, nitrous oxide, O₂, and ammonia
- Power supply: 350 W source operating at 30 kHz
- Vacuum pumping system: 11 CFM mechanical pump utilizing Fomblin oil



Plasma Etcher - ICP-RIE (Oxford PlasmaPro 100 Cobra)

Description:

- High-density inductively coupled plasma reactive ion etching (ICP-RIE) system for dry etching. Supports independent ion energy control, He backside cooling, and dual endpoint detection via optical emission spectroscopy and laser interferometry.

Details:

- Deep Si etching via Bosch or cryogenic processing, along with F- and Cl-based etching of Si, SiO_x, dielectrics, and compound III-V semiconductors
- Substrate size: up to 4" (100 mm) diameter wafers
- Electrode temperature range: -150°C–400°C
- ICP power: up to 3000 W generator
- RIE bias power: up to 300 W generator
- Process monitoring systems: *in situ* endpoint detection using optical emission spectroscopy (OES) and laser interferometry
- Available gases: SF₆, O₂, C₄F₈, CHF₃, Ar



Plasma Etcher - RIE (Technics Micro-RIE Series 800)

Description:

- Reactive ion etching (RIE) system designed for thin-film removal and ashing. Features three mass flow controlled gas channels and a water-cooled electrode process chamber designed to prevent cross-contamination.

Details:

- Materials: SiN, SiO₂, AlO, single-crystal Si, polysilicon
- Substrate size: up to 4" diameter wafers
- Output power: up to 300 W variable RF source at 30 kHz
- Process resolution: down to 25 μm features
- Base pressure: operating range less than 10 mTorr
- Gases: O₂, CH₄, H₂, and N₂.



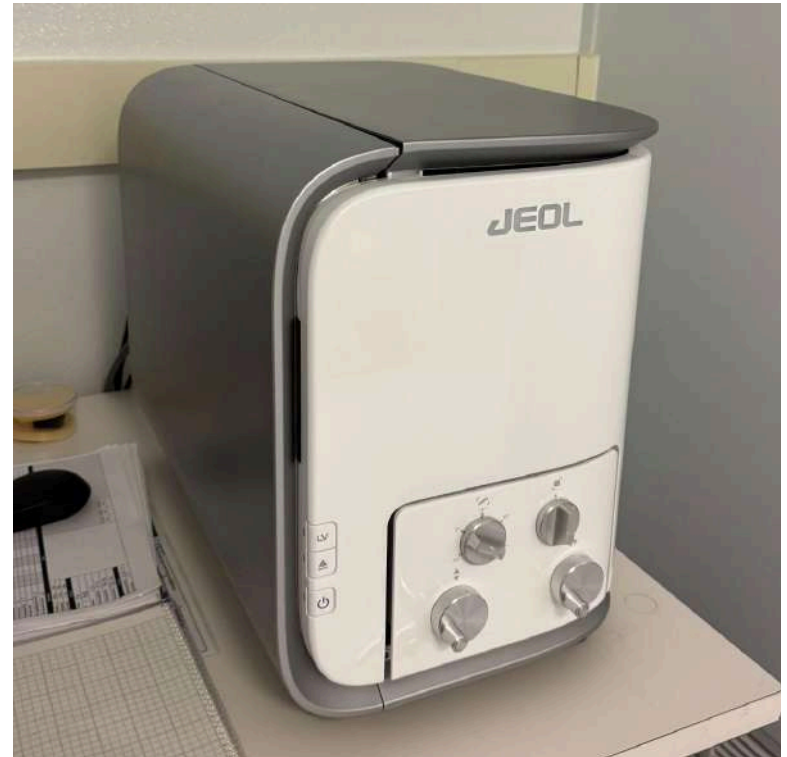
Scanning Electron Microscope (SEM) - Benchtop (JEOL JCM-6000)

Description:

- Benchtop scanning electron microscope with secondary electron imaging (SEI) and backscattered electron (BSE) imaging capabilities. Includes an integrated JEOL energy dispersive spectrometer (EDS) for elemental point, line, and mapping analysis under high and low vacuum modes.

Details:

- SEI magnification: up to 60,000x
- BSE magnification: up to 30,000x
- Accelerating voltage range: 5–15 kV with variable beam currents
- Sample size: up to 7 cm diameter × 4 cm height



Spin Coater (WS-650)

Description:

- Extremely precise rotation spinner with fully optimized process chamber and 7 programmable “recipes”.
Accommodates up to 3” diameter wafers with max speed of 12,000 rpm (based on 100 mm Si wafer)



Sputter Deposition System (Lesker PD500X3)

Description:

- Magnetron sputtering system designed for deposition of dielectric and metal thin films. Utilizes an ultra-high vacuum (UHV) process chamber with a confocal source arrangement, computer-controlled processing software, and hardware configurations supporting the co-deposition of compound and doped films.
- Applications: organic electronics, superconducting physical vapour deposition (PVD) thin films for quantum devices, light-emitting rare-earth doped films on Si substrates, medical device coatings.

Details:

- Substrate size: up to 6" diameter wafers
- Film thickness: up to 800 nm
- Substrate thermal control: sample heating up 300°C
- Available targets : Te, Si, Ge, Al



Stylus Profilometer (KLA-Tencor P7)

Description:

- Surface topography and film thickness measurement system utilizing a diamond stylus profiling mechanism. Supports programmable multi-location scanning, full-diameter unstitched measurements, and 2D or 3D characterization of step heights, surface roughness, wafer bow, and thin film stress.

Details:

- Step height range: from ~15 nm up to 1 mm
- Vertical resolution: 0.2 Å within a 327 µm vertical range; 0.008 Å within a 13 µm vertical range
- Stylus force: from 0.5 mg up to 2.0 mg
- Substrate size: from 10 × 10 mm up to of 8" diameter wafer
- Stylus geometry: 2–12 µm tip radius with a 60° cone angle
- Imaging hardware: 5 MP high-resolution colour camera for alignment and defect review
- Automation features: programmable sequencing, pattern recognition, and SECS/GEM communication protocols
- Measurements: step height, surface texture (roughness and waviness), form analysis (bow and shape), and thin-film stress evaluation



Thin Film Stress Measurement System (KLA-Tencor FLX-2320)

Description:

- Thin-film stress measurement system utilizing laser scanning to measure changes in the radius of curvature of a wafer induced by film deposition. Supports data analysis for calculating material properties, stress-temperature gradients, and stress relaxation behaviors with low measurement noise.

Details:

- Measurement range: 1–4000 MPa
- Substrate size: up to 6" diameter wafers
- Temperature: up to 500°C
- Laser source configuration: dual solid-state lasers consisting of a 4 mW Class IIIA laser at 670 nm and a 4 mW Class IIIB laser at 780 nm
- Analytical calculations: biaxial modulus of elasticity, linear expansion, water diffusion coefficients in dielectric films, linear regression, and stress-time or stress-temperature gradients
- Data visualization: trend plotting for statistical process control (SPC) and 3D mapping of wafer deflection across the surface



UV Ozone Cleaner (UV-2)

Description:

- Benchtop ultraviolet (UV) ozone cleaner designed for removing organic contaminants from substrates including Si, GaAs, sapphire, ceramics, and glass. Accommodates wafers up to 8" and process temperatures up to 300°C.



Water Purification System - Deionization (MilliporeSigma Milli-DI)

Description:

- Four-column water purification system configured to produce deionized (Type 2) water directly from a tap water feed source.

Details:

- Purified water quality: conductivity of $1 \mu\text{S}/\text{cm}$ and total organic carbon (TOC) less than 50 ppb
- Operational flow rate: 0.5–0.7 L/min
- Daily throughput capacity: maximum system capacity of 40 L/day, optimized for low-volume requirements of 3–5 L/day
- Power configuration: battery-operated baseline (no external electrical outlet required)

