

3. SYSTEM SPECIFICATIONS

3.1 DEPOSITION CHAMBER

- 304L stainless steel chamber, measuring approximately 18" (diameter) x 13.5" (deep).
- Full-diameter, top-opening access flange, mounted via articulating hinges to the deposition chamber. Access flange is supported by two gas-pressurized struts to facilitate loading and unloading operations.
- Viewports: (1) optically shielded 4.00" diameter viewport (chamber sidewall) to permit unrestricted viewing of all installed deposition sources and substrate fixturing.
- Bottom mounted pumping plenum (off chamber baseplate).
- The following chamber penetrations will be provided:
 - **Baseplate:**
 - a) (1) 8.00" (pumping plenum)
 - b) (15) 1.00" (instrumentation, gas, spares)
 - c) (1) 3.38" CF (substrate rotation)
 - **Sidewall:**
 - a) (1) 4.00" viewport (optically shielded)
 - b) (2) 2.75" CF
 - c) (1) 1.33 mini-CF
 - d) (1) 10.0" CF (rotatable, loadlock expansion)
 - **Top-plate:**
 - a) (3) 1.12" compression seal (sputter cathodes)
 - b) (3) 0.25" (shutter rotary feedthroughs)
 - **Pumping Plenum:**
 - a) (1) NW100 (high vacuum pump)
 - b) (1) 0.75" compression seal (vacuum gauge)
 - c) (1) NW25 (roughing valve)
 - d) (1) NW16 (vent valve/vacuum safety)
 - e) (1) 3.50" (high vacuum bellows valve actuator)

3.2 LOADLOCK CHAMBER

- 304L stainless steel chamber, electro-polished, measuring approximately 8.0" (diameter) x 10.5" (long).
- 8.0" electro-pneumatic, hivac gate valve (CF flanging).
- 8.0 " diameter, side-loading door, electric transfer drive
- The following loadlock penetrations will be provided:
 - a) (1) 2.75" CF
 - b) (1) 1.33 mini-CF (vacuum gauge)
 - c) (1) NW25 (loadlock roughing)
 - d) (1) VCO-4 stub (vent valve)

3.3 DEPOSITION CHAMBER PUMPING SYSTEM

- Alcatel ATP5150 turbomolecular pump (NW100 inlet flange, particulate screen, air-cooled) with Alcatel CFF450 frequency convertor.
- Alcatel 2021 two-stage, rotary vane pump (14.6 CFM).
- NW25 foreline filter
- DVI 5.0" electro-pneumatic, internal hivac poppet valve.
- NW25 bellows-sealed, electro-pneumatic, roughing valve.
- NW25 bellows-sealed, electro-pneumatic, turbo backing valve.
- 0.25" VCO, bellows-sealed, electro-pneumatic vent valve.
- 0.25" electric, mechanical pump vent valve (slaved to mechanical pump status).
- KF-25 manual valve (leak checking), mounted on foreline.

3.4 LOADLOCK PUMPING SYSTEM

- Utilization of deposition chamber mechanical pump to achieve crossover pressure of approximately 2.0E-1 torr.
- 1.0" bellows-sealed, electro-pneumatic, roughing valve. *Gauge*
- VCO-4 bellows-sealed, electro-pneumatic, vent valve.

3.5 VACUUM GAUGING/PROCESS GAS AND PRESSURE CONTROL

- Varian SenTorr CC2 cold cathode/thermocouple gauge controller:
 - Cold cathode gauge #1 (deposition chamber, gauge setpoint relay interfaced to system controller).
 - Thermocouple gauge #1 (deposition chamber, gauge setpoint relay interfaced to system controller).
 - Thermocouple gauge #2 (turbomolecular pump foreline, gauge setpoint relay interfaced to system controller).
- Granville Phillips Model 275 mini-Convectron vacuum sensor pressure switch (P/N: 275803) for loadlock chamber crossover (2.0E-1) indication.
- MKS Instruments 127A (100 mtorr FS) capacitance manometer with MKS Instruments PDR-C-1C power supply/readout.
- MKS Instruments 247C four-channel power supply/readout interfaced to (2) MKS 2259C mass flow controllers (100 sccm and 50 sccm full scale):
 - each MKS 2259C supplied with close-coupled, bellows-sealed, electro-pneumatic, isolation valve,
 - each MKS 2259C isolation valve controlled by system controller, and
 - each MKS 2259C outfitted with dual gas-inlet capability (manual toggle-type isolation valves).

3.6 SPUTTER SOURCES

- (3) DVI 3.0" diameter, internal "stalk-mount", planar magnetron sputter sources:
 - RF/DC capability,
 - Variable source to substrate distance, and
 - Clamp/bond target compatibility.

- (3) independent, electro-pneumatic source shutters (cylinder mounted air flowrate control), each dedicated to a delivered planar magnetron, interfaced to system PLC for remote open/close operation.
- Cooling water flow sense on each cathode's dedicated cooling water circuit (safety interlock).
- Quick-disconnect cooling water lines.

3.7 SPUTTER POWER SUPPLIES

- (1) Advanced Energy MDX1.5K (Low Z; 700 volt) power supply:
 - Hardwired safety interlock (chamber door, vacuum bellows safety switch, cathode water),
- (1) manual DC power switchbox, to shunt output of MDX supply to any of the three installed cathodes:
 - (2) Advanced Energy RF blocking filters (P/N 3155018)
- (2) Advanced Energy RFX600 RF power supplies, each coupled to an Advanced Energy ATX600 automatic match network:
 - Hardwired safety interlock (chamber door, vacuum bellows safety switch, cathode or Bias-Stage water),
 - Twin power output lead from match network to minimize cable heating, and
 - Matching network configured for discrete DC power input.

3.8 RF-BIAS SUBSTRATE STAGE

- (1) RF-bias substrate stage (confocal source mode):
 - (2) 10" substrate platens; one pre-machined to accept DVI's sample transfer holder and the other "blank" to support Utah's TBD substrate requirements.
- (2) DVI sample transfer holders: one pre-machined to accept a 150 mm diameter substrate and the other "blank" to support Utah's TBD substrate requirements.
- (1) DVI high performance, RF-biasable rotary motion feedthrough, 3.38" CF flanging.

- (1) direct-drive, compact, gear motor.
 - Rotation speed adjust (0-20 RPM) via front panel potentiometer.

3.9 SUBSTRATE HEAT

- (1) 3.0 kW, backside quartz heater array with reflector and deposition shield.
- 208/110 VAC step-down/isolation transformer to minimize possibility of spurious glow discharges and feedback from sputter power supplies.
- 3.0 kW PI temperature control system (Omega CN76000 temperature controller, interfaced to system PLC for remote on/off operation.
- Manual setpoint.
- (1) sheathed thermocouple positioned internally in chamber.

3.10 SYSTEM CONTROL AND AUTOMATION

- GE-Fanuc 90-30 programmable logic controller (PLC) with membrane-type operator interface.
- EEPROM memory backup.
- Valve control/sequencing, pump operation, and "soft" system interlocks (i.e., non-safety related) controlled by the PLC.
- The following operating modes provided:
 - AUTOPUMP (automatic loadlock and chamber pumpdown to high vacuum conditions),
 - AUTOVENT (automatic loadlock and chamber venting to atmospheric pressure),
 - MANUAL (permits manual (front panel) system operation and interruption of in-process automatic system sequences), and
 - MAINTENANCE MODE (key-switch selectable from MANUAL mode; permits all MANUAL MODE functionality, "soft" system valve interlocks disabled. All "hard" safety interlocks remain operational).

3.11 UTILITIES

- Electrical: 208 VAC, 60 Hz, 1 phase, 4 wire (60 A)
- Cooling water: 30-35 l/min, 15-25 degrees Centigrade, 3-4 bar differential between supply and return (6 bar maximum inlet pressure):
 - Four-circuit water manifold (metering on supply and return side); circuit designation follows:
 - 1.) Sputter cathode #1 (flow sense/interlock)
 - 2.) Sputter cathode #2 (flow sense/interlock)
 - 3.) Sputter cathode #3 (flow sense/interlock)
 - 4.) RF Bias Stage (flow sense/interlock)
- Compressed air: 10-20 l/hr, normal dry shop air, 6-7 bar (system valve operation):
 - dew point: maximum of 2 degrees Centigrade
 - oil content: 1-5 mg/m³
 - foreign particles, size: maximum of 5 microns
 - foreign particles, concentration: maximum of 5 mg/m³
- Nitrogen: (preferentially evaporated from liquid N₂)
 - 0.5 bar (chamber venting, 100 l/cycle, optional)
 - 0.5 bar (loadlock venting, 10 l/cycle, optional)
- Process gas: 5N purity
 - 0.5 bar (customer supplied)

3.12 SYSTEM DOCUMENTATION

- Three complete sets of operating instruction manuals; instruction manuals to include preventive maintenance procedures/timetable, troubleshooting guides, and fully-costed spare parts listing.
- One complete set of sub-assembly vendor manuals.
- Three complete sets of electrical schematics (B-size).
- One complete set of electrical schematics (AUTOCAD.DWG format).
- Three complete sets of mechanical drawings necessary for system maintenance and repair (D-size).

3.13 SPUTTER TARGETS

- 3.0" diameter x 0.062" thick; gold target (4N purity).
- 3.0" diameter x 0.062" thick; platinum target (4N purity).
- 3.0" diameter x 0.125" thick; copper target (5N purity).
- 3.0" diameter x 0.125" thick; aluminum target (5N purity).
- 3.625" diameter x 0.125" thick; SiO₂ target (4N5 purity) solder bonded to DVI 3.0" backing plate (backing plate included).
- 3.625" diameter x 0.125" thick; Si₃N₄ target (3N5 purity) solder bonded to DVI 3.0" backing plate (backing plate included).

