

NE860RL#12 DETAILED DESCRIPTION

REACTOR:

Large diameter RIE process chamber Ø280 mm designed for etching of thin films on wafers up to Ø200mm. It is equipped with two Ø25 mm windows, one for laser interferometry and one for sample viewing during etching.

LOAD-LOCK:

Vacuum load-lock for manual loading and with automatic transfer, including:

- Automatic loading mechanism for $\leq \text{Ø}200$ mm wafers from load-lock to reactor controlled by a stepping motor,
- Transport tool,
- VAT gate valve, MONOVAT 46 mm X 240 mm, for $\leq \text{Ø}200$ mm wafers,
- Pumping system with Pirani gauge (Base vacuum $< 5 \cdot 10^{-3}$ mbar),
- Loading and interlocks are microprocessor controlled.

CATHODE:

Cathode Ø220 mm equipped with:

- Top part made of aluminum for efficient liquid cooling and heating,
- Shuttle for sample loading and unloading (wafers up to a maximum size of Ø200mm),
- Graphite plate with recess to receive the wafer to be etched,
(note that several shuttle designs are available, using either graphite or quartz substrate holders)
- Helium heat exchange between shuttle back side and cathode with mass flow control,
- Capacitance gauge for He pressure measurement,
- Mechanical clamping of the shuttle,
- Programmable cathode lift. It enables wafer loading, unloading and mechanical clamping of the shuttle as driven by the system PC.

VACUUM SYSTEM:

High conductance pumping system, ISO 160 (150 mm), dedicated to plasma processes, equipped with:

- ALCATEL 2063C2 rotary pump (63 m³/h) with permanent inert ballast in oil (N₂),
- ALCATEL ATP 400 HPC turbo-molecular pump (400 l/s) with permanent inert (N₂) gas purge.
- Set of high vacuum and by-pass valves for rough pumping without stopping the turbo,
- Separated Penning gauge for high vacuum,
- TYLAN GENERAL capacitance gauge CDL 0 - 1 Torr for pressure control,
- Automatic pressure control using a throttle valve, with very short response time (< 1 s),
- Separated N₂ line for reactor venting with electro-pneumatic valve,
- FOMBLIN oil with filtration system and alumina cartridge.

GAS PANEL:

Gas box equipped with gas handling and 4 gas lines for reactive gases equipped with UNIT mass-flow controllers. Any chlorinated lines would include an electro-pneumatic 3 way bellows shut-off valve, a manual 4 way by-pass valve and a manual 2 way bellows shut-off valve. The others lines include an electro-pneumatic 3 way bellows shut-off valve and a manual 2 way bellows shut-off valve.

The exact gas panel configuration is to be decided by customer depending on process (up to 8 process gas lines).

The current configuration is:

O₂ @ 100sccm; SF₆ @ 25sccm; CF₄ @ 100sccm; He @ 25sccm (process He); He @ 25sccm (clamping He).

RF GENERATOR:

300 W 13.56 MHz Air-cooled solid-state RF generator with forward and reflected power monitoring (brand = ENI, type = ACG-3B).

RF MATCHING UNIT:

Automatic impedance matching with DC bias control and programmable set values of LOAD and TUNE capacitors.

CHILLER:

Chiller with dielectric liquid for turbo-molecular pump and cathode. Temperature range: 5 to 70°C. Power extracted at 20°C: 3 KW.

ELECTRONIC SYSTEM:

Electronic control for vacuum, cathode height, loading operation, working pressure and RF. When the equipment is not used an automatic stand-by position maintains electronics on, rotary pump working and turbo-molecular pump off but under N2 purge to increase its life time.

COMPUTER:

Personal Computer, operating under WINDOWS XP, including monitor, mouse and keyboard.

SOFTWARE:

NEXTRAL automatic process controller including sophisticated software operating under WINDOWS XP.

It automatically switches between steps in a multistep process according to signals coming from the laser endpoint detector or from process timers.

The number of process steps available for any process is 256. The system checks all parameters and displays any error that might occur. Each process step is closely controlled and monitored, so that reproducibility and performance are fully guaranteed.

Data logging is being a part of the software package.

Four programming modes are available:

- * Process EDITING for customizing recipes or for creation of new recipes,
- * Process EXECUTION with real time process control of any parameter and display of all process parameters versus time,
- * Process ADJUST to develop new processes by interactive process control and editing,
- * MAINTENANCE for diagnostic and system calibration.

OPTIONS:

- 1- RF generator with a 600W maximum power instead of 300W (ENI ACG-6B instead of ENI ACG-3B).
- 2- Additional shuttle, for different samples sizes, or holder's material, or using clamping system...
- 3- Dry rough pump instead of standard oil pump.
- 4- Additional gas line, for standard gas (without specific purging system):
Gas line with UNIT mass-flow controller, electro-pneumatic 3 way bellows shut-off valve and a manual 2 way bellows shut-off valve.
- 5- Additional gas line, for toxic gas (with specific purging system):
Gas line with UNIT mass-flow controller, electro-pneumatic 3 way bellows shut-off valve, a manual 4 way bypass valve and a manual 2 way bellows shut-off valve.
- 6- End point detection system :
Automatic laser endpoint detector with CCD camera to visualize the laser spot ($\varnothing 25 \mu\text{m}$) and sample to etch. It is equipped with a lens that enables a magnification greater than 100. It measures etch rate, thickness etched and enables endpoint detection. It is equipped with an XY stage for laser spot positioning.
Note: EPD system may not be useful while etching non-transparent layers (such as aluminum).