

AutoEtch 480

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Plasma Etch System

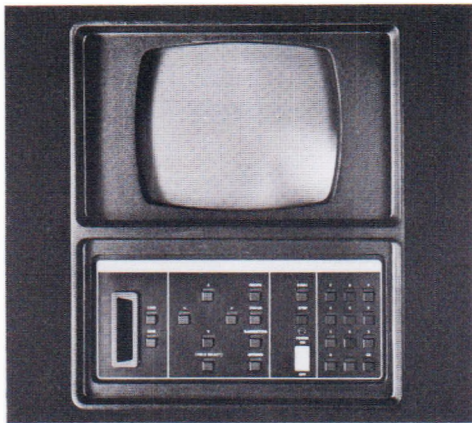
 **Lam Research**

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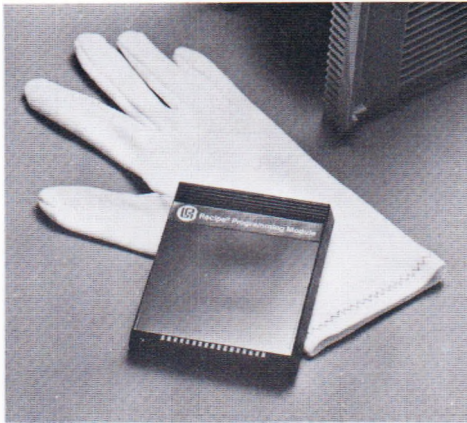


AutoEtch 480 CRT/keyboard simplifies interface at operating, engineering and maintenance levels.

Plasma etching is destined to play a major role in the '80s in helping semiconductor manufacturers produce Very Large Scale Integrated (VLSI) circuits. Plasma etching is vitally necessary to achieve the fine line geometries demanded by VLSI devices. And to meet the sophisticated needs of the next decade, Lam Research Corporation offers the new AutoEtch 480, a streamlined plasma etching system designed specifically for highly automated dry etching in VLSI production.

AutoEtch 480 has been created by Lam Research experts from "the ground up" to be uniquely different from other plasma etching systems. The system combines the very latest plasma etching technology with the most recent microcomputing and airlock wafer transfer techniques. AutoEtch 480 provides superior etching capabilities for fine line geometries, throughput rates of up to 60 wafers per hour (whether 3-inch, 100mm or 125mm), and consistent uniformity at all times.

AutoEtch 480. Classic in its simplicity, yet truly the most mature, production-worthy plasma etching system available in the world today ... and tomorrow.



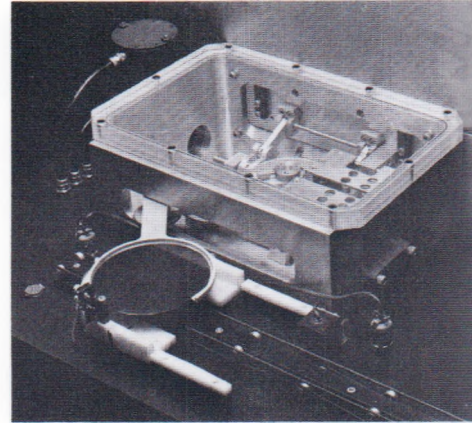
RecipeTM Programming Module allows fast, error-free entry of process variables.

A plug-in module for all processing

The AutoEtch 480 system provides the user with an unprecedented level of automation through the use of its unique RecipeTM Programming Module. This solid-state module is a major breakthrough in achieving both flexibility and ease of use in a plasma etcher. Fitting in the palm of your hand, this plug-in device permits automatic entry of all process parameters—including flow rates, pressure, RF power, substrate temperature and electrode spacing—to make process programming truly a snap.

The Recipe Module completely eliminates the complex array of knobs, dials, and buttons usually associated with plasma etchers. The process engineer merely plugs in the module, calls up the Recipe page, enters the process parameters, and the machine is then entirely programmed. There are no variables in the processing—unless you want to introduce them (again, simply from the keyboard).

The Recipe Module eliminates human errors, reduces set-up time and makes it simple to double-check machine and process parameters. And, it lets you quickly and



Airlock wafer transfer isolates plasma chamber from ambient moisture and particulate contamination.

easily re-program a process, should the need arise. With the Recipe Module, you can program an entire library of processes, store them, and use them interchangeably on the same system (or on a multiple of systems).

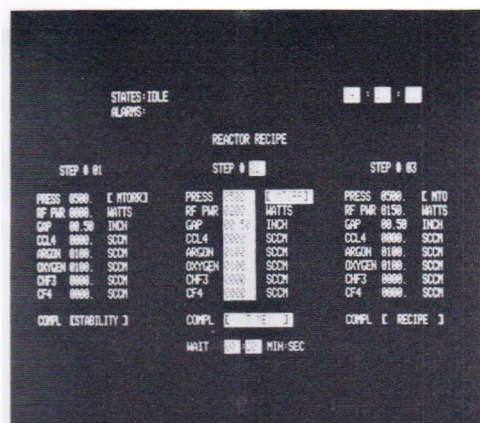
Continuous CRT monitoring

During processing, AutoEtch 480's convenient, easy-to-read CRT display provides instant updating of system status and the value of all important parameters. This integrated display differs sharply from other plasma etchers that require monitoring and adjusting a host of dials, switches, gauges and meters.

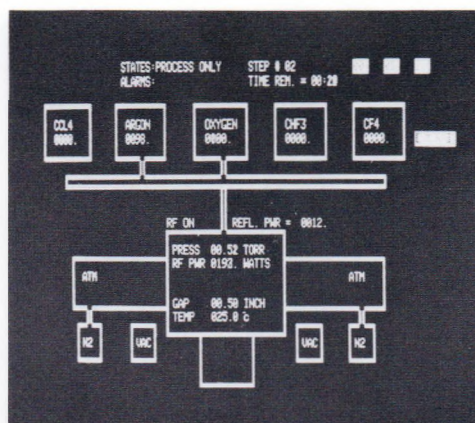
The sole means of controlling the new AutoEtch 480 is its CRT and keyboard console (and the Recipe Programming Module). This unique operating system accommodates all three levels of personnel associated with the etching process: (1) the operator, (2) the process engineer, and (3) the maintenance engineer.

While the system operator is only concerned with three keyboard buttons (POWER, START and STOP) ... and inserting and removing cassettes ... the process engineer has all the control and flexibility he

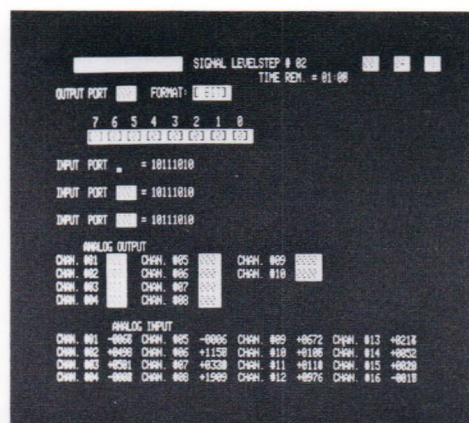
Production-worthy plasma etching system



Recipe display informs engineer of process variables as they are entered into the system.



Status display provides instantaneous update of process variables.



Direct machine control display presents input/output data for use during diagnostic or maintenance procedures.

needs to program or reprogram an entire process—right at the system's keyboard. During system maintenance, AutoEtch 480 permits direct machine control from the keyboard, so every working part can be exercised to check for proper operation.

And all the time processing is going on, AutoEtch 480's closed-loop feedback system is automatically monitoring and adjusting itself to ensure precise accuracy in all control settings. This makes the system super-easy to use in production environments, and yet ensures consistency and reproducibility in processing. It guarantees, in dramatic fashion, higher yields than have ever been possible before.

Airlocks for high yields and safety

AutoEtch 480 operates as a single-wafer system with airlocks on either side of its process chamber. Wafers are automatically loaded and unloaded through these airlocks that isolate the chamber from the ambient environment. Not only do airlocks enhance process reproducibility by eliminating moisture and oxygen effects, but they also

protect the operator from unwanted exposure to odorous and toxic gases present in the chamber.

The new AutoEtch 480 system doesn't expose any of its moving mechanisms to the plasma. Instead, it utilizes a wafer handling system that is classic in its simplicity. Wafers are automatically removed from the cassette and conveyed to the airlock entrance by a simple track. Once in position, a unique transport mechanism (patent pending) loads and unloads the airlocks and process chamber. At no time is there contact with the top or even the sides of the wafer. This clean, highly reliable design contributes significantly to higher process yields in plasma etching.

Remote diagnostics and accessibility

AutoEtch 480 provides a totally unique diagnostics and maintenance system. Not only does the CRT keep the user constantly up-to-date on the status of the machine, but it also identifies the problem should a fault or failure occur.

On-site maintenance personnel can address every moving part and control function, simply and easily, from the AutoEtch 480's CRT/key-

board, to put the system through its paces to check for proper operation. When maintenance is required, all electronic and electro-mechanical subassemblies are easily accessible through hinged side, top and front panels.

As a further guarantee of maximum uptime on the system, or to supplement on-site personnel, Lam Research provides state-of-the-art remote diagnostics. AutoEtch 480 can be connected, via a modem and a telephone line, directly to LRC's Remote Diagnostics Center. From this factory center, AutoEtch 480s located anywhere in the world can be addressed, exercised, and any fault or failure can be diagnosed. Routinely, during non-productive hours, an AutoEtch 480 system can be checked, so users have an "early warning" of possible failure conditions or the need for preventive maintenance.

AutoEtch 480 also uses a SEMI* standard communications interface, so it can be interfaced with a host computer if desired. The AutoEtch 480 provides stand-alone automation of plasma etching today, and is "compatible-ready" for interface to larger-scale fab automation operations in the future.

*Semiconductor Equipment & Materials Institute

AutoEtch 480

System Type

In-line, cassette-to-cassette. Fully automated. Single wafer. Planar etching system.

Modes

PPE-Planar Plasma Etching. RIE-Reactive Ion Etching (optional).

Performance*

Throughput

30-60 wafers/hour. System can accommodate 3 in., 100mm or 125mm wafers.

Etch Rates

Greater than 3,000Å/min.

Uniformity

Better than $\pm 5\%$ across wafer.

Stripping/Descumming

Photoresist stripping and descumming stations available.

Operation

Z80 microprocessor controlled. Programmed via solid-state Recipe™ Programming Module or keyboard. Selectable CRT-display monitoring of all process variables as well as machine status. Entire system under automatic, closed-loop feedback control. Double "key locked" to prevent accidental alteration of process.

System Parameters

Programmable lower electrode temperature and airlock crossover pressure.

Process Variables

Operating Pressure, RF Power, Electrode Spacing, Gas Flow Rates and Step Terminator Mode. Programmable for each of sixteen (excluding wafer handling) independent process steps.

CRT Display Modes

Recipe, Process Status, System Parameters, Direct Machine Control and any one of several optional/accessory displays.

Step Terminator Modes

Time, stability, and end-point detection. Automatically selectable for each step of a process.

Wafer Handling System

Fully automatic, airlocked, cassette-to-cassette type suited for hands-off wafer processing (patent pending). No moving parts exposed to the plasma. Broken Wafer Detector provided at wafer entrance station. Internal Filtration (air or dry nitrogen) System available.

Cassettes

Accommodates standard IMS/GCA, 25-wafer cassettes (optional double sender/receiver cassette configuration available).

Airlock Chambers

Completely self-contained. Machined from solid stock to ensure vacuum integrity.

Pressure

Programmable. Selectable among three preset ranges (customer selected).

Process Chamber

11½" diameter, anodized aluminum. Machined from solid stock to ensure vacuum integrity. Integral pressure control valve provided.

Pressure

Programmable from 50 milliTorr to 5 Torr with accessory 105 CFM Roots blower/27 CFM vane-type mechanical pumping system (optional pumping systems available). Automatically variable for each step of a process.

Electrode

8" diameter, planar "shower head" type.

Electrode Spacing

Programmable from 0.1" to 1.0". Automatically variable for each step of a process (patent pending).

Temperature Control System

Programmable, closed loop, forced oil system for wafer (lower) electrode.

Vacuum System

Fully automatic, all-electronic, pressure-sensing system. Fully protected from power or air failure.

Vacuum Gauges

Capacitance manometer for process chamber; thermocouple gauge for airlock. Pressure of all critical vacuum points measured and utilized by the control logic.

Vacuum Pumps

Externally located process chamber pump. Internal, 14 CFM airlock pump (optional diffusion pumping system available).

Gas System

Up to five programmable mass flow controllers available (three standard). Gas flows automatically variable for each step of a process. Liquid evaporator available for room temperature evaporation of CCl_4 (optional). Sealed and exhausted gas system.

RF Power System

Programmable for automatic computer control without operator intervention. Automatically variable for each step of a process.

Power Supply

0-500 watts, automatically stabilized.

Frequency

13.56 MHz, crystal controlled.

Output Impedance

52 ohms.

Tuning System

Automatically maintains minimum reflected power independent of variations in line voltage, gas pressure or RF power.

Power Display

Forward and reflected power displayed on CRT monitor.

Machine Interface

SEMI standard communications interface provided.

Safety System

Fully automatic, cassette-to-cassette wafer processing. Airlocked. Double "key locked". Continuous CRT-display monitoring of process and machine status. Automatic identification of fault location. Audible fault alarm. Completely sealed and exhausted gas system. Numerous hardware and software interlocks.

Diagnostics/Serviceability

System designed to monitor and report on its own performance, automatically. Machine can be addressed and completely exercised on site or from LRC Remote Diagnostics Center via modem. Full accessibility to machine sub-assemblies.

Facility Requirements

Power

208 VAC, 3 phase, 5 wire, 20 amps, 50/60 Hz (excluding external pumping system).

Cooling Water

3 gpm at 10 psi differential pressure at less than 75°F.

Compressed Air

60-100 psi, shop air.

Dry Nitrogen

5 psi, 8 CFM.

Process Gas Inputs

Up to six ¼" VCR connections provided.

Vacuum Pumping Line

Type KF-50 connection provided.

Exhaust

200 CFM required (excluding external pumping system).

External Pumping System

To be specified or provided by customer. "On/off" control signal relay provided.

Footprint

43"W x 36"D (109cm x 91cm)

Size

43"W x 36"D x 46"H (109cm x 91cm x 117cm); 72" (183cm) high with hinged display assembly extended.

Weight

Approx. 850 lbs. (380kg)

*Process dependent. Typical values given.



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