Chapter 7.9

Yield Engineering Systems G500 Plasma Cleaning System
(yes-g500) (380)

1.0 **Equipment Purpose**

1.1 The yes-g500 is a configurable argon and oxygen plasma cleaning tool. The tool can process a wide variety of samples including wafers, chips, and other oddball substrates. The yes-g500 is primarily used to functionalize PDMS surfaces for surface bonding applications.

2.0 **Material Controls & Compatibility**

2.1 Yes-g500 is built to plasma clean substrates. Silicon wafers with photoresist are allowed.

2.2 Other materials may be allowed, but require staff approval.

3.0 **Applicable Documents**

3.1 Yes-g500 vendor manual available in Nanolab office.

4.0 **Definitions & Process Terminology**

4.1 Needle Valves: Three needle valves at the back of the tool which are used to set gas flow from a given pressure.

5.0 **Safety**

5.1 Heat: The plates used to mount samples are not cooled and may become too hot to handle with hands. Never handle yes-g500 plates with clear plastic gloves as they may melt and contaminate the tool. Chamber temperature increases about 5 C per 100 seconds of plasma time.

5.2 RF Power: Be aware that the tool typically runs 300W+ of RF power. Always be certain that the RF generator is reads 0W before opening the chamber.

6.0 **Process Data**

6.1 QM for this tool is not available.

6.2 Etch data of KMPR

6.2.1 Settings

6.2.1.1 Power: 300W RF

6.2.1.2 Pressure: 160-175 mTorr (slowly drops during recipe as chamber is cleaned)

6.2.1.3 Gases: O2 gas only

6.2.1.4 Configuration: Electron Free Ion Trap

6.2.1.4.1 Average etch – ~515 nm/min

6.2.1.4.2 Non-uniformity >50%

6.2.1.5 Configuration: Active Ion Trap

6.2.1.5.1 Average etch – ~1050 nm/min

6.2.1.5.2 Non-uniformity – >50%
7.0 **Available Processes, Gases, Process Notes**

7.1 Gases

7.1.1 Gas 1: Ar

7.1.2 Gas 2: O2

7.2 Gas settings and power settings are static and require process oversight to change.

7.3 System base pressure is 75mTorr and the tool will not process if it cannot reach this pressure.

7.4 Plate Configuration

7.4.1 The yes-g500 vendor manual has several preset configurations listed. This section will discuss setup for each configuration

7.4.2 Plasma Chamber

7.4.2.1 The plasma chamber has several components. Of particular note are the chamber temperature monitor jack, the grounded rack mounts, and the RF power input strip in the back.

7.5 Plate Types

7.5.1 Type 1: Active Electrode
7.5.2 This plate has a plug in the back which connects the plate to the RF power input. This plate is **powered**.

7.5.3 Type 2: Ground Electrode

7.5.4 This plate makes contact to ground through the aluminum tabs to the rack mounting strips on the sides. This keeps the plate at ground potential.

7.5.5 One of these plates has a thermocouple built into the back with two plugs. These plugs attach onto the thermocouple jack and must always be placed in the thermocouple position. Without this, the system cannot read the temperature of the plates and will either error or have the potential for major damage from overheating.

7.5.6 Type 3: Neutral Plate

7.5.7 This plate is entirely floating from any contact and rests at the local potential of the plasma.
7.6 Process explanation

7.6.1 There are many types of processing in the yes-g500 depending on the plate order and configuration.

7.6.2 Electron Free Mode

7.6.2.1 Electron free mode places a substrate on an isolated floating plate which rests at plasma potential. The top of the substrate is exposed to downstream ions which pass from the nearby active plate, through a ground plate (which neutralizes the electron component of the plasma) and gently clean the surface.

7.6.2.2 This mode is useful for electrically sensitive cleaning and can protect devices sensitive to overcharging in plasma applications.

7.6.3 Active Mode

7.6.3.1 In active mode, substrates are placed on a ground electrode just below an active electrode. This mode generates a heavily chemical etch without a large quantity of sputtering.

7.6.4 RIE mode
7.6.4.1 Similar to active mode, in this variant the substrate is placed on an active electrode and is powered. This is effectively a sputter etch with the flowing gases. The primary difference between RIE and active modes is sputter action. RIE mode has a significant physical etch component.

7.6.5 Active Ion Trap Mode

7.6.5.1 In the Ion trap modes, the standard alternating plate model is abandoned in favor of putting two of the same plate next to each other. This creates a zone of zero potential between the two plates and creates an ion trapping zone where there is no electrostatic force applied to ions in the given region. This generates significantly larger amounts of ions present near the wafer and leads to very aggressive etch rates.

7.6.5.2 This mode generates large quantities of heat so be very aware of the temperature reading on the tool and when handling the plates afterward.
### 7.6.6 Electron-free Ion Trap Mode

**7.6.6.1** This mode is similar to the active ion trap except that two ground electrodes are placed side by side. This also creates a zone of null potential between the two ground planes, and traps ions while removing the electron component of the plasma. This is another aggressive etch, but helps protect electrically sensitive materials.

**7.6.6.2** This mode generates large quantities of heat so be very aware of the temperature reading on the tool and when handling the plates afterward.
8.0 Equipment Operation

8.1 Startup

8.1.1 Enable the tool

8.1.2 Vent the tool

8.2 Plate Configuration

8.2.1 There are several configurations of plates. See section 7 for more information about specific configurations

8.2.2 Choose the appropriate configuration for your application. Consult process staff with any questions.

8.2.3 Always build from the thermocouple plate out – make sure the thermocouple plate is always plugged in to protect the thermocouple lead.

8.2.4 After arranging plates, pull out the plate which will hold your substrate.

8.2.5 Load substrate onto the plate and insert back into the tool

8.3 Set up a recipe

8.3.1 Select “Press to go to access panel”

8.3.2 Select “Press to enter access code”

8.3.2.1 Enter 1966

8.3.3 Select “Goto recipe setup panel”

8.3.4 Select “Goto recipe setup continued”

8.3.5 Select “Press to load recipe”

8.3.6 Choose a recipe number (6-12) to edit.

8.3.7 Edit values on the two recipe edit pages.

8.3.7.1 Process staff approval is require to change all values other than process time.

8.3.8 Select “Press to save recipe”

8.3.9 Select “Exit”

8.4 Running a process

8.4.1 Select “press to select recipe” on the main menu

8.4.2 Select from process 1-12 and press enter.

8.4.3 Close the chamber door.

8.4.4 Select “press to start process”

8.4.5 Allow process to run. Monitor the process while operating and confirm that plasma ignites in chamber.

8.4.6 The system should vent after your process automatically. If it does not, press “press to vent process chamber”.

8.5 Unloading your substrate

8.5.1 Unload substrate.
8.5.2 Select recipe 13 and run as described above. This will perform a leak check and pump down the chamber.

8.5.3 Abort the process when the chamber reaches <200 mTorr.

8.5.4 Disable the tool.

9.0 Troubleshooting Guidelines

9.1 System cannot reach base pressure

9.1.1 Report a yellow fault on the tool with the fault symptom “vacuum”.

9.1.2 The system must reach at least 75 mTorr and stabilize to make base pressure. In reality, the system needs to be down near 70mTorr to trigger the pressure switch properly.
NanoLab Qualification Form

Yield Engineering Systems G500 Plasma Cleaning System
(yes-g500) (380)

Name ____________________ Office ____________________ Date ________________
Campus Phone _________________ Home Phone ____________________
Login ___________________________ Trainer __________________________
Qualification Test Passed (Signed by Front Desk) _________________

Oral Qualification Checklist

- What gases can the yes-g500 run?
- What is the access code to edit customized recipes?
- How do you run a recipe?
- How do you edit a recipe?
- How do you save a recipe?
- How do you load a recipe for editing?
- What is the base pressure for the system?