Plasma cleaning/etching system PE-100

Version: May 9, 2023

SPECIFICATIONS

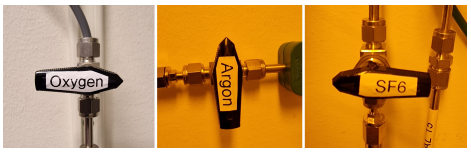
Chamber dimension: 12"H x 12"W x 14"D
Vacuum gauge: 0-1 TORR , 0-1.3 mbar
RF power: **0-300 WATTS** at **13.56 MHz**
Gas flow: 0-50 CCM O2 X 3
AC service: 230 VAC, 50HZ, 1 PHASE, 3 wire, 15A
Process gas: 15 to 30 PSIG
Optimal values: Gas flow 50 CCM, power 75 Watt, time 5 minutes.

Plasma Etch Recipe Guidelines

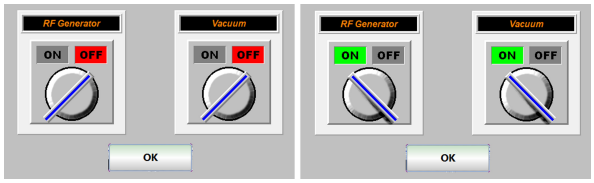
Where to start depends on the application needed and the end result you are looking to achieve. Is your process to prep the material for bonding/activation/promote adhesion and/or create a more hydrophilic surface? Is your process aimed more towards an etching recipe to remove material, such as desmear or etchback? Is your process simply to just remove contaminants from the surface for example organics, nonorganics, oils, oxides, carbon?
If **you do not know** what contaminants are present on the surface of your product, you may try starting with the following to be safe: O2 50%+Ar 50% at 75% power for 5-15 minutes. A combination of both gases will make sure both organic and non-organic contaminants are removed.
Activation, **removal of organic** contaminants, plasma functionalization: O2 plasma at 75% power for 5-15 minutes.
Removal of non-organic contaminants: Ar plasma at 75% power for 5-15 minutes.
Removal of Oxides: H2 plasma at 75% power for 5-30 minutes, Ar plasma will also work, but may require longer time, and is not as effective. A combination of the two will also work.
If removing carbon after any type of laser ablation/cutting, the recommended time can reach up to 30-45+ minutes.
Activating PTFE(Teflon): H2 plasma at 75% power for 20-30+ minutes. In some cases H2 can be difficult to acquire for some companies. In which case, Helium is a suitable substitute. A mixture of 70% H2 and 30% N2 at 75% power for 20-30 minutes will also work.
When aiming to **etch a pattern into a wafer** covered with a type of mask(photoresist): O2 10%+CF4 90% or another type of fluorine gas at 75% power, time will depend on the amount of etching required.
When looking to etch your product, gas mixtures are usually going to consist of Oxygen, and an addition of CF4, SF6, or another fluorine-based gas. The following recipe starting points will be based off CF4 as the primary go to gas along with Oxygen.
Desmear/Etchback: Recommended power and time is going to depend on the following: size of your system, amount of levels or number of shelves, thickness of material, and the amount you are looking to etch or required etchback.
Standard Desmear: 50% Oxygen+50% CF4 at 75% power for 20-25 minutes.
Etchback: 50% O2 50%+CF4 at 75% power for 30+ minutes.
Adding more Oxygen while reducing your CF4, may increase your etch-rate, but may decrease your uniformity. Adding more CF4 while reducing your Oxygen, will increase uniformity, but may decrease your etch-rate. Adjust your overall gas flow rates. Doing so will also change your vacuum pressure during plasma. A lower vacuum pressure (example: 200mTorr) will lead to a more uniform plasma. Increasing or decreasing your RF power will have an effect on your etch-rate up to a certain point.
Etch-rates will vary from system to system and cannot be given for each individually customized system, but will need to be determined through trial and error.
These recipes are starting points. Further testing and experimentation will need to be done to find the right recipe for your application. In order to identify if your part is sufficiently cleaned or requires more time, a simple water drop can suffice. Measuring contact angle is the simplest way to identify if enough plasma treatment has been applied.

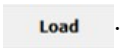
OPERATION

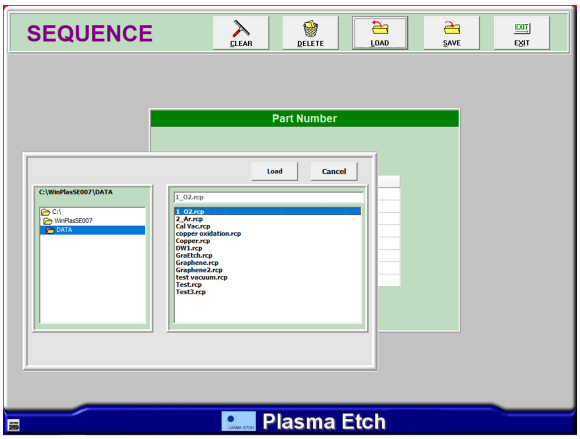
1. Locate the main values for the processing gases (O2, Ar, He, SF6) available in the lab. Open the valve(s) needed for the plasma treatment.



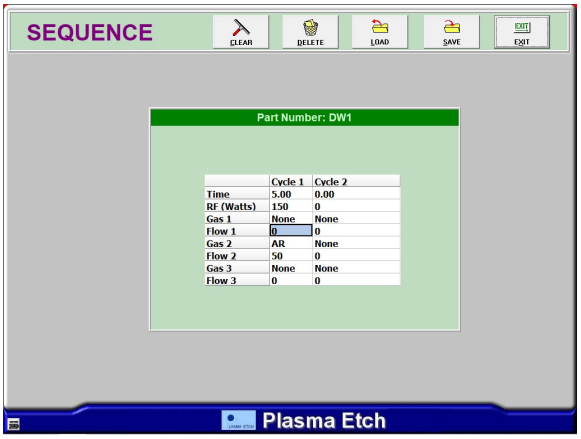
2. Turn ON the main power switch of the device (on the wall plug)  , then press the Power button  on the front panel.
3. Start software "**WinPlasSE007D**"  (found on the Desktop).
4. Put your samples in the chamber.
5. Go to Power menu  , turn ON RF Generator and Vacuum then press OK.

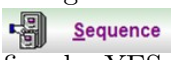


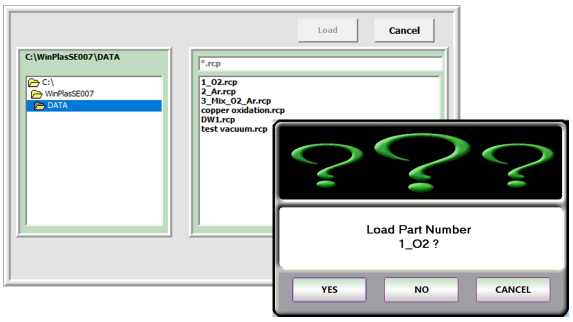
6. Go to Technician menu  , within Technician menu go to Sequences  , then LOAD  , click on the recipe wanted then end by pressing Load  .



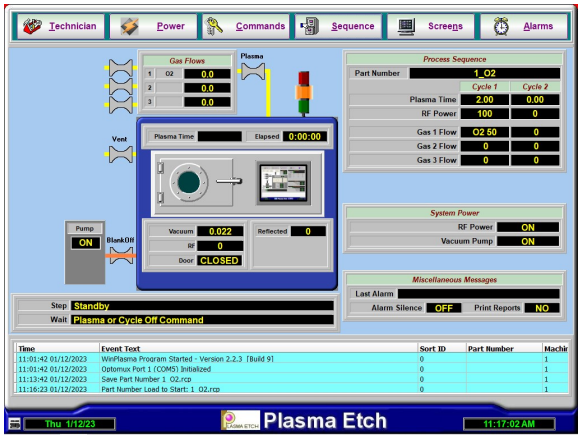
Now you can edit/change the input-values like processing Time, RF (Watts), Gas type and the gas Flow rate. Press  to save the changes, and finally press EXIT  . A mixture of three different gases is possible to set in this step.



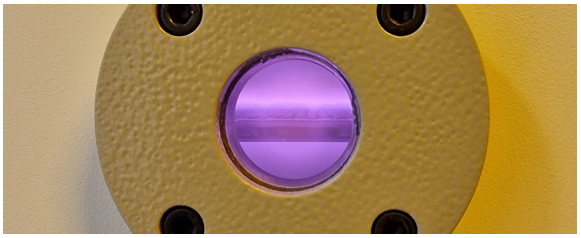
7. Now it is time to run a recipe (sequence) and generate plasma. Go to Sequence menu  and Load the wanted recipe, confirm by YES.



All new given values will come to main screen

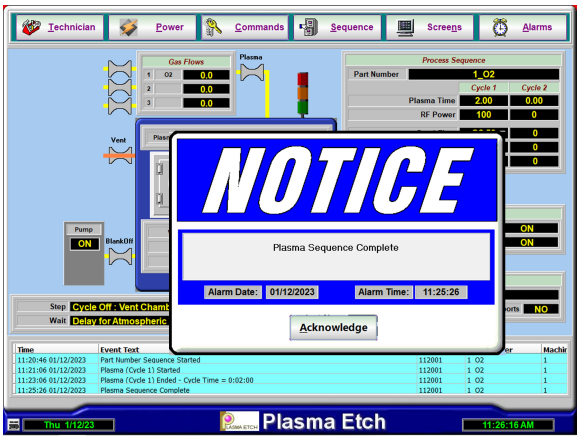


8. Go to Commands  menu and press Plasma  , confirm by YES. You will hear a value opening-sound and gas-flow will start then the plasma will be generated.



Valves will close, gas flow will stop.

9. A completion NOTICE will pop up with in a minute after the sequence is finished, confirm by Acknowledge. The chamber will vent automatically, wait until it is done, it can take a minute (venting sound should stop) then you can open the chamber.



Treatment complete

10. Open the chamber at take out your samples.
11. Repeat the steps 4-10 if a second sample will be treated.
12. Otherwise go to Commands menu 

and press Standby 

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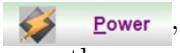
13. Go to Power menu 

, turn OFF RF Generator and Vacuum then press OK.
14. Turn OFF the main power switch of the device (on the wall plug) 
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15. If the software to be shut down? it must be done via Task Manager.
16. Close all gas valves used for the plasma treatment.