CORAL Name: Asher-TergeoPro-Strip, Asher-TergeoPlus-Remote, Asher-TergeoPro-Clean

Location: 6U
Purpose: Etching, Plasma Cleaning
Contact: Cody Corey, Dave Terry

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Introduction

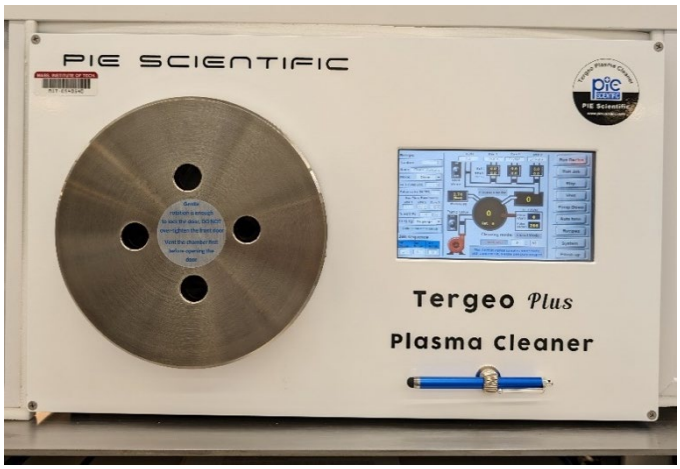
The Pie Scientific Tergeo Plasma Cleaners are designed to generate low pressure plasma using non-toxic gases. The ions and neutral radicals generated inside the plasma source can then be used to etch or remove a thin layer of materials from the surface of the samples placed inside the plasma chamber. There are three Tergeo plasma cleaners in the cleanroom: Asher-TergeoPro-Strip, Asher-TergeoPlus-Remote, Asher-TergeoPro-Clean. The software and basic operation of the three systems are the same, but each system has a dedicate purpose detailed below. Note that the three systems and their associated labware should not be used interchangeably. All systems require a PTC-approved process.



Asher-TergeoPro-Strip

This asher is intended bulk removal or stripping of photoresist, surface descum, sample cleaning and general surface functionalization by changing surface energy of the samples. This tool can accommodate samples sizes ranging from small pieces up to 8-inch wafers and allows for a flexible range of substrate materials. The process gases available in this system are Oxygen and Argon.

Asher-TergoPlus-Remote



This asher is intended bulk removal or stripping of photoresist, surface descum, sample cleaning and general surface functionalization by changing surface energy of the samples. The TergeoPlus has the option to run both direct and remote plasma for additional flexibility in processing. The remote plasma option generates the reactive radical species away from the sample chamber: this results in a gentler process that runs at a lower temperature and lower ion bombardment of the sample to reduce surface damage. This tool can accommodate samples sizes ranging from small pieces up to 6-inch wafers and allows for a flexible range of substrate materials. The process gases available in this system are Oxygen and Argon, it also has a water vapor module to provide a broader range of surface functionalization techniques.

Asher-TergeoPro-Clean

Photoresists and organic materials are not allowed in this asher. It is intended for critical sample cleaning and general surface functionalization by changing surface energy of the samples. This tool can accommodate sample sizes ranging from small pieces up to 8-inch wafers and has restricts substrate materials to clean substrates without photoresists; explicit PTC approval is required to use the Asher-TergeoPro-Clean. The process gases available in this system are Oxygen and Argon.

Safety

- Do not try to defeat any interlock on the system – oxidizers (O_2), high temperatures, and high-power RF energy are contained within the system.
- If you encounter any equipment problems while operating the system, contact the technical staff in charge of the system. Do not try repairs on your own.
- Do not try to force the door open. Forcing the door open while the system is under vacuum can damage the tool and/or cause harm to the operator or other users.
- The chamber and samples/lab equipment inside may be hot after a process. Use caution when removing samples and working inside the plasma chamber.

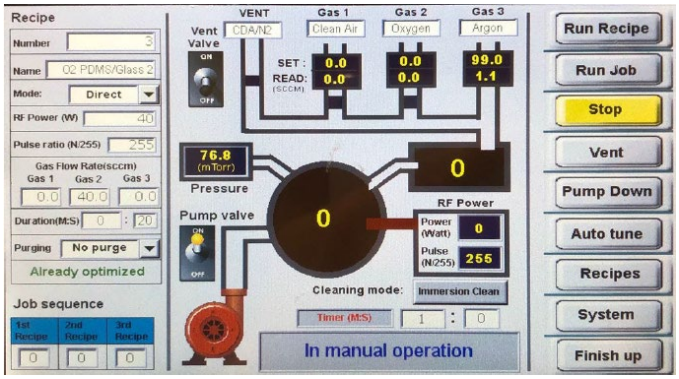
User Qualifications and Responsibilities

- All users must have a PTC approved process to prevent cross-contamination between systems.
- All users shall report any problems with the system via CORAL.
- Leave the chamber in a ‘Pumping Down’ state when finished processing and before you disengage the tool.
- Sample holders and labware for the four asher systems (including the Asher-Barrel-Thierry) are dedicated to each system. Do not use sample holders for system or processes that are not specified as this will result in process and tool contamination. If holders or labware are missing or if there is a new requirement for different labware, please coordinate with staff.

Operating Procedures

Reserve the system prior to use and ENGAGE Equipment prior to starting your process in CORAL/NEMO.

1. The system will be in a 'pumping down' state and under vacuum. Press the 'STOP' button and then the 'VENT' button to bring the chamber to atmosphere.
   a. The tool uses a Pirani vacuum gauge which is only accurate at vacuum less than 10 Torr. The chamber pressure readout may read 760 Torr, but may still be under vacuum.
   b. Gently pull on the door handle to check if the chamber has reached atmosphere. You may also hear a quiet hissing from the nitrogen vent inside.
2. Once the system has reached atmosphere, press the 'STOP' button to close the vent valve, then open the door. The chamber vent *will not automatically stop*.
3. Place sample(s) and quartz plate or aluminum wafer holder inside chamber.
   a. The surface should be close to level and the closest edge of the plate/sample holder should be in line with the closest edge of the quartz barrel.
   b. Your sample(s) should be approximately 1 inch away from the far edge of the plate/sample holder you are using. This ensures that the sample is close to the center of the plasma and helps with repeatable results.



Tool main operating screen.

4. Close chamber door and press the 'PUMP DOWN' button to bring the chamber under vacuum.
   a. Base pressure is reached once the tool has pumped down below 20 mTorr (without gases flowing).
   b. Given more time, the tool is able to pump down below 10 mTorr.
   c. Chamber pressure during a process will be dependent on gas flow.
5. Load the desired recipe by pressing the 'RECIPES' button to see the list of recipes loaded on the tool. Select which recipe you would like to run, then press the 'LOAD RECIPE' button, it will now be displayed on the left side of the screen.
   a. Standard "locked" recipes are available for common processes.
   b. Standard "flex" recipes are available where simple edits may be made to change the recipe run time. Parameters for these recipes should be verified prior to starting the process. See Appendix for a summary of recipe details.
   c. If additional recipe customization is needed, discuss with the tool owner or other staff member for help setting up "custom" recipes. The system has a limited number of saved recipes, so parameters for custom recipes may need to be entered and verified for each tool use.

Page 1 | Page 2 | Edit Recipe | Load Recipe | Main Screen

#	Recipe Name	Mode Selection	Power (Watt)	Duty Ratio	Gas 1 (sccm)	Gas 2 (sccm)	Gas 3 (sccm)	Duration (M:S)	Purging Gas	Tuned? (Y/N)
1	Pure Argon	Immersion	150	255	3.0	0.0	0.0	2 : 0	No	Yes
2	Pure Oxygen	Immersion	150	255	0.0	2.0	0.0	2 : 0	No	Yes
3	Low power mix	Immersion	25	255	5.0	2.0	0.0	2 : 0	No	Yes
4	Medium pow. mix	Immersion	75	255	5.0	2.0	0.0	2 : 0	No	Yes
5	High pow. mix	Immersion	150	255	2.0	2.0	0.0	2 : 0	No	Yes
6	Remote mix MP	Remote	75	255	5.0	2.0	0.0	2 : 0	No	No
7	Remote MIX HP	Remote	150	255	20.0	3.0	0.0	2 : 0	No	No
8	Remote O2 HP	Remote	150	255	0.0	2.0	0.0	2 : 0	No	No
9	Remote Ar LP	Remote	25	255	10.0	0.0	0.0	2 : 0	No	No
10	Low power O2	Immersion	25	255	0.0	1.0	0.0	2 : 0	No	Yes

Recipe menu page

6. Press the 'RUN RECIPE' button to begin the loaded recipe.
   a. The process timer will start counting down once the system detects plasma.
   b. The 'RUN JOB' button is used to run up to three recipes sequentially. More information on this can be found in the Appendix.
7. When your recipe has finished you may vent the chamber and remove your sample(s).
   a. Remember to shut off the vent when the chamber has reached atmosphere/the door has been opened. *It will not shut itself off.*
   b. Use caution when removing samples as contents may be hot.
8. Close the door and press the 'FINISH UP' button. This will bring the chamber under vacuum and return to and idle state.
9. Once the tool has reached idle after pump down, disengage in CORAL and report accurate information on your process run in the corresponding notebook nearby the tools.

Appendix

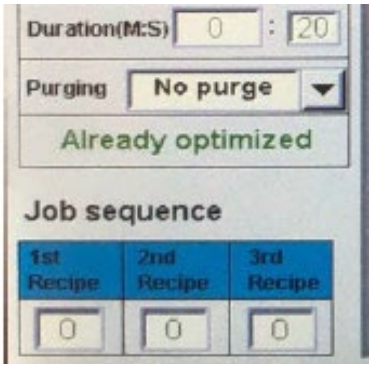
Recipe Tables

Asher-TergeoPro-Strip Locked Recipe List										
#	Recipe Name	Mode	Power (Watt)	Duty Ratio	Gas 1 (sccm)	Gas 2 (sccm)	Gas 3 (sccm)	Duration (M:S)	Purging Gas	Tuned (Y/N)
1	CleanO2GasLine	Direct	0	255	0.0	99.0	N/A	2:00	No	Yes
2	O2 Isotropic	Direct	200	255	0.0	95.0	N/A	2:00	No	Yes
3	O2 Directional	Direct	200	255	0.0	10.0	N/A	2:00	No	Yes
4	O2FastAsh	Direct	500	255	0.0	15.0	N/A	2:00	Gas 2	Yes
5	WafersInBoat	Direct	500	255	0.0	95.0	N/A	2:00	No	Yes
6	O2 75W 10	Direct	75	255	0.0	10.0	N/A	2:00	No	Yes
7	O2 SuperGentle	Direct	25	255	0.0	95.0	N/A	2:00	No	Yes
8	O2 PDMS	Direct	50	255	0.0	25.0	N/A	0:25	No	Yes
9	O2PulsedWeak	Direct	35	50	0.0	10.0	N/A	1:00	No	Yes
10	Argon 100W	Direct	250	255	10.0	0.0	N/A	2:00	No	Yes

Asher-TergeoPro-Clean Locked Recipe List										
#	Recipe Name	Mode	Power (Watt)	Duty Ratio	Gas 1 (sccm)	Gas 2 (sccm)	Gas 3 (sccm)	Duration (M:S)	Purging Gas	Tuned (Y/N)
1	CleanO2GasLine	Direct	0	255	0.0	99.0	N/A	2:00	No	Yes
2	O2 Isotropic	Direct	150	255	0.0	95.0	N/A	2:00	No	Yes
3	O2 Directional	Direct	150	255	0.0	5.0	N/A	2:00	No	Yes
4	O2FastAsh	Direct	300	255	0.0	8.0	N/A	2:00	No	Yes
5	WafersInBoat	Direct	300	255	0.0	95.0	N/A	2:00	No	Yes
6	O2 PDMS	Direct	35	50	0.0	10.0	N/A	0:30	No	Yes
7	O2 75W 10	Direct	75	255	0.0	10.0	N/A	2:00	No	Yes
8	NoSputterGentle	Direct	30	255	0.0	95.0	N/A	5:00	No	Yes
9	Argon 100W	Direct	100	50	5.0	0.0	N/A	2:00	No	Yes
10	Ar+O2 100W	Direct	100	255	10.0	10.0	N/A	2:00	No	Yes

Asher-TergeoPlus-Remote Locked Recipe List										
#	Recipe Name	Mode	Power (Watt)	Duty Ratio	Gas 1 (sccm)	Gas 2 (sccm)	Gas 3 (sccm)	Duration (M:S)	Purging Gas	Tuned (Y/N)
1	CleanO2GasLine	Direct	0	255	0.0	99.0	0.0	3:00	No	N/A
2	MixedWaterPDMS	Direct	25	255	0.0	10.0	5.0	0:30	No	Yes
3	O2+Water Ash	Direct	250	255	0.0	10.0	5.0	2:05	No	Yes
4	O2 Only PDMS	Direct	35	255	0.0	25.0	0.0	0:20	No	Yes
5	O2 FastAshing	Direct	500	255	0.0	12.0	0.0	2:00	Vent	Yes
6	O2 HighPressure	Direct	300	255	0.0	90.0	0.0	2:00	No	Yes
7	O2 100W	Direct	100	255	0.0	10.0	0.0	2:00	No	Yes
8	O2 Rem Low	Remote	50	255	0.0	10.0	0.0	2:00	No	Yes
9	O2 Rem High	Remote	300	255	0.0	90.0	0.0	2:00	No	Yes
10	Argon 75W	Direct	75	255	10.0	0.0	0.0	2:00	No	Yes

Tips and other useful information

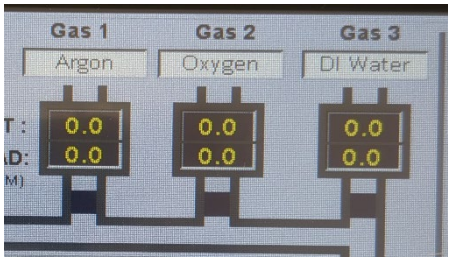


Up to 3 recipes can be run sequentially. To do this, insert the recipe numbers in their respective spots in the Job Sequence box at the bottom left of the main screen.

- Recipe numbers can be found in the recipe menu in the leftmost column next to each recipe (1 through 20).
- Pressing the 'RUN JOB' button will start with the first recipe you have queued up and automatically load and run the others you have queued.
- To omit a step in the queue, input 0 for the recipe number.
- Pressing the 'STOP' button will stop the current recipe that is running and continue to the next one.
- Pressing 'FINISH UP' will stop all recipes and bring the system to the Idle state.

The process gas lines can be flushed before running a recipe, this is especially useful if the tool has been sitting idle for several hours.

- Recipe #1 'CleanO2GasLine' will flush out the O_2 line. This can be used as the first recipe in a sequence to ensure higher purity of gas in the chamber.
- Lines can also be flushed manually without making or changing a recipe:
  - Open the pump valve by tapping on the on/off switch so that it's set to 'ON'.
  - Tap the MFC (mass flow controller) set/read indicator that you wish to open.
  - Enter in '99' for the flow and hit enter.
  - Wait 2-5 minutes for the gas to flow through the lines, then set the MFC to 0 to close it.
  - For the water vapor MFC: set flow to 99, wait for the 'READ' flow to stabilize around 10 sccm, then set the MFC back to 0.



The Tergeo-Plus-Remote is capable of running processes in “remote mode”, also known as downstream plasma ashing. This results in a much slower removal rate, but is a much gentler process than “direct mode”, or upstream ashing. Remote plasma does not generate as much heat as direct plasma, so the process will run at lower temperature.

- The plasma mode can be changed while editing a recipe or on the left side of the main tool screen.

