

# March Plasmod Oxygen Plasma Cleaner

## Standard Operating Procedure

Faculty Supervisor: Prof. Robert White, Mechanical Engineering (x72210)

Safety Office: Peter Nowak x73246 (Just dial this directly on any campus phone.)

(617)627-3246 (From off-campus or from a cell phone)

Tufts Emergency Medical Services are at x66911.

For more information on the March Plasmod or plasma in general see:

<http://www.marchplasma.com/>

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### Dangers:

- (1) This tool generates an RF plasma using high voltages. Do not turn on the plasma with the metal door open.
- (2) This tool uses pure pressurized oxygen which is a strong oxidizer and can pose a fire and explosion hazard. Do not increase the pressure at the outlet of the oxygen tank above 50 psi.

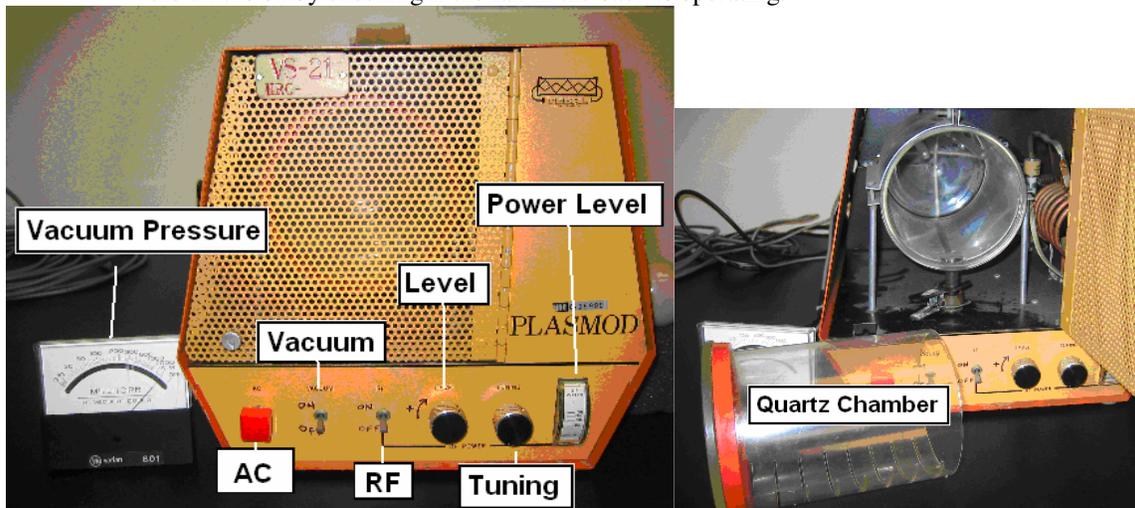
### 1.0 Material Requirements:

- 1.1 Equipment: Wafer tweezers/forceps
- 1.2 Personal Protective Equipment: Nitrile gloves and goggles.

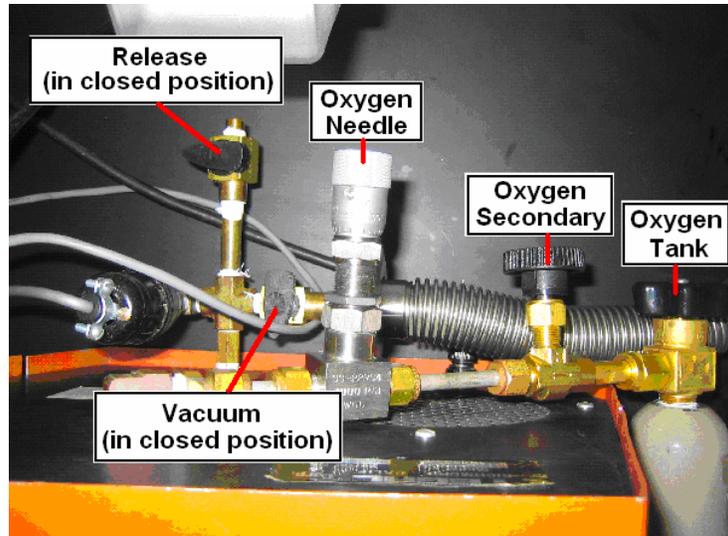
### 2.0 Procedure:

#### Turn on and load samples:

- 2.1 Turn on Plasmod with "AC" button in front. The button does not light up; you can make sure the unit is on by checking if the fan in the back is operating.



- 2.2 Open metal door (arrow on handle points left) and pull out the quartz chamber.
- 2.3 With forceps or wafer tweezers, place samples to be etched in chamber and replace chamber. The metal door can be left open – the chamber needs to be held in place when vacuum is first turned on to ensure a tight seal.
- 2.4 Make sure all valves are closed (5 valves: oxygen tank valve, oxygen secondary valve, oxygen needle valve, vacuum valve, release valve)



**Pump down and purge the chamber:**

- 2.5 Turn on pump under the table (switch is on the front).
- 2.6 Open the valve connected directly to the vacuum hose. The vacuum gauge should now read vacuum pressure. Wait for reading to drop below 150 mTorr.
- 2.7 Turn on “vacuum” switch on the front of the Plasmod while holding the quartz canister tight to the seal. You may need to wiggle the chamber around a bit to get the chamber to seal, you will hear the leaking stop and the chamber will seal.
- 2.8 Close the metal door.
- 2.9 Wait until the vacuum gauge reads less than 200 mTorr.
- 2.10 Open the oxygen valve on the oxygen tank. Check the supply pressure inside the cylinder is greater than 200 psi.
- 2.11 Adjust the regulator on the oxygen tank so that the outlet pressure is 50 psi.
- 2.12 Open the oxygen secondary valve.
- 2.13 Open the oxygen needle valve to allow oxygen into the chamber. Monitor the chamber pressure while opening the needle valve; once oxygen starts to flow into the chamber the chamber pressure will rapidly increase. Adjust the needle valve gently to achieve a chamber pressure of about 500 mTorr. Note: It takes ~6 full turns of the needle valve before it first opens.
- 2.14 Control the needle valve so the vacuum reading settles at about 500 mT.
- 2.15 Allow the chamber to purge with oxygen for 1 minute.

**Set up operating pressure and turn on plasma:**

- 2.16 Adjust the needle valve to achieve your desired etching pressure. The 150-300 mTorr range is recommended.
- 2.17 Make sure that “Level” dial is turned completely down.
- 2.18 Make sure that the metal door is latched closed.
- 2.19 Turn on “RF” switch.
- 2.20 Turn “Level” up slowly until a plasma forms. The plasma should be a blue-ish color. Once the plasma forms, adjust the matching network tuning using the “tuning” knob to create a bright, uniform, and stable plasma. Plasma will flicker off when tuning is adjusted too far; back it down and retry. You will get a more uniform plasma at lower pressures, but probably a more dense plasma at high pressures.
- 2.21 Once plasma is stable, set desired power level using the “Level” knob, and plasma treat for desired time. Maximum power achievable is about 75 W.

**Turn off the plasma and vent the chamber:**

- 2.22 After the etch time is complete, turn down power level completely.
- 2.23 Turn off the “RF” switch. The plasma should disappear.

- 2.24 Close oxygen valves (starting at the valve on the tank and working up the line to the Plasmod)
- 2.25 Turn off the “vacuum” switch.
- 2.26 Open metal door, take out quartz chamber and remove pieces with forceps/tweezers. Replace the chamber and close the door.
- 2.27 Close the pump valve.
- 2.28 Turn off the pump.
- 2.29 Open vacuum release valve (the valve farthest back and facing the wall).
- 2.30 Gently open the pump valve to let air back into the hose.
- 2.31 Close all valves.
- 2.32 Turn off “AC” button on front.

**Optional (for PDMS-glass bonding):**

If your goal is to bond PDMS to glass, the following steps apply:

- A. Piranha clean the glass before beginning. (See Piranha clean SOP).
- B. Expose both the glass and the PDMS to a 75 Watt, 150 mT Oxygen plasma for 30 seconds.
- C. Place the surface into contact. A dark bond region should rapidly form.
- D. Optional additional heating on a hotplate at 75 °C for 5-10 minutes may increase bond strength.

Note that exposure to oxygen plasma will make the PDMS surfaces hydrophilic for some period of time. Over the course of hours or a few days the surfaces will become hydrophobic again.

If at any time you feel a situation is dangerous, do not hesitate to call the safety office (x73246, Peter Nowak) or the faculty supervisor/lab manager (x72210, Robert White).

**Report all accidents (injuries, major spills, fires) to the safety office at x73246 (Peter Nowak). For emergencies, call Tufts Emergency Services at x66911.**