Harrick Plasma Cleaner Quick-Reference Guide for plasma-treating PDMS

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1. Fill out the **Log Book** before proceeding.
2. Turn on the plasma system using the left **POWER toggle switch** on the front of the unit.
3. Let the plasma system vacuum tube amplifiers warm up for **10 minutes**.
4. Open silver valve on the green O_2 cylinder strapped to the table leg, if desired.
   - Open the valve a few turns. Do not open it all the way; the handle should turn freely.
   - The outlet pressure (left gauge) should be 7-10 psi. Contact Adams Microfab personnel if the pressure is significantly different.
   - Contact Adams Microfab personnel if the tank pressure (right gauge) is 500 psi or less.
5. Ensure that the rubber O-ring in the chamber cap is clean and free of any debris. Clean with IPA and a wiper if necessary.
6. Turn on the vacuum pump using the right **PUMP toggle switch**.
7. Put the cap on the chamber so that the system begins pumping down.
8. Turn on the Lesker vacuum gauge using the **toggle switch on the back**.
9. Adjust the flow meter so that oxygen flows at about 20 sccm.
10. Let the vacuum pump warm up for **2 minutes**.
    - If O2 is being used, this will provide time to purge the lines and chamber of air.
11. Be prepared to catch the chamber cap and switch the PUMP toggle switch to OFF.
12. Load your PDMS —and glass if required— parts in the chamber.
    - Load the parts so that the surfaces to be bonded are exposed to the plasma flame.
    - Make sure that the parts can be quickly retrieved, as the activated surface will react with the air within about 5 seconds.
    - If your parts are small, use a 2” x 4” piece of glass to support them.
13. Turn on the vacuum pump using the **PUMP toggle switch**. Put the cap on the chamber so that the system begins to pump down.
14. If necessary, adjust the flow meter so that oxygen flows at about 20 sccm.
15. Let the system pump down for **1 minute**.
16. Close the flow meter needle valve (full clockwise) so that the float rests at the bottom.
17. Let the chamber reach a base pressure of about 70 mTorr before proceeding.
18. Set a timer for 40 seconds. Do not start it yet.
19. Crack the flow meter needle valve (very small fraction of a turn counter-clockwise) so that the float bounces between 20 and 30 sccm.
20. Turn the **RF LEVEL** knob to **HI**, and **start the timer**.
    - Do not adjust the **flow meter**. The float will drift back to 0 sccm; that is okay.
    - The chamber pressure should spike to about 100 mTorr, and then drift back down.
    - The oxygen plasma flame should be a bluish color. If it is bright pink, then nitrogen (air) is leaking into the system; contact Adams Microfab personnel for assistance.

21. When the timer alarms, switch the **PUMP toggle switch** to **OFF**. The chamber cap will fall.
22. Immediately remove your parts from the chamber, and quickly assemble them before the treated surfaces react with the air.
    - You have about 5 seconds to do this.
    - If the parts do not permanently bond, dispose of the PDMS part(s). Further treatment will not work, and will only damage the PDMS. If desired, Contact Adams Microfab personnel for assistance.
23. Turn the **RF LEVEL** knob to **OFF**.
24. If you are treating additional PDMS parts, return to step 9; otherwise proceed.
25. Turn off the plasma cleaner using **POWER toggle switch**.
26. Turn off the Lesker vacuum gauge using the **toggle switch on the back**.
27. Close the green O_2 cylinder strapped to the table leg.

Notes:

- The Harrick Plasma Cleaner RF level power settings are detailed below:
  - Low: 6.8 W
  - Medium: 10.5 W
  - High: 18 W
- The internal dimensions of the quartz chamber are 3” diameter by 7” deep.
- The RF frequency is 8 - 12 MHz.
- Consult the Harrick Plasma Cleaner user manual for further information.
- For a thorough explanation of the process of plasma treating PDMS, see “Studies on Surface Wettability of Poly(Dimethyl) Siloxane (PDMS) and Glass Under Oxygen-Plasma Treatment and Correlation With Bond Strength” by S. Bhattacharya, *et al.*, published in the Journal of Microelectromechanical Systems, Vol. 14, No. 3, June 2005.