

Ion Beam Etching

1. Set-Up

- 1.1. STOP the turbo pump
- 1.2. Close the Valve behind the Turbo pump
- 1.3. Wait till Turbo Pump reaches 50% of its speed (400Hz) and vent the chamber slowly; you can shorten the slowdown time by inserting argon on the chamber with the flowmeter.
- 1.4. Stick your sample to the sample holder with double sided scotch
- 1.5. Attach the sample holder to the moving arm inside the chamber
- 1.6. Start pumping the chamber
- 1.7. Verify that the butterfly valve is completely open
- 1.8. Turn the Turbo ON when pressure < 10 mbar
- 1.9. Open the water valves to cool down the Ion Beam Gun and your sample (if needed)

2. Setting the environment

- 2.1. Wait till pressure $< 5 \times 10^{-5}$
- 2.2. Set the flowmeter to around 2 sccm (5 to 10 sccm)
- 2.3. Adjust the butterfly to have between 2 and 5×10^{-4} mbar

3. Ion Beam Source Setup

- 3.1. Turn the power supply on
- 3.2. Turn on the source by pressing the SOURCE button
- 3.3. Recommended starting conditions

Cathode filament current	Discharge voltage	Neutralizer filament current
4 A	40 V	3.6 A

- 3.4. Set the Beam and Accelerator voltages and current

Beam Voltage	Beam Current	Accelerator Voltage	Accelerator Current
300 V	30 mA (not set)	150 V	6 mA (<20 % Beam)

3.5. Wait 5 minutes for the SOURCE to warmup then start the BEAM

3.6. Set the Neutralizer Emission

The neutralizer removes the electrons from the beam and minimizes surface charging.

For a Beam Current of 30 mA the Neutralizer Current should be at least 37.5 mA (> 125% Beam Current).

4. Notes

4.1. Electron Backstreaming

If the accelerator grid voltage is set too low, it is possible for electrons from the neutralizer to migrate into the discharge plasma. This condition is referred to as electron backstreaming. Electron backstreaming will lead to erroneous beam current readings and will result in a lower etch rate on the target (or a lower deposition rate). The source can be quickly tested to determine if electron backstreaming is taking place.

In Table 6.6 are data from an example of electron backstreaming. As the accelerator voltage is decreased from 150 to 50V, the discharge current erroneously increases at 50V. Note the beam current also increases. Similar to these data, testing for backstreaming should be conducted with a fixed cathode current. The power supply is running in manual mode.

ACCELERATOR CURRENT should be less than 10% of the BEAM CURRENT

Table 6.6. Electron back-streaming example.

Gas (SCCM)	Pressure X 10 ⁻⁴ (mBar)	Cathode Heater (A)	Discharge		Beam		Accelerator		Neutralizer	
			I (A)	V (V)	I (mA)	V (V)	I (mA)	V (V)	Heater (A)	Emission (mA)
5	2.6	3.96	0.33							
5	2.6	3.96	0.33							
5	2.6	3.96	0.35							

5	2.6	3.96	0.35							
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