Glow Discharge of an ALS Photon Beam Stop (PBS)

Purpose

This document defines the steps to condition the photon beam stop (PBS) before titanium sublimation pump (TSP) sublimation. Every new PBS must be cleaned one time prior to being exposed to photons from synchrotron light.

Scope

This document is intended to assist ALS vacuum technicians.

Procedure

The PBSs on the storage ring (SR) vacuum chambers are cleaned in situ using the glow discharge process. The process gas is N_2, which is ignited using a direct current (DC) power supply. This procedure is used in conjunction with ALS Procedures MT 02-02 and MT 02-14, respectively (see References at the end of this document).

NOTE: To start this process, ensure the SR sector chamber is under vacuum and has been leak-check-qualified. Make sure the TSP roughing valve is closed. Glow discharge can also be done when the chamber is at atmospheric N_2.

1. Close the photon stop (PST) valves with 125 psi gas and lock them into the down position with the mechanical closure. **No spacer shim should be in place.**

2. Use an ohmmeter to ensure that photon stop is electrically isolated from the SR arc sector chamber. If this is not the case, locate the short and remove it.

3. Blow down the PBS water.

4. Set up the high voltage (HV) DC power supply.

NOTE: Insertion device **(**ID) chambers not connected to the SR must be grounded, as the chambers are electrically isolated from the ID support structure.

- **a.** Ground the HV DC power supply to the building and to the apparatus before connecting to AC power source.
- **b.** Front panel settings:
  - **i.** Set current adjust knob to 1½ turns clockwise.
  - **ii.** Set voltage selector switch to 0-100 volts.
  - **iii.** Set voltage adjust knob counterclockwise to low limit.
- **c.** Connect HV cable to SHV connector on (PST) and power supply. Install HV shield cage around the upper section of the PST.
- **d.** Connect to 110 V AC power.

5. Connect the vacuum gas manifold to the TSP roughing valve.

6. Connect the LN_2 gas line to the variable leak valve.

7. Ensure the TSP roughing valve is closed.

8. Use the Drytel pump to evacuate the gas manifold.

- **a.** Purge volume of residual air out of manifold with LN_2 dewar by opening leak valve to full open position for one minute.
- **b.** Close leak valve and pump manifold down to <5 µ.

9. Open the TSP roughing valve completely.

10. Open the leak valve to allow the LN_2 gas to enter the manifold system, and maintain a pressure between 175 µ and 300 µ.

NOTE: Monitor sector chamber vacuum pressure to assure proper closure of the PST seals against the glow discharge process gas pressure. If sector chamber vacuum rises above 5×10^{-6} torr, discontinue glow discharge process by shutting off LN_2 gas and valve in the Drytel to evacuate the PBS chamber. Contact the cognizant vacuum technician in charge.

11. To ignite the glow:

- **a.** Turn on the AC power switch and wait 2-3 minutes for warm-up.
- **b.** Starting at 0-100, slowly ramp up the voltage through each range to reach 700-800 V.
- **c.** Do not exceed the 700-800 voltage switch position.
- **d.** Ramp voltage up toward 750 V (max.) until current reads 100mA (max.). Adjusting the gas pressure and voltage influences the current draw.

NOTE: If the current light comes on, turn current-adjust knob clockwise until the light goes out.

- **e.** Monitor the current until it reads 100 mA.
- **f.** Monitor the voltage — should read ~750 V.
- **g.** Allow the glow to “burn” for 30 minutes.
- **h.** Monitor continuously and adjust, as required, to maintain pressure and current parameters.

12. Ramp voltage down and turn off the power and LN_2 gas at the variable leak valve after 30 minutes.

- **a.** Secure the HV DC power supply
  - **i.** Turn voltage-selector switch to 0-100 position.
  - **ii.** Turn off DC switch.
  - **iii.** Turn off AC switch.
  - **iv.** Disconnect from 110V AC power source.
- **b.** Continue to pump the residual gases away until a vacuum of $<10^{-3}$ torr is achieved.

c. Continue pumping 30 minutes more.

d. Disconnect HV DC power supply connections while waiting for pump down.

e. Close the TSP roughing valve.

f. Bake TSP — refer to Section **5.3** in procedure MT 02-14 (see References below).

13. Raise the PST and replace spacer shim.

NOTE: Monitor sector chamber pressure. If sector chamber pressure rises above 5×10^{-6} torr, contact the cognizant vacuum technician in charge.

14. Return water flow to PBS.

15. Vacuum leak check the TSP roughing valve with the sector chamber residual gas analyzer (RGA).

References

DOE Order 5480.19, Conduct of Operations, Guidelines, Chapter 2

DOE Order 420.2B, Safety of Accelerator Facilities, Guidance, Chapter II.A.2

Procedure MT 02-02, Storage Ring Sector Bakeout Procedure

Procedure MT 02-14, Photon Stop (PST) Removal and Installation