

**OPERATING INSTRUCTIONS FOR DENTON VACUUM LLC
DV-401 CARBON COATER WITH 6" CHAMBER**

5. CARBON YARN & CARBON ROD EVAPORATION SOURCES

The Carbon Yarn and Carbon Rod Evaporation Sources are adjustable and are designed to provide carbon films for support, replication or conduction. The mounting posts are drilled and tapped to screw onto one of a pair of low-voltage feedthroughs. The rectangular extension block connects the upper post to the lower post. The height is adjustable by loosening the screw holding the unit to the mounting post.

Warning!

DO NOT permit the mounting post to touch the pumpout cover which is at baseplate ground. This would short the filament current directly to ground.

5.1 LOADING CARBON YARN

The carbon yarn is placed across two spring loaded electrode posts. To load carbon yarn, pull the spring load electrodes and place up to 3, 2" strands of yarn in back of the electrodes. (Carbon sublimes-i.e., it goes from a solid to a gas with no liquid phase). When reloading, allow time for mandrels to cool as they get quite hot, especially when firing carbon for 30 seconds or longer. For heavy deposits, you may double or triple the yarn across the posts.

5.2 LOADING CARBON RODS

Two carbon rods are positioned in the center of the "yoke" to do the coating. One rod will have a point or reduced section. The other will have a full diameter section that has been carefully FLATTENED on the end touching the point (or reduced section) of the other rod. Both carbon rods should be inserted, one after another, through the outside end of the stationary rod holder. First, the pointed rod should be inserted (point trailing) and pushed through with the flattened carbon rod to move into the movable rod holder. Continue pushing the rods until the spring is deflected about 1/8 inch. Tighten the thumb screw holding the flattened carbon in the stationary holder.

With the carbon source loaded, place the samples on the pedestal. Position the Pyrex cylinder in the center of the baseplate. Place top blanking plate on top of cylinder.

5.3 EVAPORATION

The DV-401 vacuum pumping system is used to evacuate a glass cylinder with a carbon evaporation source mounted within the chamber. The source can be mounted so as to vary the source-to-specimen distance from 3 1/2" to 5". Distance will depend on the size of the sample to be coated and/or the sensitivity of the sample to heat.

Denton Vacuum supplies carbon yarn and carbon rods of excellent quality. It is suggested that a low power setting, to degas the carbon, be used; slowly raise to evaporate. Degas the carbon (bright red) for 5 to 10 seconds. (Watch the chamber pressure rise, and then start to fall back.)

Carbon may be evaporated slowly or rapidly. Normally, after degassing, the power is increased to where the carbon starts depositing. Length of evaporation time will depend on the desired thickness of carbon film. It should take from 30 seconds to totally evaporate the carbon. **DO NOT** take power too high for more than one minute.

A rapid evaporation (flashing) may be utilized by presetting the control to 75 percent of dial rotation and then turning on the power. The flash will last from 1 to 2 seconds and help reduce heat damage.

Carbon vaporizes due to localized heat caused by resistance to flow of electric current. Carbon resistance lowers as carbon heats up, but will stabilize.

CAUTION !

The bright light from the carbon evaporation source can damage the optic nerve. NEVER look at a heated source without eye protection such as welder's glasses or a coated piece of glass such as one might use to watch a solar eclipse.

6. OPERATING THE DV-401

- Turn ON the main circuit breaker located on the rear panel.
- Press the mechanical pump switch to ON.
- Vent valve automatically closes.
- After three seconds of pumping, you should not be able to lift the carbon head. If you can, turn off the unit and reposition the cylinder and/or top plate.
- Within three to four minutes the chamber vacuum gauge should read about 30 millitorr.
- Gas (Argon) may be used. By pumping the chamber below 50 mT and then raising the chamber pressure to 50 mT, you will have a clean, inert gas in the chamber. Gas is an option and is not necessary.
- Open the gas-off valve and adjust the pressure in chamber to about 50 mT.
- Next, select the mode of carbon evaporation desired: **CONSTANT OR MANUAL**. In the constant mode of operation, the power level selected on the power control knob will be continuously applied to the carbon fixture. In the manual mode of operation, first select the power level desired and power will only be supplied when the pulse switch is pressed.
- For carbon rod, rotate the power control knob until the current on the amp meter reads 15 amps. The carbon point should be bright red and outgassing. Increase the power level to between 30-40 amps or until a light spark is seen.

Note: Do not exceed 50 amps on the meter. Continue until desired deposition has been achieved or the carbon tip has been evaporated, or the carbon yarn has worn through.

- To vent unit and to remove your sample, depress the system pump switch and close the gas shut-off valve.
- Depending on the number of carbon yarn strands, rotate the power control knob until the carbon yarn begins to glow. Let the carbon yarn out gas for several seconds, then increase the power until you see the yarn evaporate.

With a source-to-specimen distance of 4", about 1/6" of carbon point will deposit about 30 angstroms of carbon film. A 3/8" length of .040 inches reduced section will deposit about 100 angstroms of carbon.

For evaporating at relatively high pressure, it is good practice to check carbon film thickness. Coat a glass cover slip with gold. The gold color will change to copper when the cover slip is over coated with 100 angstroms of carbon; to orange with 150 angstroms of carbon; and to purple with 200 angstroms of carbon.

At 50 millitorr the average gas molecule travels about .04" between collisions. With a source-to-specimen distance of 4", the carbon will make many collisions. It will arrive from all available directions. At above 75 millitorr the thickness of the carbon film will diminish rapidly, as compared to the expected thickness.