

Society of Vacuum Coaters 45th Annual Technical Conference 2002

Vendor Poster V-9

Use of the Delta Glow™ High-Energy Plasma Source for Vacuum Process Chamber & Load Lock Cleaning

The Delta Glow™ high-energy plasma source was introduced to the market in 1992 and has been employed in both vacuum deposition and process enhancement applications. This presentation will discuss its use in cleaning and preparation of vacuum process chambers.

Load Lock Chamber Uses

Water vapor stimulation & removal

Typical vacuum processing tools utilize a main process chamber where the actual process happens in addition to at least one lock chamber. The lock chamber(s) enable the substrate to be introduced to and removed from the main process chamber without bringing the main process chamber up to atmosphere.

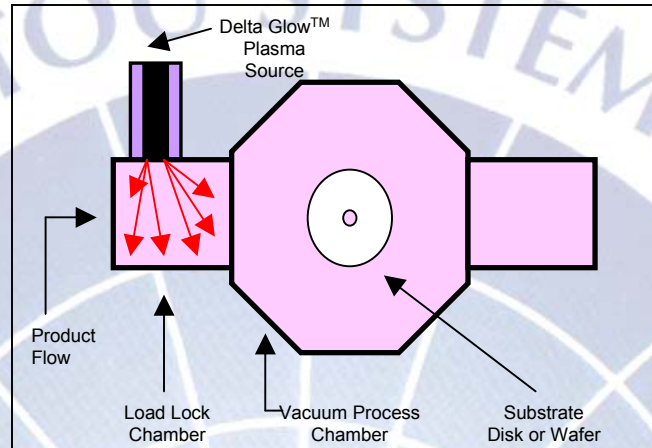
The load lock chamber will cycle in-between atmosphere and a low base pressure upon each substrate introduction. Upon each cycle and the type of substrate to be processed, water vapor will be introduced along with the substrate. The Delta Glow plasma source is attached to the lock chamber and employed to stimulate the removal of water vapor through the use of various gas chemistries.

The energetic plasma contains both radicals and neutrals in addition to being a source of UV light that forces water vapor molecules away from the chamber walls and fixturing to be pumped away. The result is a quicker pump down of the lock chamber to typical transfer pressures.

This technique can also be employed in the main process chamber to reduce water vapor contamination introduced during servicing or at the time of manufacturing test.

- Desorption of water vapor on surfaces via electron & ion bombardment
- UV activation caused by light generated in the plasma discharge
- Chemical Activation using process chemistries such as NF_3 & O_2

Typical hardware for lock chamber use



Some processes will benefit from using the Delta Glow to perform substrate surface cleaning after pump-down and while in the chamber. These processes include surface conditioning and surface modification. The deposition process step (next in line) will benefit as there will be a cleaner substrate surface to start with in addition to better film adhesion.



Model DG-300 With Automatic Matching Network

Typical Delta Glow hardware used for chamber clean and process. The image on the left illustrated our Model DG-300 13.56 MHz system while the image on the right shows the Model DG-80 80 MHz source.

The source on the left has a 50mm process tube while the DG-80 has a 20mm tube.

Some studies suggest that the use of VHF (Very High Frequency) to drive the source results in higher density plasma discharges.

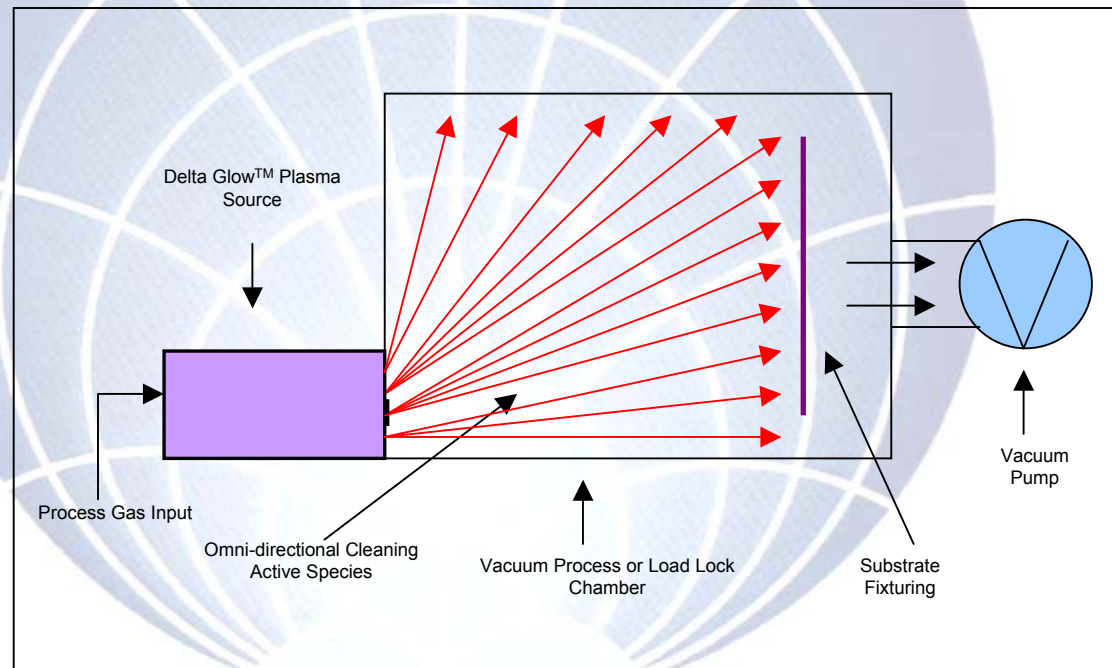


Process Chamber Uses

Process Chamber Cleaning

During typical deposition use, the main process chamber will get contaminated with deposited film residue and other byproducts of the process. Remote, downstream plasma source technology has been utilized to provide an in-situ clean of the chamber and its internal components. Using highly reactive gas chemistries, the Delta Glow is typically used to clean vacuum process chambers in between process cycles and during equipment commissioning.

Semiconductor and flat panel display CVD process chambers are cleaned using gas chemistries such as NF_3 & O_2 . Another new application is the cleaning of high power industrial laser cavities. Built up contaminants are etched from the internal cavity surfaces and removed away with a high vacuum pumping system.

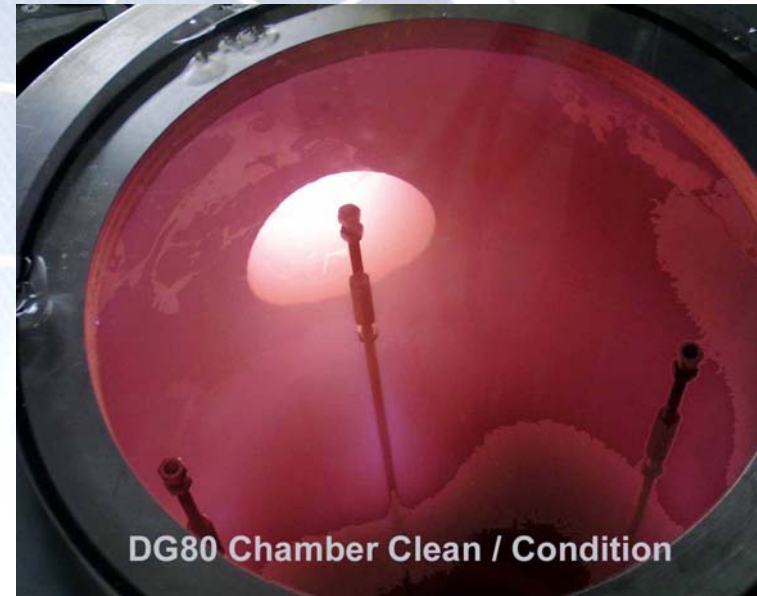


Installation

The Delta Glow plasma source is typically installed onto the vacuum chamber through the use of ISO or KF style flanges. These products have been custom manufactured to meet the customer's interface requirement.

The Model DG-80 has an integrated impedance matching network so all that is required is connection to the chamber, process gas connection, RF power (to the RF generator) and 24VDC to operate the cooling fan.

The Model DG-300 uses a remote impedance matching network so in addition to the above there is an additional cable to connect the matching network.



Process Chamber Uses

Multiple source clusters

The Delta Glow plasma sources may be combined in multiples on a single vacuum interface plate. The RF power from the generator is split using a specialized device to enable equal amounts of power to be directed to each plasma source.

These clusters may be annular or linear.



RESULTS

- Faster Pump-down on New Chambers
- Chamber Cleaning Between Process Cycles
- Reduced Contamination In Deposited Films
- Better Film Quality Control

