

13.56 MHz Hollow Cathode Plasma Source HCD-L 300 A (Flange on version)

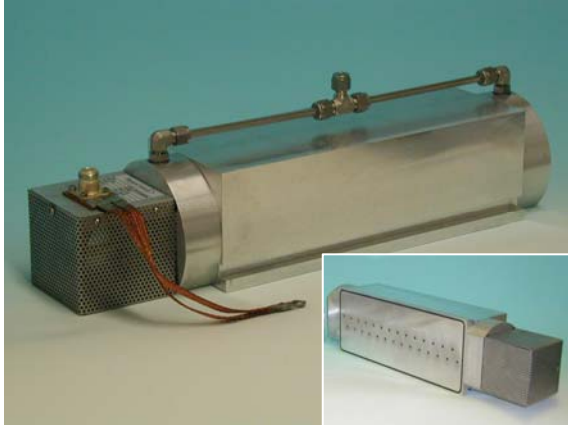


Fig. 1: HCD-L 300 A

Hollow Cathode Discharge - module for plasma aided materials processing and synthesis

The HCD-L 300 is a very efficient but comparatively simple device for producing remote plasmas with high densities. The HCD-L 300 in its linear form consists of two coaxial tubes of 30 cm length. The inner tube is the hollow cathode and the outer grounded tube forms the anode.

Both cathode and anode are supplied with two rows of coaxial holes aligned to each other resulting in 30 plasma jets. The source is all-aluminum manufactured to avoid contamination problems.

A primary working gas is fed into the cathode from both ends in order to maintain a constant gas pressure over the entire cathode length. Rf-power at 13.56 MHz is applied to the cathode and an intense primary plasma is generated, approaching plasma densities of 10^{11} cm^{-3} . The coaxial holes in the cathode allow plasma jets to form and create a remote plasma in the process chamber. The overlap of plasma jets results in a very homogeneous plasma density distribution.

Good film quality

The homogeneous plasma results in a small thickness variation. To name an example, HMDSO-derived SiO_x thin films on a substrate showed typical thickness variation of only about $\pm 3\%$. Applications for SiO_x films include scratch resistant, anti-corrosion and barrier layers.

Continuous plasma treatment and deposition

Single and double side deposition or modification of thin foils in a continuous process is possible.

Low temperature treatment of thermally sensitive substrates

Possible are treatment of foils, papers and textiles. Since the thermal load of the substrates during remote processing is very low (can be kept lower than 40°C) the process can be applied to thermally sensitive substrates.

Since the HCD-L 300 A can be installed on a flange outside of the vacuum chamber, the plasma source is **air-cooled and offers plenty of room in the vacuum chamber** in comparison with the HCD-L 300 System.

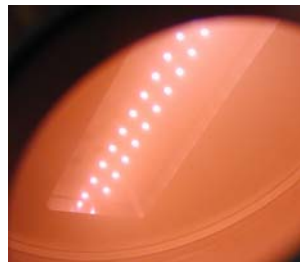


Fig. 2:

View into vacuum chamber while operating the plasma source

Fig. 3: The HCD-L 300 Atmosphere can be installed on a flange outside of the vacuum chamber.



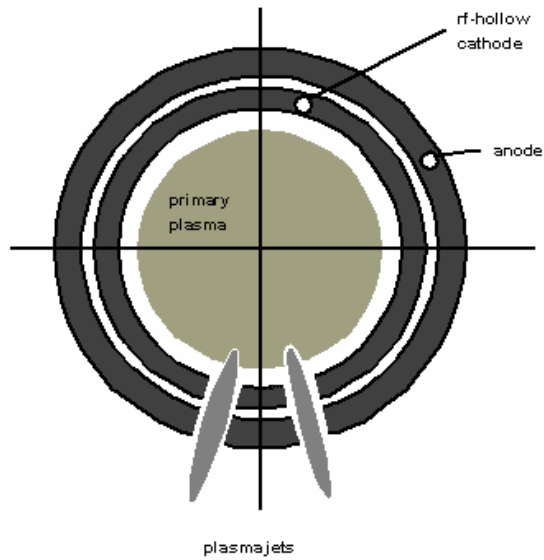


Fig. 4: Schematic cross section through a *HCD-L*.
Shown are two cylindrical tubes aligned coaxially. The inner tube is rf-powered enclosing the primary plasma; the outer tube is electrically grounded. Two rows of holes are arranged along the cylinder axis forming the high intensity primary plasma jets consisting of ions, electrons and excited species.

Concept of the HCD-L

Basically, the *HCD-L* is of cylindrical symmetry featuring two aluminum cylinders of different diameters. These cylinders are inserted into each other and aligned coaxially (Fig. 4).

Both cylinders are electrically isolated from each other. The inner cylinder is connected to the rf-power generator; the outer cylinder is grounded. Along the cylindrical axis multiple holes are drilled into the inner and outer cylinder allowing plasma jets to be extracted after the primary plasma has been excited in the hollow cathode. A proprietary internal cathode structure guarantees a homogenous jet formation over extended source lengths.