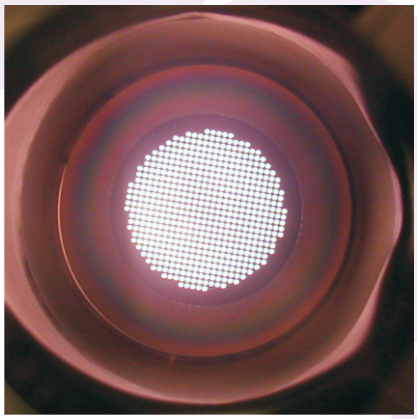
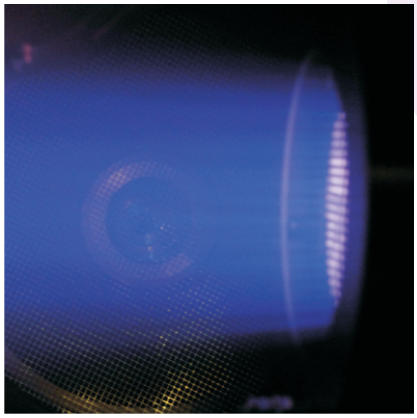
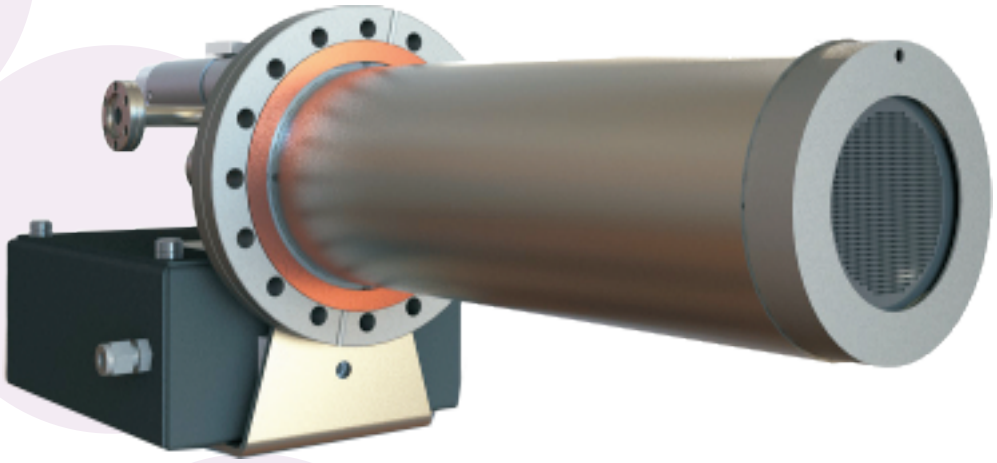
RFMAX

RF ion sources







Features

- 100% UHV construction
- Efficient water cooling
- Inductively coupled discharge
- Dual/triple grid system
- Custom grid designs available
- Manual/automatic tuning
- Software controlled

Applications

- Sample cleaning
- Thin film densification
- Control of film chemical composition
- Ion milling
- IBAD
- MEMS

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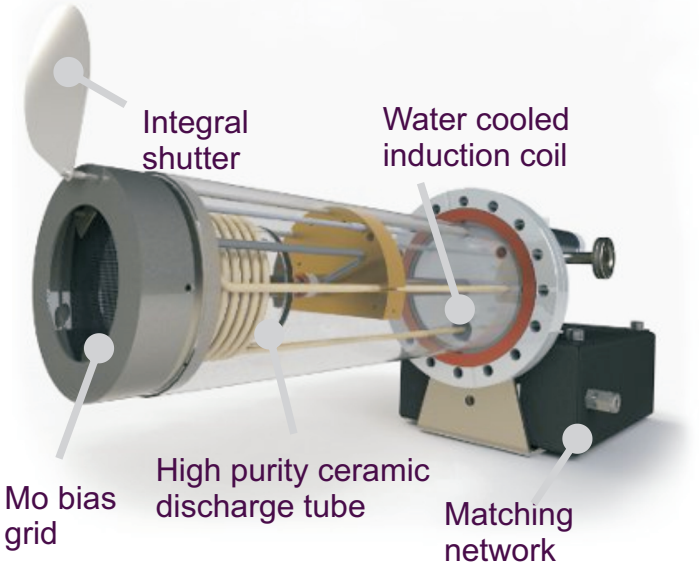
RF ion sources

Ion sources

Beams of accelerated ions are used to modify and erode surfaces under vacuum conditions. By carefully selecting the energy and composition of an ion beam, this can be used, for example, to improve significantly the characteristics of a growing film by both densifying the film and modifying the chemical composition of the film. Alternatively, ion beams can be used to erode (mill) existing films or sputter target material to project a plume of material for deposition on a substrate. In the latter case, the growing films can have an excellent qualities for many applications owing to the elevated kinetic energy of the sputtered material.

RFMAX ion sources



The RFMax ion sources are designed for use in UHV or HV deposition systems for applications where a broad, energetic beam of ions is required with a moderately low energy spread. The sources can generate ion beams from 50eV up to 1000eV and with beam currents between 10mA and 150mA. The beams have a typical divergence of 7 degrees when using nominally flat grids. Optionally, convex or concave grids may be mounted to give divergent or focussed beams, respectively.

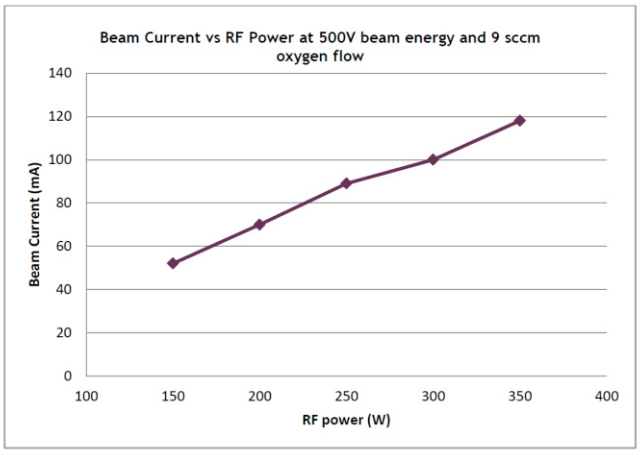
The ion source contains a helical coil wrapped around a ceramic discharge tube. RF power at 13.56MHz is applied to this coil with a power between 100 and 600W at the same time as a gas is introduced into the discharge tube. The RF field generates a plasma within the discharge tube, thus supplying the charged particles which form the basis of the ion beam.

The discharge tube is enclosed by a pair of high-transparency grids. The grid material can be carbon, molybdenum or titanium.
For most applications molybdenum grids are recommended.

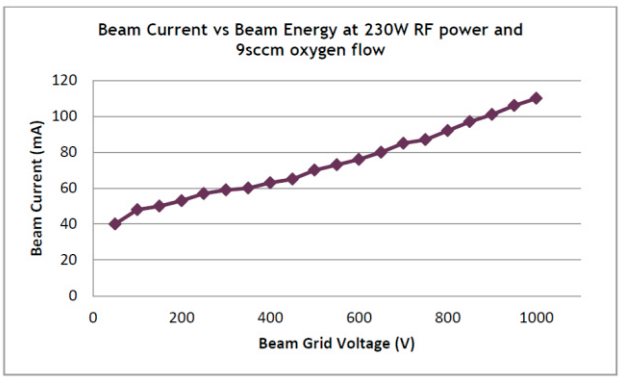
The inner grid (the Beam grid) has a voltage applied which is equal to the energy of the ion beam the user wishes to generate. The outer grid is held at earth potential. This potential difference between the grids creates a field gradient which acts to draw ions from the plasma and through the holes in the outer grid. The multiple 'beamlets' combine to form one broad ion beam which emerges into the chamber.

Operation

In RFMax ion source the relationship between RF power and beam current is close to linear. Thus, by changing RF power it is possible to make small changes to the beam current for a fixed beam energy.



Beam current also displays a near-linear dependence on beam energy.



Accessories & options

Cooling

Operation at high RF power requires efficient water cooling. In our sources the induction coil, the gas inlet and the tip of the source are internally water cooled. The cooling prevents overheating of the source components and additionally, it eliminates impurities from being outgassed into the deposition environment and keeps UHV environment clean.

Gases

The source can be operated with Oxygen, Nitrogen, Argon. The table below shows gas compatibility with various materials:

Grid material	Gases
Carbon	Ar, N_2
Molybdenum	Ar, O_2, N_2
Titanium	Ar, N_2

The source can also be used with some organic gases such as methane, but these should be heavily diluted with hydrogen gas to avoid carbon deposits forming on the inside of the discharge tube. Please contact us for recommendations on non-standard gases.

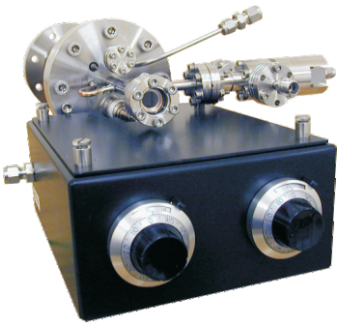
Gas control

Generally, the gas is introduced to the ion source through a mass flow controller (MKS), which can be calibrated for a variety of discharge gases. Mantis Deposition manufactures a four channel controller that can be coupled to up to four mass flow controllers to control the gas flow rate into the discharge tube.
The compact unit mounts in a standard electronics rack and has four digital displays indicating the flow setting for each unit.

Shutters

All of our RFMax sources can be fitted with either a manual or motor driven shutter. Shutters are constructed of refractory metals to ensure UHV compatibility.

Tuning



Tuning provides a mechanism to couple RF power correctly to the plasma discharge. The RFMax ion sources come with manual tuning units as standard.
The manual tuning unit uses a pair of variable vacuum capacitors to change the impedance of the source and to match it to the impedance of the RF power supply.

Optionally, the ion sources can be fitted with an automatic tuning on request. The automatic matching unit provides quick and precise tuning of the source when plasma conditions change.

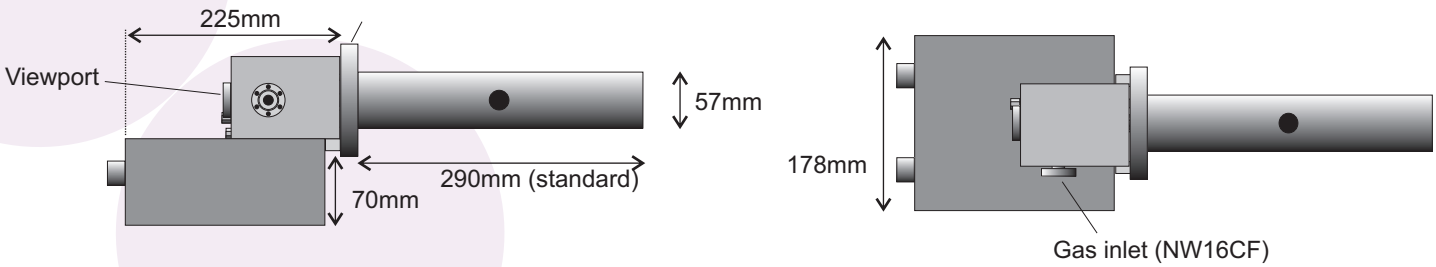
Matched with our in-house software, the RFMax sources can be integrated into a fully automated deposition systems. Available functions of the software package includes automatic plasma ignition, automatic gas flow control and recipe process control. The automation package is suitable for both R&D and production applications.

Special requests

We are very interested to hear about customer's applications and are ready to accommodate special requests if our standard sources will not immediately allow your goals to be met.
For example, we can design custom grid plates and change the size of the sources to accommodate required deposition area and flow ranges.

Specifications

RFMAX30 (not to scale)



	RFMAX30	RFMAX60
Mounting flange	NW63CF	NW100CF
In vacuum length	290mm (standard)	290mm (standard)
In vacuum diameter	57mm	96mm
Gas compatibility	O_2, N_2, H_2, Ar	O_2, N_2, H_2, Ar
Cooling	Water (0.5l/min)	Water (0.5l/min)
RF power	30-600W	30-600W
Gas flow	8-10sccm	10-15sccm
Beam energy	0.1-1keV	0.1-1keV
Current density	Up to 5mA/cm^2	Up to 6mA/cm^2

Accessories

Automatic Matching Unit - The manual matching unit can be replaced with an automatic matching unit to relieve the user of the task of making minor adjustments as plasma conditions change.

Beam Neutraliser - A beam thermaliser can be added to the end of the source to inject electrons into the ion beam to ensure that the total charge arriving at the sample is near zero. This allows ion beam sputtering of dielectrics and better beam optics to be achieved.

OTHER: Manual Teardrop Shutter, Automated Teardrop Shutter.

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