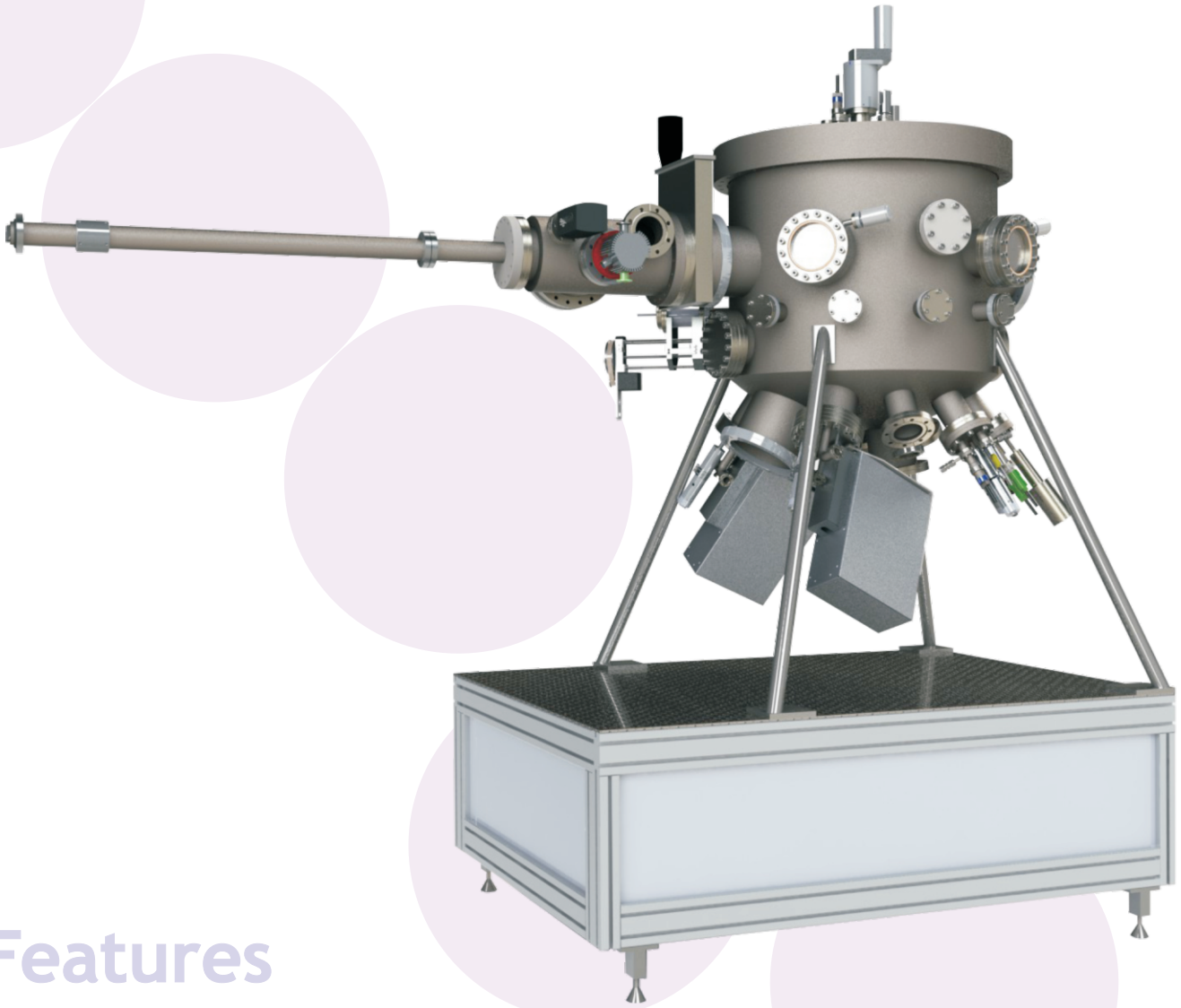
M600

UHV deposition systems



Features

- Cylindrical, true UHV-construction chamber
- Full cryopanel option
- Multiple UHV, CF deposition ports
- Analysis, load-lock and viewing ports
- Multiple sample holder options including rotation, heating, cooling, RF/DC bias
- Range of turbo,ion and cryo pumping options
- Deposition source options include e-beam, sputtering, thermal, K-cell, nanoparticle deposition and oxide/nitride sources.

Applications

- Semiconductor films
- Oxides/nitrides
- Nanostructured films
- Multilayers
- Compound semiconductors
- Glancing angle deposition
- Ultra-thin films

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Base chamber

Chamber configuration

The M600 system is based on a UHV, conflat flange platform with a large metal-sealed top flange. This allows true UHV to be achieved while granting excellent chamber access through the large top-flange. All joints are internally welded and polished on request to reduce to an absolute minimum any outgassing.

Ports: Base ports are confocal as standard allowing a wider variety of deposition sources to be employed than with non-confocal arrangements. Two side-mounting ports for high-power e-beam sources can be specified while still leaving up to seven confocal deposition ports in the base. Numerous ports are provided for gauges and analysis tools.

Cryopanel: The system can be equipped with cryogenically-cooled panels to aid pumping and avoid thermal cross-talk between sources.

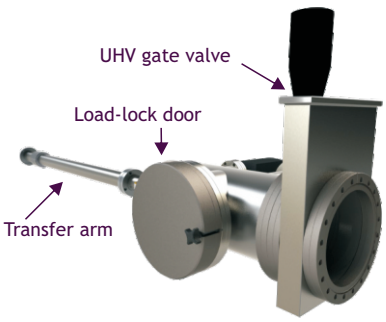
Bakeout: Internal bakeout heaters or full external bakeout tents can be incorporated, which allow the base pressure to attain a value of less than $1.0x10^{-10}$Torr with appropriate pumping.

Pumping: M600 can be equipped with pumps ranging from 300 to $2000ls^{-1}$ turbo pumps, cryo and ion pumps, but alternative pump types can be specified.

Shielding: The chamber can optionally be equipped with removable cross-contamination shielding in applications where high rates of deposition are required.

The main chamber design can be configured according to customer requirements.

Sample loading

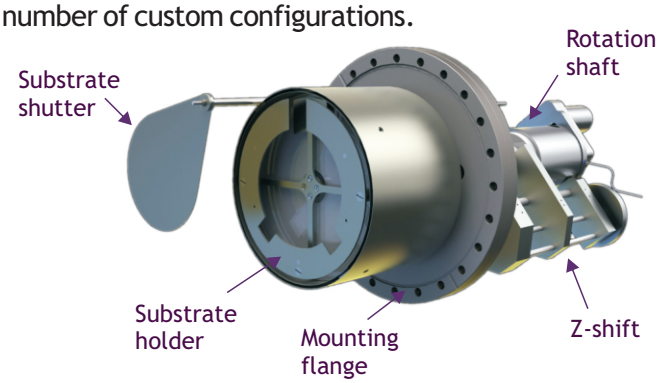


The base system is equipped with side-entry door appropriately sized for the sample platform chosen (1" to 6" as standard, 8" on request).

Optionally a load-lock can be mounted for clean sample transfer while leaving the main chamber under vacuum. Sample transfer is actuated via a magnetically-coupled transfer arm. Sample hand-off is enabled via z-shift lift-off of the sample table. Sample transfer can optionally be automated from a sample storage cassette.

Sample Manipulator

The sample table/manipulator can be configured as standard from 2" (51mm) to 6" (153mm) or multiple smaller samples. Alternatively it can be modified for a number of custom configurations.



Substrate table options include:

- Variable speed sample rotation(20-80rpm)
- DC or RF bias
- Sample heating up to 800C
- Sample cooling (with water or liquid nitrogen)
- Z-shift

All hot-zone components in a heated sample holder are manufactured from refractory materials in order to maintain system purity.

Gauges, Analysis

The system is configured as standard with full-range gauges to allow seamless pumpdown monitoring. Ports can be included for RHEED, ellipsometry, residual gas analysers or quartz crystal monitors.

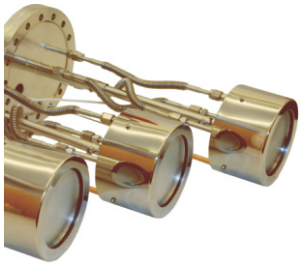
Automation

A comprehensive automation software package is available for M600. The software package enables automated control over almost all functions of the system to enable recipe driven processes. Additionally standard functions such as automatic pump down and venting are included.

Alternatively the system could be controlled manually with power supplies installed in electronics rack.

Components

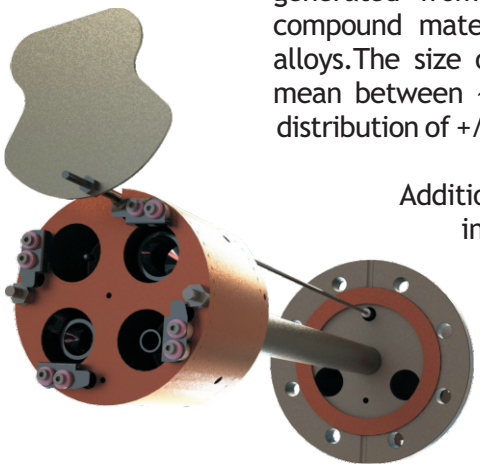
Sputtering sources



The chamber base ports can accommodate up to six sputtering sources. We can supply 1", 2" or 3" UHV magnetron sputtering sources for DC or RF operation. The sources can be equipped with standard or high-strength magnets and additionally balanced or unbalanced magnet sets. Additionally, in-situ Z-shift and target tilt features can be incorporated.
Alternatively we are happy to incorporate existing or third party guns into the system.

E-beam sources

We offer two types of UHV e-beam evaporation sources:

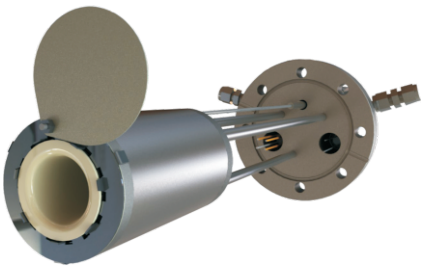


1. Low dose, high accuracy.
These are intended for highly-controlled, ultra-thin film deposition of refractory materials. All models incorporate integral flux monitoring for all evaporation pockets. The pockets are connected to independent high-voltage line and co-evaporation of up to four materials could be achieved.
See separate brochure.

2. Multi kW sources.
These offer high deposition rate and high capacity. Up to two larger sources (single or multi-pocket) may be installed into the system.

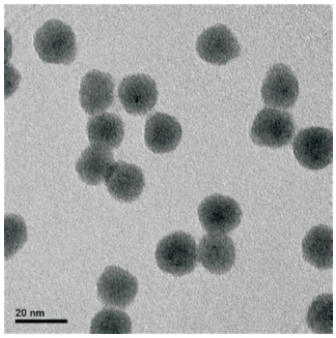
Effusion cells

Our K-cells are designed for high-purity, high-precision evaporation of materials in MBE or hybrid UHV applications. Both high and low-temperature models are equipped with a water-cooled shroud, which ensures minimal outgassing contamination during operation.

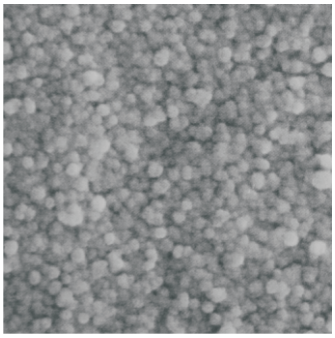


The K-cells can be supplied with PBN, Al_2O_3 and BeO crucibles depending on material and maximum operating temperature.

Nanoparticle sources



TEM image of TiO_2

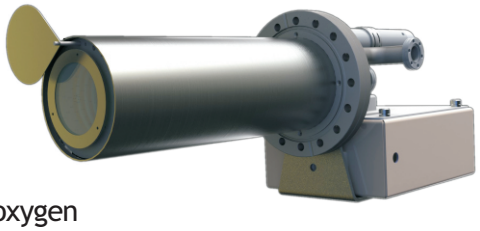


SEM image of Ag

Our Nanogen50 nanoparticle source can be installed on the chamber to allow controlled nanoparticle deposition onto the sample. Nanoparticles can be generated from any metal as well as from many compound materials (oxides, nitrides, carbides) and alloys.The size of the particles is highly controlled - mean between ~0.5nm and 20nm with a narrow size distribution of +/-15%.

Additionally, our Nanoshell source can be installed inline with the nanoparticle source to produce core-shell nanoparticles.
See separate Nanogen50 brochure.

Oxides/Nitrides



For the growth of oxides or nitrides at low pressure, it is often necessary to use a more reactive form of oxygen (and certainly nitrogen) to form oxides or nitride compounds. Our RF plasma sources generate beams of highly reactive *atomic* oxygen or nitrogen and can be incorporated to act alongside conventional metal deposition sources to grow high quality compound layers. The coaxial RF coil design ensures very efficient power transfer into the plasma. The sources are compatible with a range of gases such as 0_2 , N_2 , H_2 and CH_4.

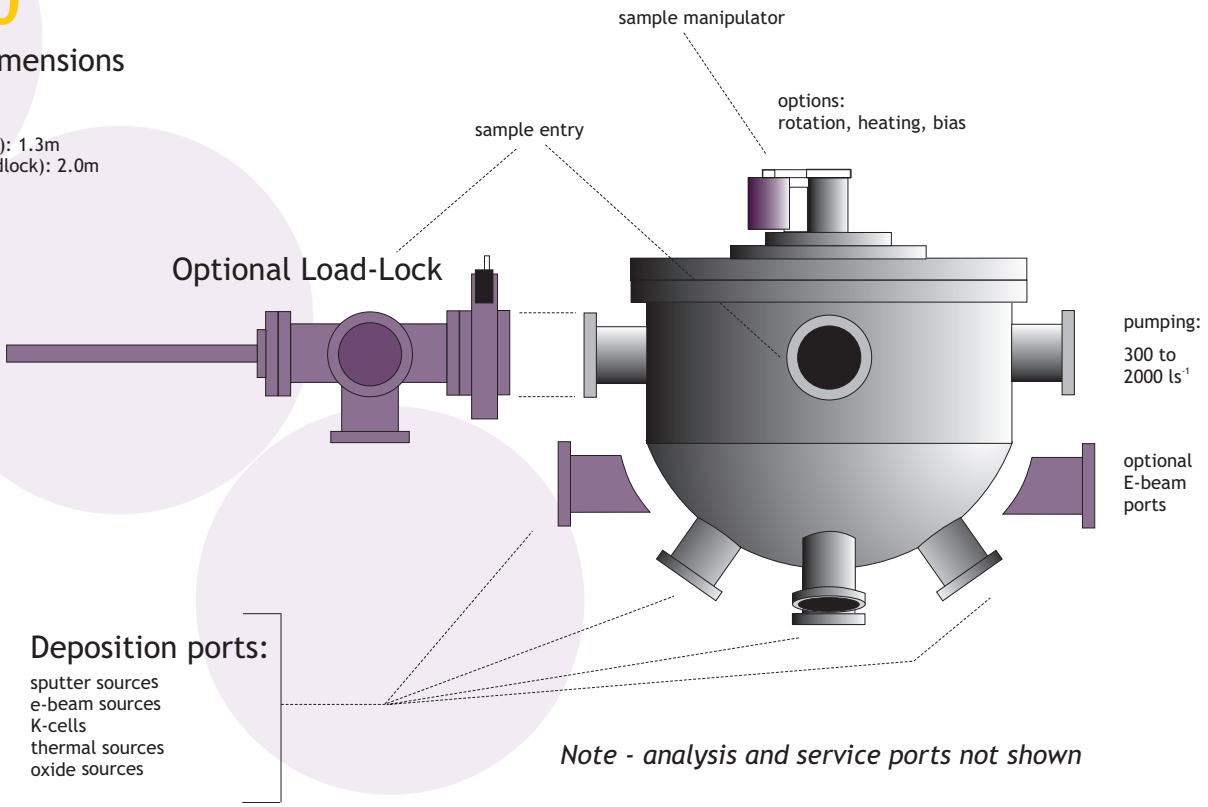
Note, these sources require a chamber pressure lower than $2x10^{-3}$mbar to operate.

Specification

M600

Overall dimensions

width: 1.5m
height: 1.6m
length (standard): 1.3m
length (with loadlock): 2.0m



Note - analysis and service ports not shown

M600 (Standard)

Chamber	
Construction	Cylinder/hemispherical, UHV
Top flange	Metal-sealed
Radial ports	Size and quantity defined by sample size and application
Deposition ports	5 (or 7) x NW100CF 4 x NW35CF
Pumping	
Main pump	300 ls^{-1} to 2000 ls^{-1} Turbo Ion, cryo options
Backing pumps	Dry pumps (scroll)
Base pressure	<1x10^{-10} Torr (see note below)
Manipulator	
Sample mount	Suitable for 2-6” samples
Sample loading	Through sample entry door or optional load-lock
Other	
Electronics	Cabinet-mounted
Gauging	Ion gauge/Pirani
Frame	Low footprint frame on transport casters

Options

Load-lock	
Pumping	70 ls^{-1} Turbo
Transfer	Magnetically-coupled transfer arm
Manipulator	
Rotation	To 80 rpm
Heating	To 1000 °C
Z-Travel	100 mm
Bias	Optional power supply
Bakeout	Internal or jacket
Cryopanel	Full or half optional
Film Monitoring	QCM, Ellipsometry, RHEED
Automation	Full process automation including recipe-driven programming and full data logging

Note: to operate the system with a base pressure in 10^{-10} Torr region in a practical manner, a load-lock and bakeout should be employed. Ultimate base pressure depends on pumps and sources configuration.

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