KORVUS TECHNOLOGY

HEX HIGHLY MODULAR PVD SYSTEMS

Sputtering • Organics Deposition • E-Beam Evaporation
Coating Research & Development • Glovebox Compatible

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Welcome to the HEX Series

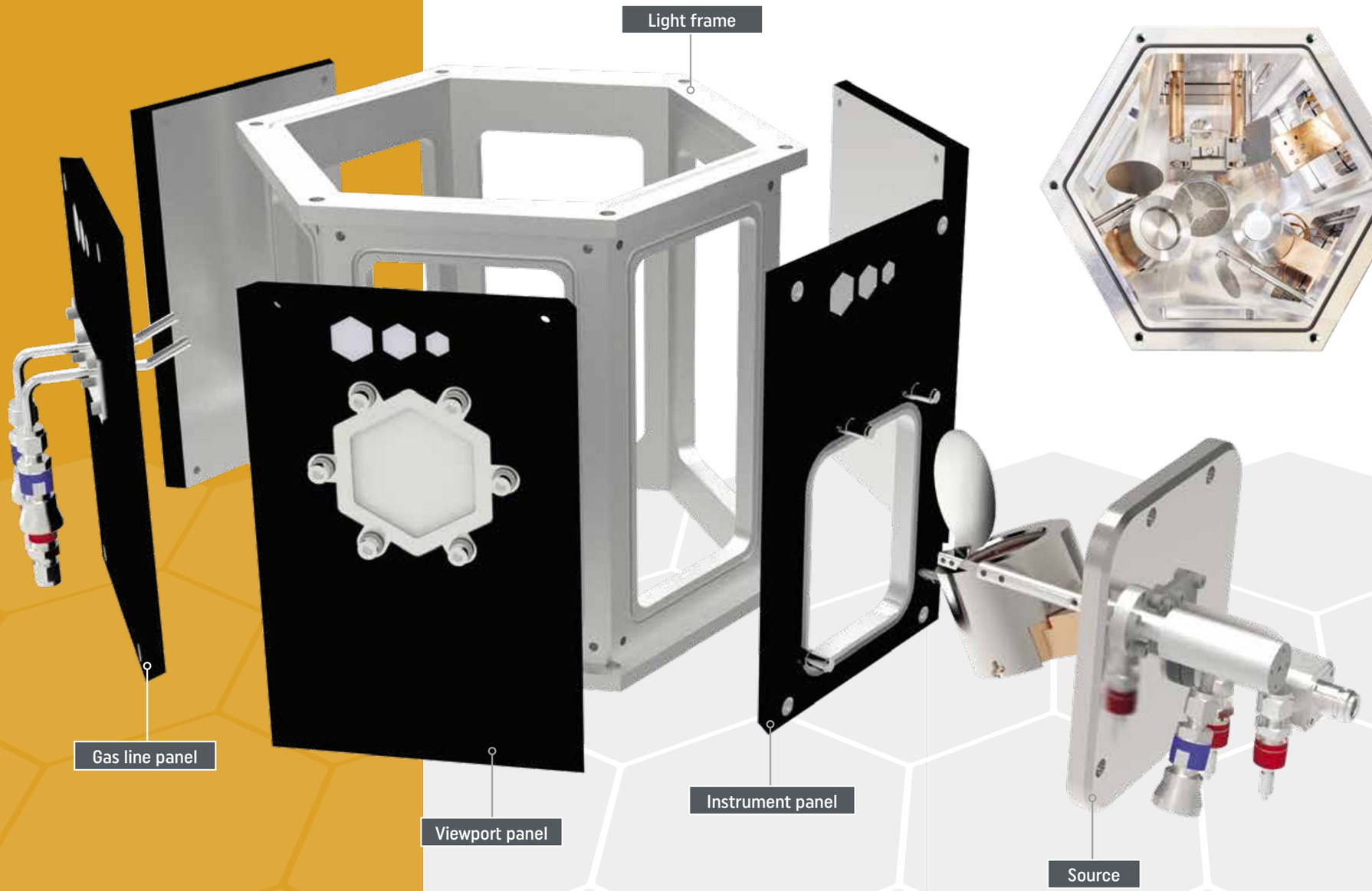
Highly modular PVD systems with a unique open-frame architecture, offering an unmatched level of user control, customisation and upgradability to researchers in thin-film deposition.

The HEX series of thin film deposition systems provide a versatile range of deposition options for your research and implementation applications. Starting from the base system, the unit can be upgraded to different configurations of source instruments. These upgrades are modular and simple to install, providing a cost-effective solution while reducing system downtime. Whatever direction your research takes you in, the HEX is by your side.

The HEX deposition system is highly flexible and versatile, offering users the ability to re-configure and upgrade their HEX

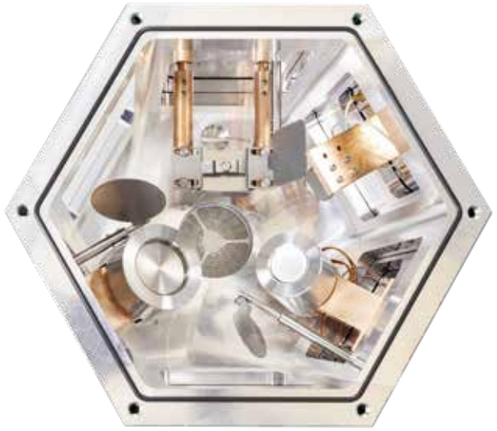
ADAPTABLE CHAMBER DESIGN

In contrast to conventional PVD systems which attach instruments using welds, the HEX system utilises viton gasket o-ring seals almost exclusively. This allows for its ground-breaking open-frame architecture, in which all panels can be removed, interchanged and reattached quickly and efficiently, minimising downtime during system reconfiguration and maintenance procedures. This concept is the bedrock upon which the flexibility of the HEX is built.



COMPACT CONVENIENT DESIGN

The HEX system is benchtop or can be positioned on a portable electronics rack, saving valuable lab space, whereas the HEX-L sits on a movable frame. This means that both instruments can be quickly and easily moved around a lab, or between different labs- allowing for flexibility not just in the instrument itself, but in where and by whom it can be used.



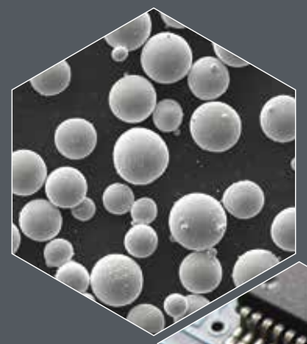
HEX on Electronics Rack

SPECIFICATION

	HEX	HEX-L
Maximum Sample Size	4" (100mm) diameter	6" (150mm) diameter
Standard Turbo Pump	HiPace80	HiPace300
Optional Turbo Upgrades	HiPace300	HiPace700
Maximum Deposition Sources	3 (plus QCM)	6
Load Lock Option	No	Yes

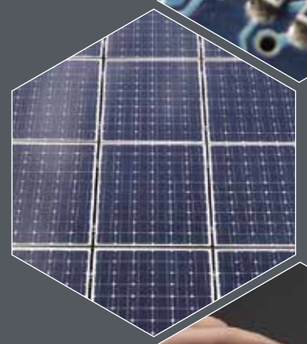
APPLICATION

The unique open-frame design and flexibility of the HEX make it a powerful platform for a range of applications; including solar research, semiconductor applications and teaching.

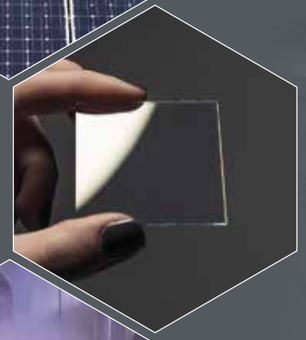


Sample preparation for surface analysis, SEM, TEM, AFM/SPM and electron spectroscopy

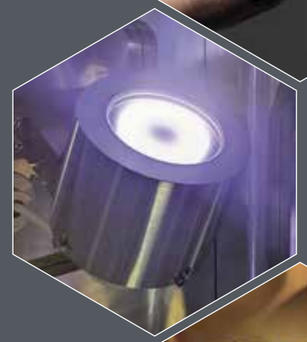
Research and development of new coatings



Solar cells, semiconductor and battery R&D.



ITO coatings



Sputter deposition

Teaching and training

RELIABLE DEPOSITION SOURCES

FISSION MAGNETRON SPUTTERING SOURCE

Designed for 2" diameter targets, the sputter sources are equipped with SmCo magnets and accept targets with thickness ranging from 0.5 to 6mm of non-magnetic materials and up to 1mm for magnetic materials.

The sources can be used with DC, RF, pulsed DC or HIPIMS power supplies.

TAU E-BEAM EVAPORATOR (METALS)

Our high-accuracy (sub-monolayer) mini E-beam evaporators are ideal for ultra-thin film deposition of metals with reliable process control.

The range consists of a single pocket and a four-pocket source.

The control electronics allows up to four sources/pockets to be operated simultaneously.

Material can be evaporated from rods or material held in a crucible.

ORCA ORGANIC MATERIAL DEPOSITION SOURCE

The ORCA organic deposition source operates between 50 and 600°C. Sensitive organic materials can be evaporated with precise control due to water-cooling and temperature feedback loop.

TES THERMAL BOAT SOURCE

The thermal boat source allows for the integration of a range of thermal boats for the deposition of both metals and organics/polymers. A cost effective source.

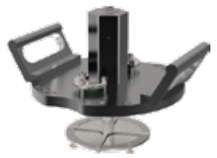
CUSTOMISABLE SAMPLE STAGE

EFFICIENT SAMPLE EXCHANGE

The sample stage is fitted with two ergonomically designed handles for easy transfer to and from the chamber.

ROTATING STAGE

Optional RF or DC bias

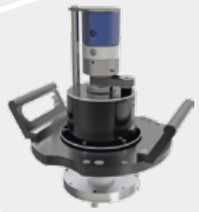


ROTATING HEATING STAGE

Temperature: 100-500°C

ROTATING COOLING STAGE

Water Cooled



TAU

ELECTRON BEAM EVAPORATION SOURCE

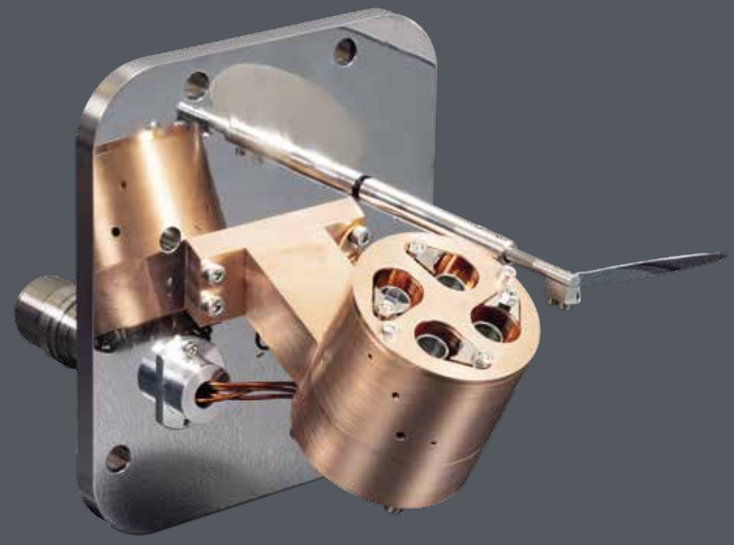
Electron-beam evaporation allows direct heating of target materials and is capable of evaporating challenging materials such as Tungsten.

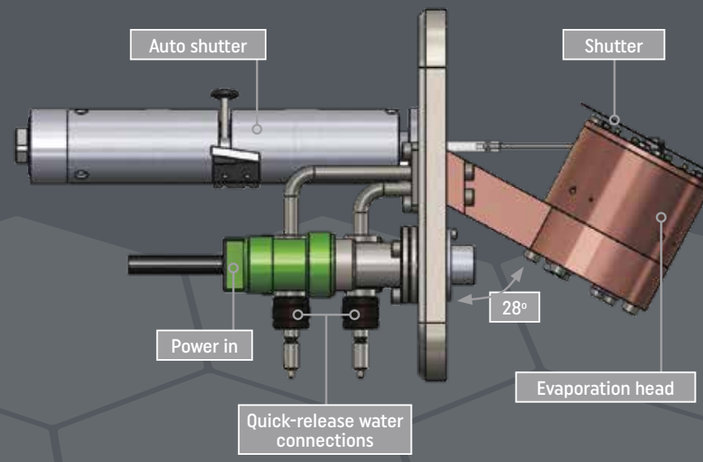
Alternative thermal evaporation techniques employ radiative heating, limiting the evaporation temperature of the target to substantially below the temperature of the heating element. In E-beam evaporation, a high-energy electron beam is directed towards the target material, thereby heating it to evaporation temperature.

The TAU evaporators are 'mini' sources, which operate with the target material at high voltage and the emission filament at low voltage, eliminating the need for beam-bending magnets.

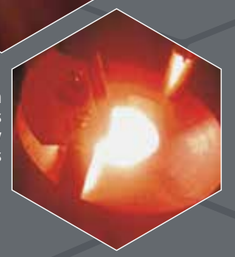
The sources accept either rods of conducting target materials or crucibles which can hold metallics. The TAU is recommended for metals only for film thicknesses from sub-mono-layer to 200nm.

The TAU sources use an enclosed, cooled head, ensuring that the thermal load on the chamber is reduced to a minimum. This makes the sources useful for evaporation onto sensitive substrates, allowing efficient use of expensive materials such as gold when evaporated from a collimating crucible.





Co-evaporation of up to 4 materials



Metallisation
Lift-off process
Refractory materials

	TAU-4
Pockets	4
Maximum Power Per Pocket	250W
Materials	Rods (max 4mm dia), Crucibles
Co-evaporation	Yes
Cooling	Water (min 0.5l/min)

TES

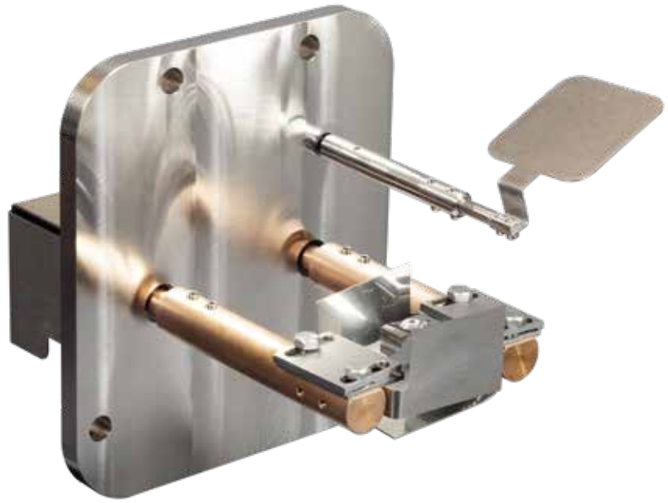
THERMAL EVAPORATION SOURCE

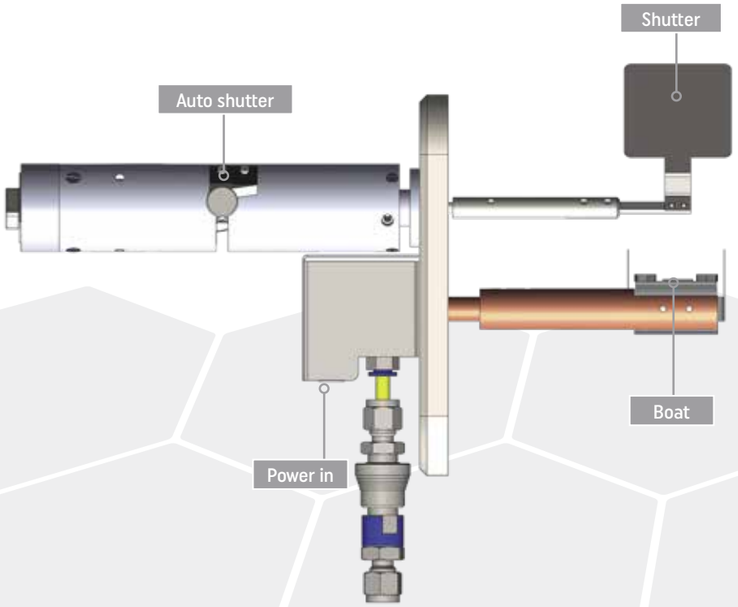
Thermal evaporation sources are used for basic thin film deposition processes. The evaporant material is placed in a conductive boat and is heated by passing a high electrical current through it. As the temperature of the boat rises, the material in the boat begins to evaporate. The temperature, and hence the evaporation rate of the material, is controlled by the amount of current applied.

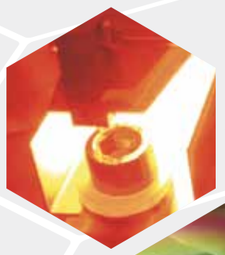
Advantageously, thermal evaporation requires no process gas so the process can be performed under very high vacuum conditions resulting in very few impurities being incorporated into the deposited films.

The evaporant material can be replenished through quick removal of the source or via the top of the chamber through a reloading tube. Material can be in the form of pellets, powder or coated coils/filaments. Boats and filaments can also be easily and efficiently replaced.

Each source can be equipped with a manual or automatic shutter. Up to three sources can be accommodated in the HEX chamber and up to six in the HEX-L. The sources can also be used in conjunction with other techniques such as Sputtering, e-beam deposition and low-temperature sources.







Simple Operation
Water Cooled

Contact metallisation
AR coatings

Boat Volume	1cc to 5cc
Temperature Range	50-2200°C (material dependent)
Power Supply	DC, 1.2kW

FISSION

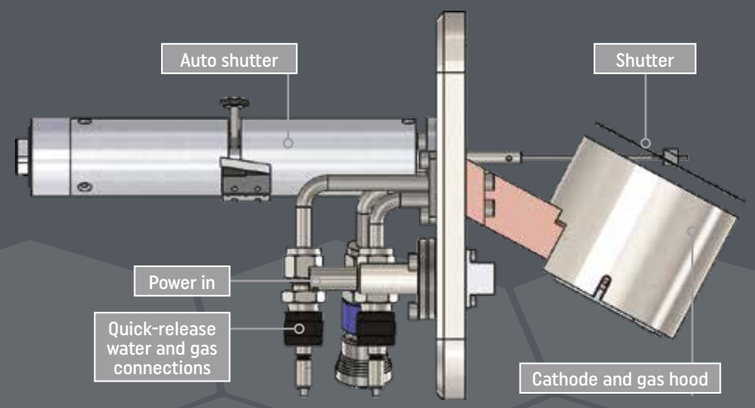
MAGNETRON SPUTTERING SOURCE

Sputter deposition is a widely-used technique for the deposition of thin films. A plasma is ignited above a negatively biased 'target' which has the effect that ions are drawn from the plasma and accelerated towards the target material. On impact, the argon ions eject atoms/molecules from the surface - a process known as sputtering. The sputtered material forms a vapour, which re-condenses on a substrate to form a thin film.

The Fission magnetron sputtering source enables rapid, contaminant-free deposition of metal or dielectric films. Water-cooling and gas connections are made using quick-release connectors to dismount the source, and eliminating the hazard and inconvenience of draining coolant-water each time the source is removed from the chamber.

The Fission source can be operated in DC mode and RF mode. Gas introduction is through the gas hood, allowing a higher partial pressure to be achieved near the target surface and thereby reducing the overall chamber pressure required during deposition.

The Fission source can be used to sputter all (solid) metals, insulators and semiconductors. Multiple sources may be used in one system in order to grow multilayer or composite material films.



RF/DC Sputtering
High target useage

Metallisation
Dielectric films
Multilayers

Target Diameter	50mm (2")
Maximum Target Thickness	6mm (1mm magnetics with strong magnets)
DC Power Supply	780W (600V, 1.3A)
RF Power Supply	300W (13.56MHz)
Gas Feed	Integral through gas hood
Cooling	Water (min 0.5l/min)

ORCA

ORGANIC EVAPORATION SOURCE

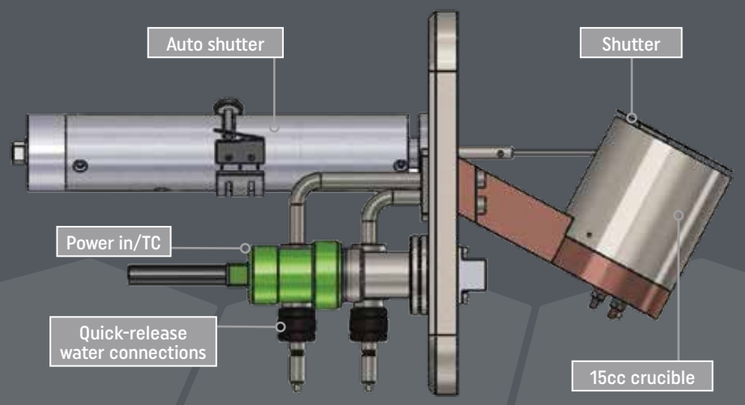
The evaporation of materials at low temperature (50-600°C) requires specialised sources which are designed to operate in this range. Conventional evaporation sources are built to operate most efficiently at temperatures >1000°C which requires that conductive thermal losses are kept to a minimum. At lower temperature, radiative losses are significantly reduced and control loops in conventional cells suffer from overshoot and slow temperature change.

The ORCA low-temperature evaporation source employs active cooling of the crucible to ensure that the heating process is balanced by a strong opposing cooling process which results in exceptional temperature stability and control.

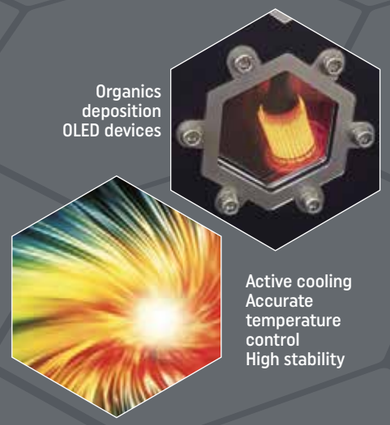
The crucible is constructed from high thermal-conductivity material, ensuring no hot-spots arise which could distort the evaporation rate. Optionally, alumina or graphite liners may be employed.
The crucible is easily removed/swapped without the need for tools, although this is often not necessary since access to the source in order to refill the crucible is efficient and simple.

The K-type thermocouple is inserted into the body of the crucible, giving more accurate readings in comparison to typical touch-contact arrangements.

The source may be used in conjunction with e-beam, thermal or sputtering sources. Thermal cross-talk is kept to a minimum through the cooled shielding cap.



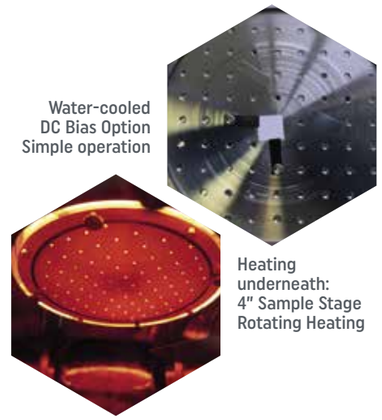
Crucible Volume	15cc
Temperature Range	50-600° C
Thermocouple	type K
Power supply	DC
Cooling	Water (min 0.5l/min)



Organics deposition OLED devices

Active cooling
Accurate temperature control
High stability

SAMPLE STAGE



Water-cooled
DC Bias Option
Simple operation

Heating underneath:
4" Sample Stage
Rotating Heating

Selecting the correct sample stage for a specific application is as important as choosing the correct deposition method. The features of the sample stage can affect the uniformity, the morphology and the resulting film composition.

The HEX base system comes with a static sample stage as standard which can accommodate samples up to 4" diameter. All sample stages can be equipped with either a manual or a motor-driven automatic shutter. The system features a convenient set of mounting posts to secure the stage when replacing samples without needing to clear additional work space.

Sample Rotation

The stage may be upgraded to magnetically operated sample rotation. The rotation (0, 5- 28rpm as standard) improves the film uniformity and is recommended for samples with dimensions greater than 15mm and/or where good uniformity is important.

Sample Heating

The rotating stage has options for heating to 500°C which will result in improved film morphology for some materials during deposition or for post-annealing.

Sample Cooling

A rotating water-cooled sample stage can be employed to reduce unwanted uncontrolled temperature-rise in sensitive samples such as during the coating stage in lift-off processes.

Bias Table

Optional sample table bias can be used for soft substrate pre-cleaning (RF) or to change the properties of your film.

Options

- 5-28rpm
- DC or RF
- Manual or Automatic sample Shutter

Rotating/Heating Table

The rotating (and optional heating) sample stage dramatically improves deposition uniformity and is recommended for samples >15mm

- 5-28rpm rotation
- K-type thermocouple

Options

- 500°C heating option
- Manual or Automatic Sample Shutter

Cooled Table

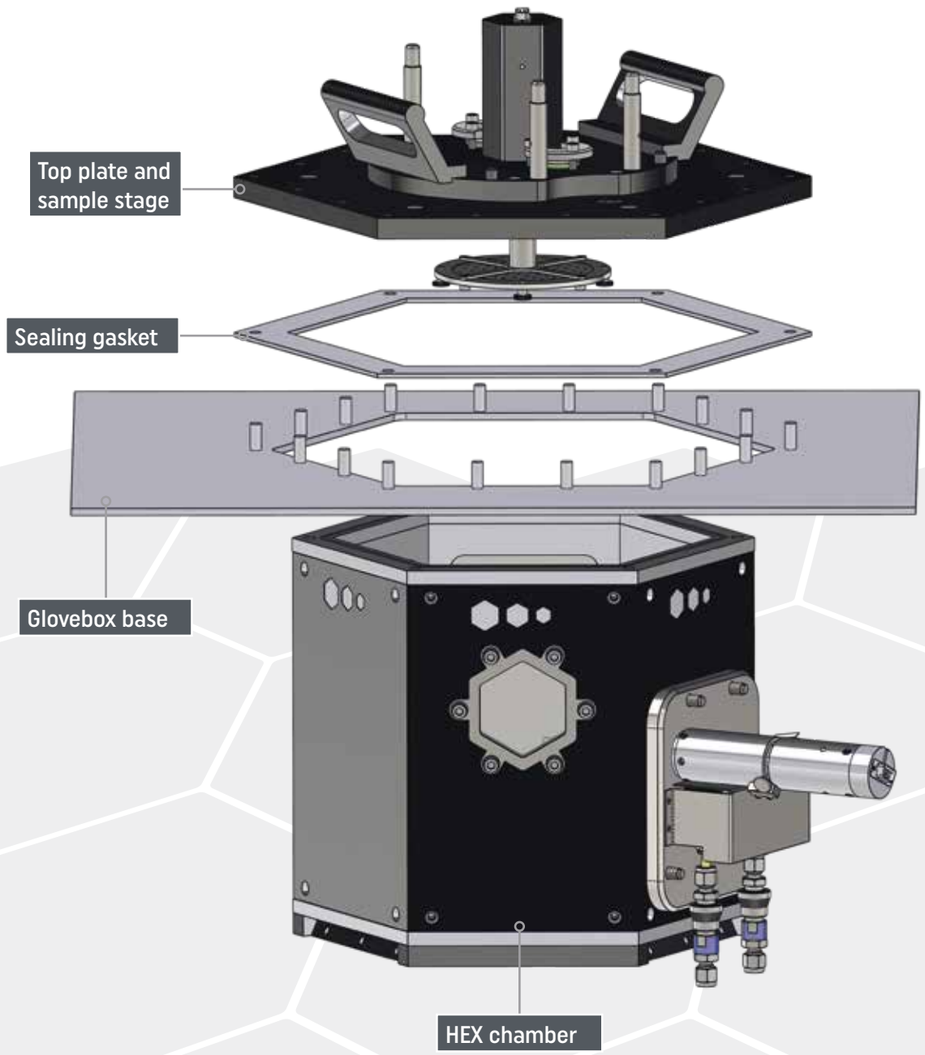
The water-cooled stage allows temperature-sensitive samples to be coated without danger of thermally-induced damage.

Options

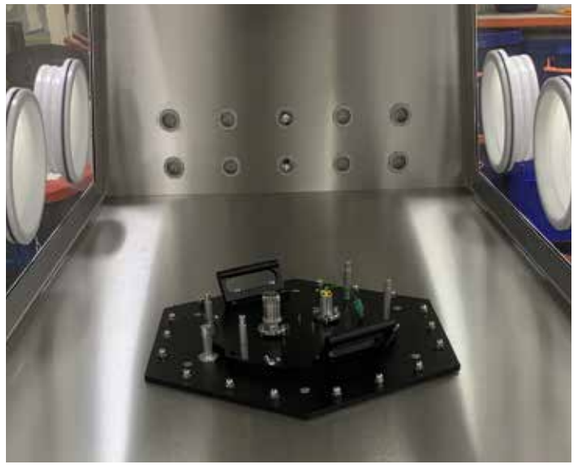
- 5-28rpm rotation
- Manual or Automatic Sample Shutter

GLOVEBOX INTEGRATION

The HEX series is ideally suited to air sensitive research applications that require a glovebox, such as battery R&D. The integration design offers two key advantages. Firstly, the system occupies minimal space in the glovebox itself, allowing use for other purposes. Secondly, as the chamber sits below the glovebox, the system is easily accessible for cleaning and modification.

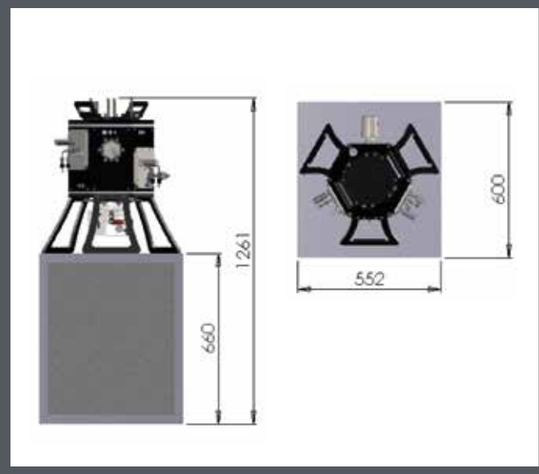


Both the HEX and HEX-L are glovebox compatible, and integration can take place at any time as research requirements develop. Both models occupy almost zero space within the glovebox itself-providing researchers an elegant solution to the problem of evaporating organic and air-sensitive materials.

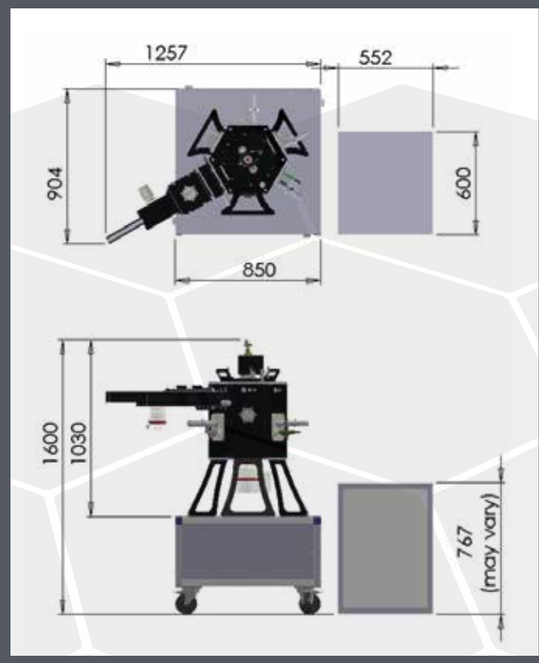


UTILITY REQUIREMENTS

Power: 110V/220V single phase, 16A socket
Water: 0.5l/min, 50psi
6mm OD tube inlet to system
Gas: Ar (sputtering), N_2 (venting, optional)
6mm OD tube inlet to MFC



HEX on electronics rack



HEX-L on frame with electronics rack
(Shown with optional load-lock mounted)

NIOBIUM AUTOMATION SOFTWARE

OVERVIEW

The Niobium Automation software package allows the user full PC control over the HEX deposition system and components. The full data-set is automatically logged, charting of multiple parameters is possible and sophisticated process programming is enabled via step based procedures including looping and conditional options.

Icon representation of connected electronics units

Detailed control of instruments in discrete parameter windows

Customisable quick-view instrument status in system panels

Charting of multiple parameters simultaneously

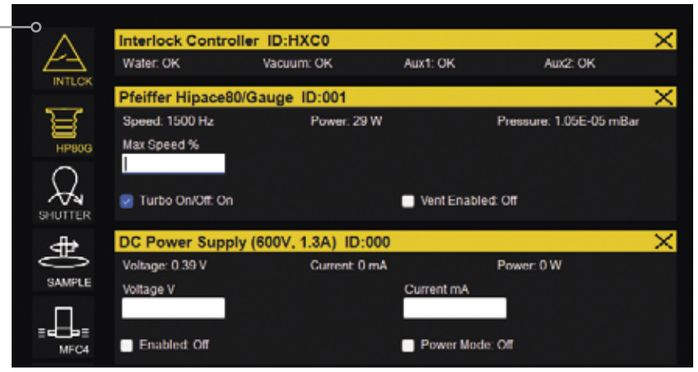
System overview

Program status panel

Modular software design allows easy addition of control units when upgrading the system. Our proprietary software facilitates the addition of Korvus-manufactured, as well as third-party components to your HEX or HEX-L.

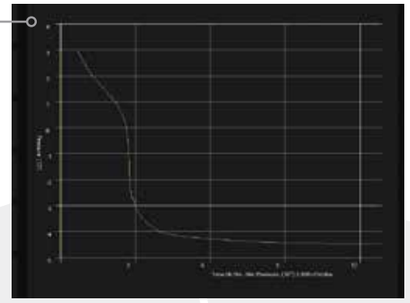
Instrument Control

- Connected electronics units are represented by icons, which are clicked to show or hide the detailed parameter set for the unit
- All parameters can be renamed by the user



Charting/Logging

- Multiple parameters can be charted simultaneously.
- Autoscaling and zoom functions
- Automatic logging of all system parameters into a CSV file

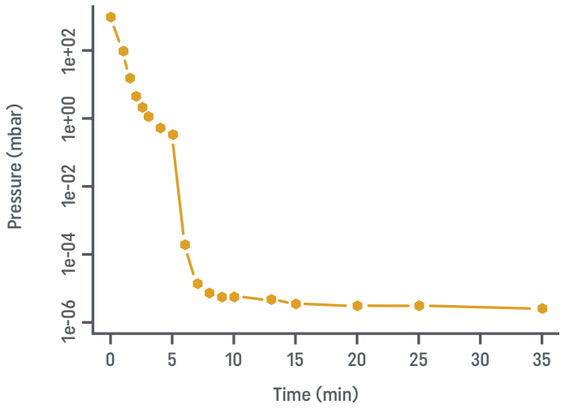


Programming

- Programming of deposition processes via time-based event procedures
- Programs can be stored and incorporated into new programs
- Looping allows repetition of processes
- Conditional programming allows steps to complete only if certain conditions are met. For example, a source shutter can be closed when the measured film thickness on a QCM is above a certain value

RAPID PUMP DOWN

HEX pump down curve with HiPace300 turbo pump



The HEX system is shipped as standard with an HiPace80 turbo pump (optional HiPace300 upgrade) while the HEX-L standard is a HiPace300 turbo (optional HiPace700 upgrade). Both are backed by oil-free pumps and pressure is measured by a full-range gauge.

The low chamber volume allows rapid pumpdown, with operational pressure (10^{-5}mbar) for typical applications being reached in less than 10 minutes.

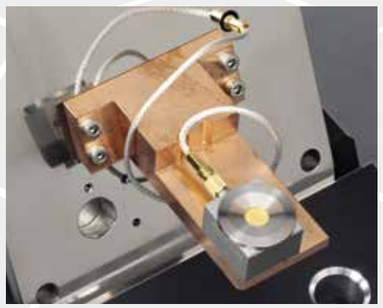
The system base pressure with standard pumps is 2 x 10^{-6} mbar, although with routine system maintenance, lower pressures are commonly reached.

Times to get down to mid/low 10^{-6}mbar.	
HEX 80	30-40 mins, venting in <10 mins
HEX 300	20-30 mins, venting <10 mins
HEX-L 300	30-40 mins, venting 20 mins
HEX-L 700	20-30 mins, venting 20 mins

ACCESSORIES

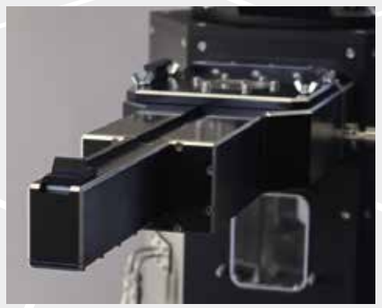
THIN FILM THICKNESS MONITOR

Film deposition rate and thickness can be determined with the use of a quartz-crystal monitor (QCM) which uses the change in resonant oscillation frequency of a thin quartz crystal.



LOAD-LOCK SAMPLE TRANSFER

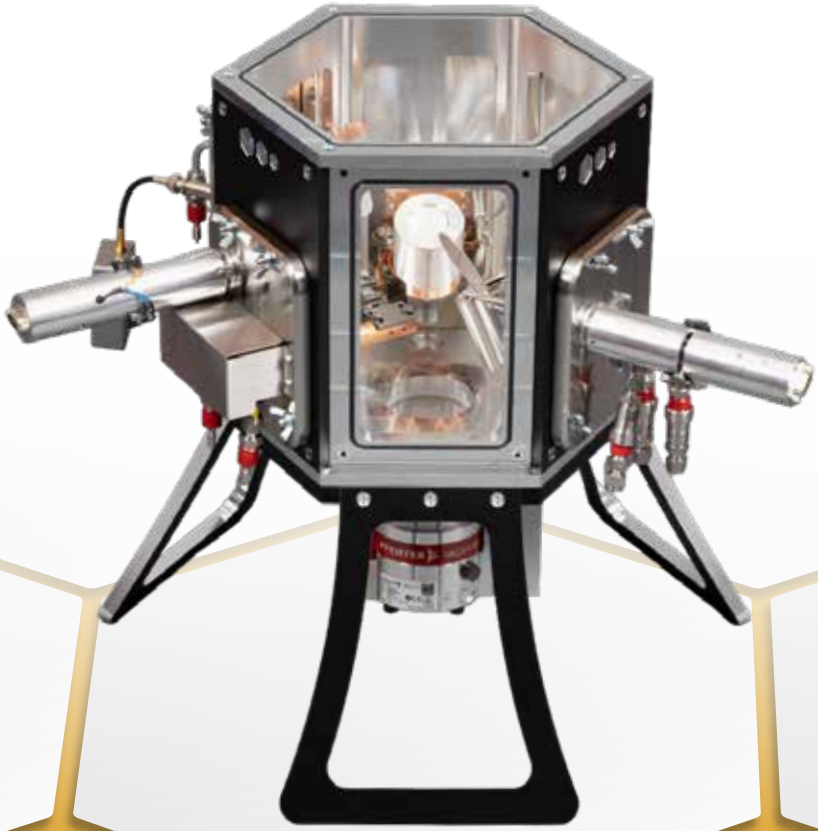
For applications demanding the highest purity, a load-lock sample transfer system may be employed.



THIRD-PARTY OPTIONS

The unique architecture of the HEX system allows users to modify panels to their own design and thereby allowing fitment of custom or third-party instruments.

Korvus Technology has over 20 years' experience in the high and ultra-high vacuum sector. With over 100 HEX series systems installed worldwide, Korvus Technology remains at the forefront of the PVD industry. Korvus is now part of the Judges Scientific group, while remaining an autonomous company. This allows Korvus to remain agile to the research challenges of its customers and continue its customer focused culture.



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