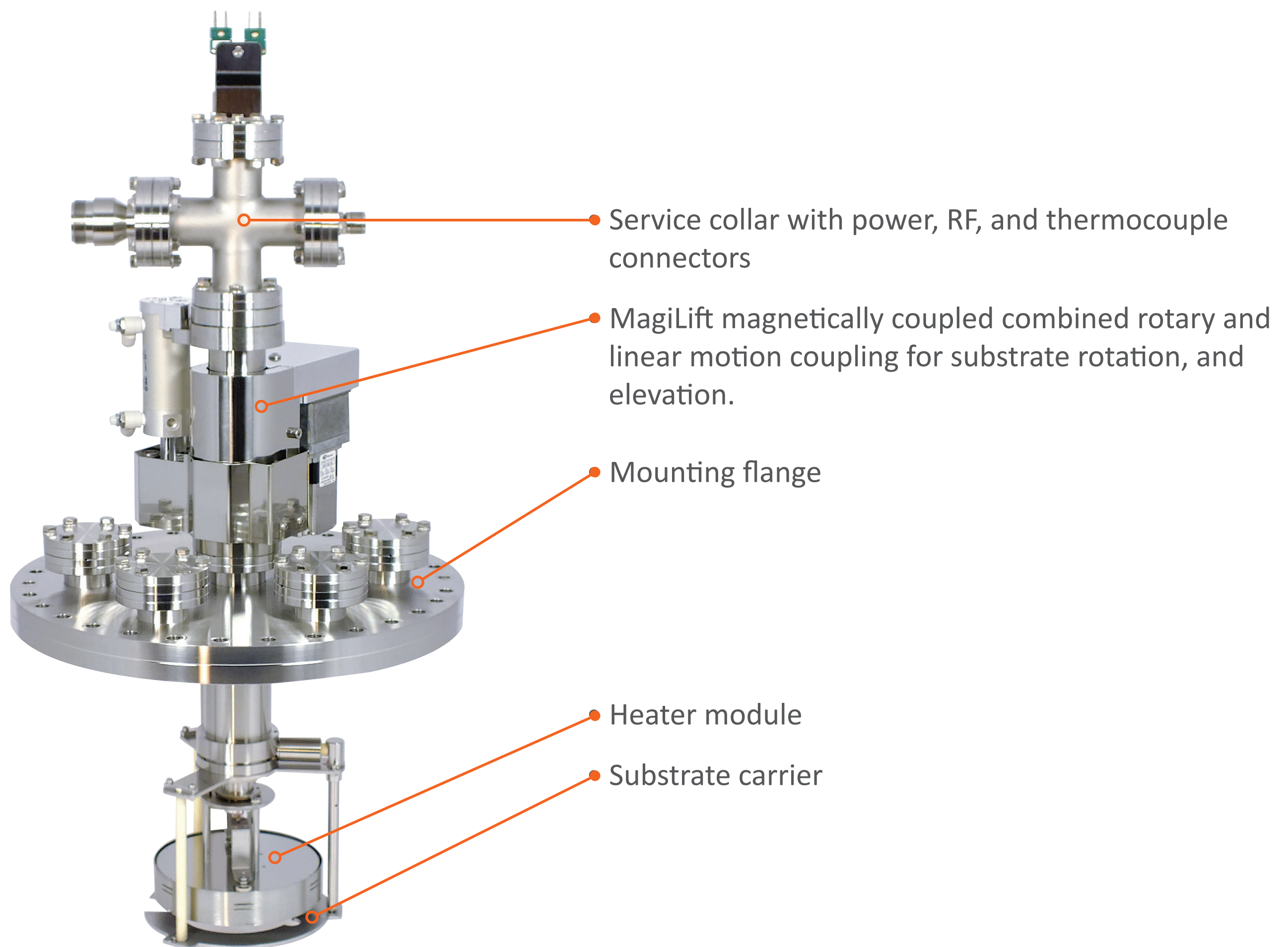
T: 01323 811188
E: sales@uhvdesign.com
www.uhvdesign.com

APPLICATION NOTE

EpiCentre for Cathodic Arc Deposition

The EpiCentre is a product developed over many years for use in the vacuum deposition for the growth of exotic high-tech materials. An example of a standard ECI stage for sputter up configuration is shown below.



Originally conceived for applications in Molecular Beam Epitaxy where high uniformity, high temperature heating and continuous rotation of the substrate, whilst maintaining Ultra High Vacuum conditions are of paramount importance, these products are now finding many more diverse applications in other coating methodologies.

Although not immediately thought of as a UHV technique, sputter deposition has matured, become more refined, and the need for increasing cleanliness and process control has driven materials scientists to use UHV EpiCentres, such as our range of ECI in-line stages and ECR right angled stages as the technology of choice.

T: 01323 811188
E: sales@uhvdesign.com
www.uhvdesign.com

In fact the majority of EpiCentres are now sold for use in such applications where the above mentioned characteristics required for MBE are enabling scientists to push back the frontiers as to what's possible in sputter coating. In order to further perform in this field of application the ECI stages now also have an option for RF biasing of the cradle using a proprietary in vacuo slip ring arrangement. This enables substrate cleaning prior to deposition, by creating an RF plasma, which by virtue of efficient RF coupling creates a substrate auto-bias of ~-450V at power at 100W power for rapid substrate cleaning.

We are regularly required to customise these stages for special applications, which may include for example the provision to load masks below the substrate for patterning applications, and many others.
UHV Design maintains a strong focus on innovation and the ability to respond to the changing needs of our customer's requirements and quite recently we undertook to adapt an ECI stage for a Cathodic Arc Deposition application.

Originally developed in the Soviet Union in the 60's, cathodic arc deposition uses as a source, a low voltage, high current arc rastered over the surface of a cathode, the material of which is that required to be deposited as a coating. The localised temperature at the cathode spot is extremely high (around 15000 °C), which results in a high velocity (10 km/s) jet of vapourised cathode material. The arc has an extremely high power density resulting in a high level of ionization (30-100%), multiple charged ions, neutral particles, clusters and macro-particles (droplets).

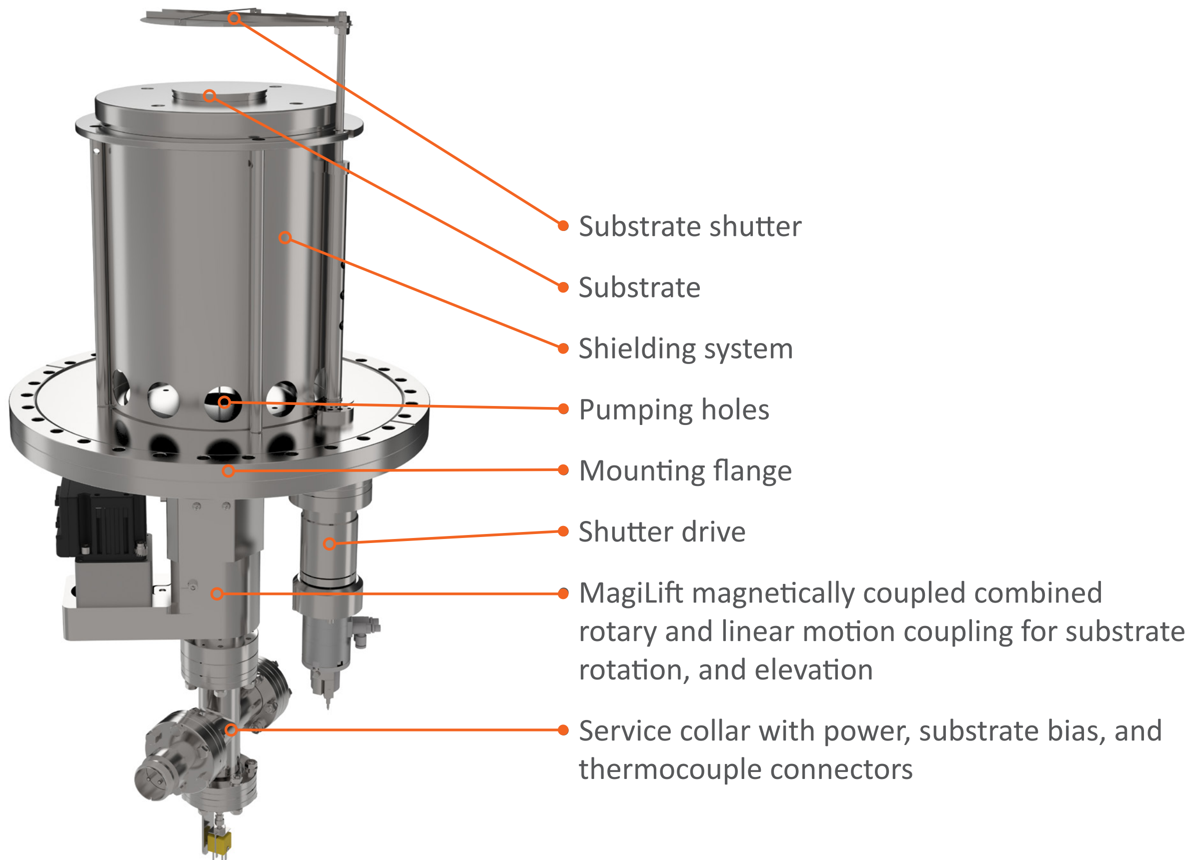
All this means that the technique is well adapted to producing very dense and very hard coatings of high melting point materials. If a reactive gas is introduced during the evaporation process, dissociation, ionization and excitation can occur during interaction with the ion flux and a compound film will be deposited, such as an oxide or nitride for example. Some sources also employ a filter that uses magnetic fields to selectively separate species. Cathodic arc deposition is often used to synthesize extremely hard films of TiN, TiAlN, CrN, ZrN, AlCrTiN and TiAlSiN.

Also carbon ion deposition is possible to create diamond-like carbon films. The DLC film from filtered arcs contain an extremely high percentage of sp3 C / diamond which is known as tetrahedral amorphous carbon, or ta-C.

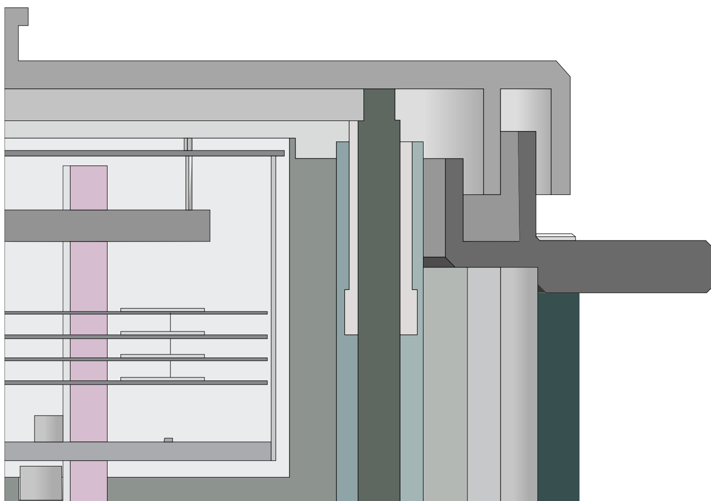
In the context of our Epicentre stage design this application posed some particular design problems in terms of shielding to prevent the stage from getting 'clogged up' with the very high deposition fluxes that are possible with the Cathodic Arc technique and also to enable the stage substrate cradle biasing system to be able to carry the quite high currents that the source is capable of generating.

T: 01323 811188
E: sales@uhvdesign.com
www.uhvdesign.com

Below is a view of the final stage showing the fully screened design. Although optically opaque to the line of sight flux, the shielding must still allow for good vacuum conductances to allow the stage to be efficiently pumped. The Cathodic Arc ECI stage for coating down configuration is shown below.



Shown below is a cross-section of the labyrinth ‘seal’ between the top substrate cradle and the cylindrical shields, providing good optical baffling, vacuum conductance and freedom to rotate.



The demanding substrate current handling was overcome using 3 of our standard in-vacuo electrical brushes, as used in our RF biasing system on a more standard instrument. This has been done many times before in fact, in systems requiring a 300W RF biasing capability. As such it was easily able to handle the 8A sample current requirement from the cathodic arc source.

FOR MORE INFORMATION

Please contact us via sales@uhvdesign.com or telephone +44(0)1323 811188 to discuss this application in more detail.

For more information on our complete range of UHV manipulation products please visit our website: www.uhvdesign.com which includes our unique product configuration tool that enables all of our products to be viewed, configured and emailed directly as a 3D CAD file.

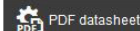
+ Click here to learn how to use the product configuration tool

Email Address

Accept licence agreement

Available products: 1

TTX40-100-25-H



Parameter	Value	Unit
ORDERNO Order number	TTX40-100-25-H	
INFO Info	-	
TFS Travelling flange size	CF40	
FFS Fixed flange size	CF100	
AO Actuation options	Manual thimble	
S Axial stroke	25	
POS Position	0	mm
POSX Position	0	mm
POSY Position	0	mm
ROT Rotation	0	°
E Encoder	NO	
W Weight	11.8	kg

3D

This is a pregenerated default preview. It may differ from your current selection.