HHV WORLD

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Editorial

*We would like to start the year 2022 with a tribute. Our Chairman, **S.V.Narasaiah**, passed away on the 8th October 2021 at an age of 97 years after leading the organization for over 55 years.*

We dedicate this issue of HHV World to him and commit to continue his vision to build an organisation on the lines and values that he has instilled in all of us. Mr.S.V.Narasaiah fought many odds in building a technology company from the 1960's in a country that was challenged with poverty, technological isolation and embargoes. His foresight and commitment to establish a vacuum technology based company in India will always be remembered as his contribution for establishing a critical capability for future generations.

Post Covid, business seems to be back to normal and a significant investments are taking place across the country and overseas in capital equipment and enhancement of manufacturing capabilities. Our equipment division both in thermal and thin films process are experiencing a large overload of orders. We are enhancing capabilities and capacities in place to ensure that more deliveries happen at the committed time.

In the last quarter we developed and launched new products which are highlighted in this issue and also entered into new areas of work through exciting relationships with domestic and international partners on the industry and scientific front.

A new large automotive metallisation system has been developed and supplied in addition to a new and improved capability for precision welding. New designs of arc welding furnaces for various applications have been supplied from HHV.

We have been involved in developing many R&D relationships with leading manufacturers' and scientific bodies. Long term collaborative arrangements have been drawn up with a new HHV ASM partnership to meet the requirement of the Semiconductor sector.

In the thin films area new products have been developed in defence and space sectors and HHV has developed new capability to manufacture Si-Crome resistors for various applications in defence, electronics, improved its ITO capacity and enhanced its ability to do large area coaters. We have developed a wide range of triple band coaters on infrared materials.

Our special thin film equipment uses for various coating processes developed collaborations with industrial leaders to build large area telescopes. The world of forensics has undergone a major change in the detection of fingerprints using techniques of vacuum metal deposition. HHV has been a leader in this field and released a fresh set of models covering the full range of equipment required for getting high quality solutions for the process of crime detection.

HHV Crystals is our newest member is meeting the requirement of the watch crystal market by producing the best in class product for the watch industry.

HHV continues to attend and host multiple exhibitions both virtual and in person. We have webinars to enhance our technological presence in building state of art capacity in vacuum and thin film technology. We will be participating in the DEF EXPO show shortly and have been awarded the Innovation Award for the Open Challenge 3 from IDEX.

Our international reach through our wide network of distributors anchored through HHV Ltd based in UK continue to provide global support and superior services to all our customers gloablly. We have moved location to meet with the growing business and needs.

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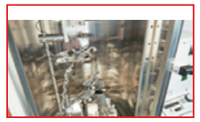
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Twin Door Metallizing System for Automobile Industry

HHV has developed a large size high production rate vacuum metallizing system for coating head lamp and rear lamp reflectors for automobiles.

HHV's twin door metallizing system has a large chamber of size 1800 mm diameter, 2000 mm height with a chamber volume (with door closed) of 5100 m3.

It has been designed for a cycle time of 10 minutes. Its configurations allow coating parts made of;

1. Thermoplastics (PC, ABS, ABS+PC, PC-HT, PA, PBT)
2. Thermosets (UP-BMC)

It is sophisticated but easy to use system and accomplishes effective deposition on substrates with complicated shapes, sizes and with surface areas of 50 x 50 mm and depths from 2 to 200mm.

The system has an inbuilt process cycle which can be selected in any order as required:

1. Plasma pre-treatment of substrates using Argon gas as the process gas
2. Plasma CVD pre-treatment of substrates using HMDSO
3. Thermal Evaporation of Aluminium
4. Plasma CVD protective coating of substrates using HMDSO

The twin door mechanism helps to reduce process cycle times and increase output. It has two independent gas inlet systems, one for Air/Nitrogen/ Oxygen/Argon to carryout glow discharge cleaning processes and the second for the monomer to carry out plasma polymerization process for pre-coat and post-coat of the reflectors.

A combination of rotary, roots pumps and a high vacuum pump enables a working vacuum of 1 x 10-5 mbar in the chamber, thereby reducing process cycle time. The deposition source consists of tungsten filaments located on each door and connected to a bus bar. Two work holders are located in each door and rotate during the metallization processes.

Each work holder has been designed to have a carrying capacity of 75 Kg. A glow discharge cleaning system has been provided for plasma pre-treatment of substrates. A thyristor controller monitors and controls the power on the filaments so as to avoid sudden changes in power that could cause deposition defects.

Computer based control instrumentations enable complete automation of vacuum and evaporation cycle by using PLC and SCADA software which also acquires various data for each process cycle that can be stored and recalled. Necessary safety, alarms and controlled systems have been provided to ensure safety and ease of operations.

Gloved Vacuum Welding Chamber for High Precision Welding

Welding in controlled atmospheres or vacuum give deep and narrow welds with superior quality. The controlled atmosphere increases penetration, changes the profile of cross section and produces less porosity. In general, Electron Beam Welding, Arc Welding, Laser Welding and TIG Welding can be done in controlled atmospheres.

Recently, HHV had the opportunity to export two gloved vacuum welding chambers. HHV has designed and developed the systems to carry out the welding processes under inert gas conditions.

Horizontal Gloved Vacuum Welding

HHV's second vacuum welding chamber is a horizontal, cylindrical vacuum chamber of 1300 mm (diameter) and 1500 mm (length). It is used to carryout welding process in an inert gas (argon) environment.

The front flat door is located on a dolly structure with wheels that can move back and forth on the rail manually. The lighting arrangement enables sufficient illumination without any shadow formation. Two view ports are provided for gas sensors - Nitrogen and Hydrogen.

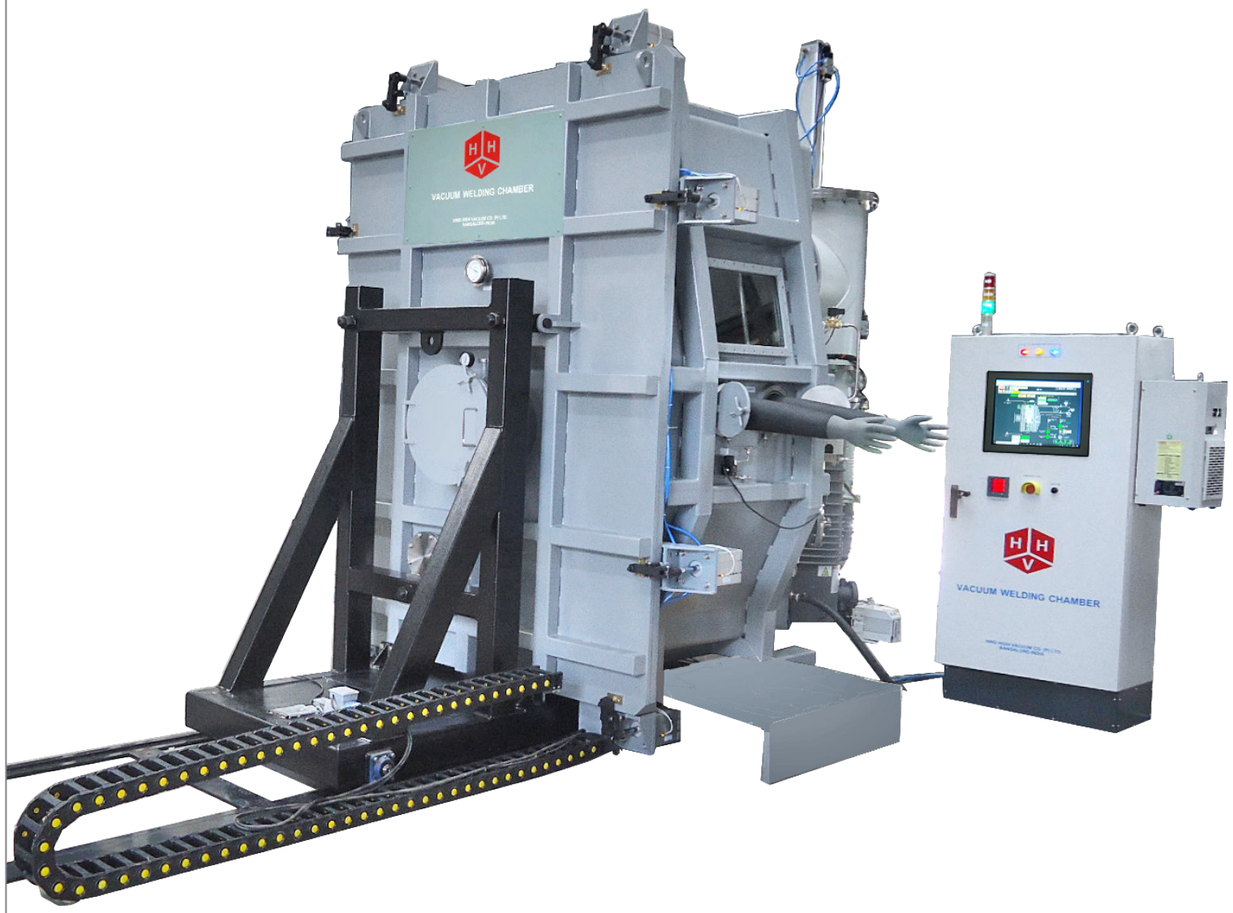
A roots pump vacuum pumping system enables the system to achieve an ultimate vacuum of 1.3 x 10-3 mbar from a clean, cold, empty, degassed condition in 20 minutes. The entire vacuum welding process can be automated with control instrumentations, programmable logic controller and SCADA.

Vertical Gloved Vacuum Welding

The automated gloved cubical vacuum welding chamber is 1600 mm in width x 1700 mm length and height of 2300 mm. It can be used to carryout welding processes in an inert gas (argon) environment. A high vacuum pumping system enables the system to achieve an ultimate vacuum of 6 x 10-5 mbar in clean, cold, empty, degassed condition within 30 minutes.

There are two gloved ports of 150 mm diameter on either side of the chamber and the gloves are tested to withstand a pressure difference of 1 bar. Two view ports are suitably positioned ergonomically to enable the welder operate by observing through the viewports. These view ports are slanted at an angle to avoid any parallax error in viewing. Lights are provided to illuminate the inside of the chamber

A tool port of 400 mm diameter x 450 mm length enables loading and unloading components without breaking vacuum. The entire vacuum welding process can be automated with control instrumentations, programmable logic controller and SCADA.



Argon ARC Melting Furnace with Suction and Casting Facility

HHV has been at the forefront in developing Argon Arc melting vacuum furnaces to make special materials of high purity under an inert atmosphere or vacuum environment. HHV's Argon arc melting furnaces with casting facility are used for melting of metals and casting them into rods of different sizes under high vacuum and inert atmospheres.

Ease of operation, dependability, versatility and affordability are the special features of this Argon arc melting furnace, while offering instant high temperature and quick as well as extremely pure melts. Because of its small volume the furnace is easily purged and a high degree of purity can be maintained for each melt.

The furnace has a chamber of size 400 mm width, 400 mm depth and with 400 mm height and is provided with a circular view port for clear visual observation inside the chamber.

The water cooled hearth (cathode) with an interchangeable top surface is fabricated out of electrolytic grade copper and holds the sample to be melted.

A DC power supply is provided to melt 10 grams to 200 grams of material with melting points of up to 3500° C. High vacuum of 1 x 10-6 mbar can be maintained within the furnace chamber.

The molten materials are cast in a copper mould by suction, through a vacuum pump. A provision is made for attachments to the vacuum pump for evacuation prior to back filling with inert gas. Various sizes of copper moulds are used to cast rods of different diameters and lengths.

Vacuum Ovens for Long Period Life Cycle Testing

HHV has been offering vacuum ovens with cylindrical and cubical geometry for laboratory and industrial applications for over five decades. These ovens are used for vacuum baking, degassing, heating, drying and annealing of components in a controlled atmosphere in the field of Electrical and Electronics, Chemical, Pharmaceuticals and Aerospace.

The chambers are fabricated out of stainless steel (SS 304 grade), with front door openings. These ovens have removable type loading trays to accommodate components and have external or internal tubular heaters and insulation to attain uniform temperature inside the chamber. A thermocouple monitors the temperature measurement.

A high speed vacuum pumping system, integrated with necessary piping and valves rated for high gas throughput handling produces clean and high vacuum in the chamber. The electrical controls and instruments are housed inside the cabinet at a convenient place for smooth operation of the system.

Safety devices and features

- Motor protection circuit breaker
- Pressure switch
- Water flow switch
- Alerts user both visually and audibly to any malfunction of the temperature sensor

Optional features

- Inert gas filling system
- Programmable Logic Controller (PLC)
- Human Machine Interface (HMI)
- Chiller unit

The cubical vacuum chamber has been designed with dimensions of 760 mm (W) x 945 mm (H) x 1160 mm (D) and a wall thickness of 8 mm. A pumping system enables an ultimate vacuum of 5 x 10^{-2} mbar

The door has a rectangular port with a toughened glass view port to have a clear view of the process inside. A light port is provided to illuminate the chamber inside. The chamber is provided with ports for evacuation, gas inlet, oil inlet, thermocouple feedthrough, power feedthrough, vacuum gauge, etc. A tray has been provided to keep 6 x-ray generators with size 400 mm (D) x 180 mm (W) x 390 mm (Ht.).

The horizontally mounted cylindrical oil storage chamber, dimensions 400 mm diameter and 1000 mm depth, is provided to store about 80 liters of oil. The system is also equipped with ports for evacuation, gas inlet, heater feedthrough, thermocouple feedthrough, level sensor, vacuum gauge, etc.

The oil in the storage tank is heated internally through a tubular air heater which is inserted into a hollow tube inside the chamber to raise the temperature of the oil to about 70° C for degassing. Temperature measurement and control is by means of a digital PID controller.

A programmable logic controller with HMI is provided for automation of the vacuum cycle, purge cycle, temperature cycle and to achieve various necessary interlocks.

Index matched ITO coating (IMITO)

The reflectance of light on interfaces or surfaces of an ITO layer can be reduced considerably by integrating it into an anti-reflective multilayer called an Index Matched ITO (IMITO).

In a bright environment, the reflection and scattering of light of the display will reduce the contrast of the image. If these reflections can be effectively controlled, the contrast can naturally be increased. In order to reduce the impact of ambient light AR film can be used to reduce reflectivity. Therefore, combining the above factors, and in order to increase the light transmittance of the conductive layer, HHV has made a film with the function of reducing the reflectivity on an ITO transparent conductive film that has been coated on glass, which is transparent to the transparent conductive medium and the glass substrate. It is also designed to match the refractive index of the material connected with IMITO to reduce the remaining reflectivity.

Benefits

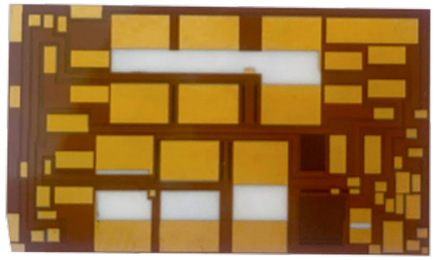
- Low specific electrical resistance
- High surface quality
- High environmental and temperature stability

Applications

- Electrical layer in LCD technology
- Counter Electrode on Lid Glass for LCOS micro-displays

SiCr Thin Film Resistors

HHV introduces the new SiCr based thin film resistor (TFR) with a nearly zero temperature coefficient of resistance (TCR). The lower the TCR, the better a resistor can maintain its precise value despite of ambient temperature variations and self-heating when power is applied.



HHV has proven precision thin film resistors will meet the exact requirements which is ideal for specific applications which requires low noise, high stability and an ultra-low temperature coefficient of resistance.

These thin film resistors are manufactured by depositing a resistor layer and conductive layer in a vacuum process. This will form a thin uniform resistor and conductor layers with a thickness of few microns on ceramic substrates. After this process the thin layers are subjected to multiple step by step photolithography procedures. This gives précise values for the resistance with very low tolerance limits.

Applications:

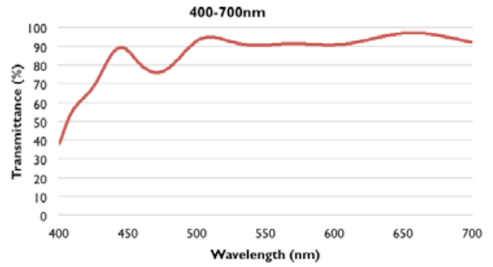
In Monolithic Microwave Integrated Circuits (MMIC) Technologies, TFRs are used in circuits such as Analog and Mixed Signal Circuits, Operational Amplifiers, Bias Circuits, Feedback Circuits, Analog to Digital Converters (ADCs). Etc.

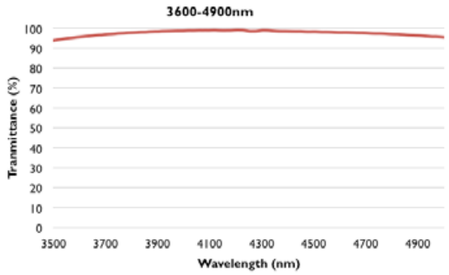
Features:

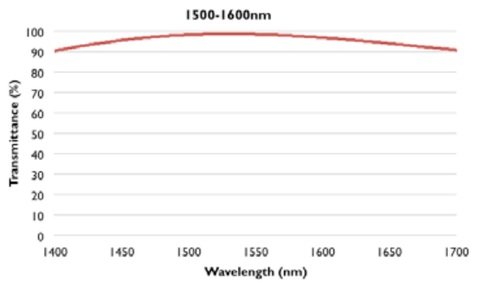
- Standard near zero TCR value. (±0.02 ppm / °C)
- Resistor tolerances: ≤ 5% to ≤ 10%
- Tested as per MIL – C – 675C standard for temperature and humidity
- Stable film and performance characteristics (-35 to +125 °C)
- Wattage range: 10 to 250 mW

Triple band AR coating on Multi spectral ZnS

With the rapid development of modern aerospace technology, infrared optical instruments are used more and more widely, such as infrared laser, infrared thermal imagers. The harsh environment of the use of infrared optical instruments requires excellent optical properties and good resistance capacity of the environment in order to keep the system perform stable.







Wavelength (micron)	Achieved result
450-700nm	90.8%
1500-1600nm	98.14%
3.6-4.9 microns	98.0%

The development of modern optical instruments requires that a window contains multiple bands so that it can save space occupied by the volume of the instrument and facilitate system installation.

Multispectral ZnS has good spectral transmittance property from 0.4 μm to 11 μm and a strong anti-laser damage capability from visible to infrared spectrums. It has excellent performance has been widely applied in the infrared and laser systems.

Considering these mechanical and chemical properties and the combination of substrate, ZnS is selected as a high refractive index material. The low refractive index material needs to be matched with ZnS, which has high firmness, a wide transmission region and low absorption at the visible, SWIR, MWIR regions. At HHV, we have designed and fabricated triple band high performance AR coatings on ZnS.

IVD 1200 Max: Ion Vapour Deposition System for Aerospace Components

HHV's Ion Vapor Deposition (IVD) system - IVD 1200 Max is built for plating air-craft components with a protective Aluminium layer. The IVD Aluminium is a proven process for aerospace components, and has been in service for over three decades in the industry where substrate materials have typically been High Strength Steels, Aluminium and Titanium alloys.

This technology is an alternate for Cadmium electroplating due to the challenges involved in handling and safe disposal of Cadmium, and enables plating using a nontoxic and environmentally clean process cycle.

In this system, Aluminium is evaporated from resistively heated elements called "boats" placed at regular intervals along the length of the coater. Each boat is made from a special composite material that withstands long term evaporation of Aluminum without developing stress or eroding. A continuous feed of high purity Aluminium wire (typically 99.99 %) is maintained onto the boat till the required coating thickness is evaporated onto the jobs. The Aluminium evaporated from the boat spreads out into the vacuum vessel coating the jobs and the walls of the vacuum vessel in the vicinity of the boat.

HHV IVD 1200 Max

A negative bias is applied to the work holder. This is used to generate plasma that aids in pre-cleaning of jobs prior to coating, and for providing ion assistance during the coating process. In order to generate this plasma, the process itself is carried out in the range of 10-2 mbar pressure. Due to the decreased mean free path of the metal vapour in this pressure range, as compared to traditional evaporation processes, the spacing between the jobs and the boats is much lesser and maintained within ~ 250 mm. The enhanced scattering between the metal vapour and the gas molecules results in spreading of the material all around the jobs resulting in good thickness uniformity and all round coating of most complex of shapes in one coating operation.

The coating chamber is made of SS 304, and is ~ 1200 mm in diameter and 900 mm long. The vacuum system consists of a Rotary Vane, Roots Booster pump, and Diffusion pump along with a liquid nitrogen trap that can be optionally used. It is possible to individually control each of the boat and the corresponding wire feed. For the deposition, jobs can be loaded above the boats on a flat work holder (300 mm width × 600 mm length) or on a barrel work holder (300 mm dia × 600 mm length).

The entire system is automated through PLCs, and can be run in manual mode or in automatic mode from pre-stored recipes. The interface is through a touch screen IPC. Data-logging facility is provided that can be used for audit and process tracking. The system is also provided with necessary interlocks to prevent incorrect operation of the system ensuring both operator and machine safety.

Semiconductor Fab Coaters

HHV has built and commissioned a series of production coaters for class 1000 and class 100 clean room fabs recently.

Due to the criticality associated with maintaining a low particle count in the operating environment where these coaters will be located, special considerations have been taken with regards to the material selection, and the overall design of the system. In order to maintain the cleanliness throughout the overall build cycle of the machine, HHV has commissioned a clean room space within its premises dedicated for assembling and testing of clean room equipments.

This class 10000 clean room space has an area of 650 sq.ft, and is fitted with the HEPA filtering and air-conditioning systems of the required ratings to maintain the specified work conditions in the lab.

Once the equipment assemblies were completed, the personnel from the thin film equipment division (TFED) and the thin film and optics division (TFOD) got together to establish the performance of the machines. The deposition conditions for each of the materials required by the customer was established for achieving the optimum properties in terms of thickness, composition, refractive index, low absorption, etc. Following this, the uniformity of the layers deposited was characterized and appropriate mask development, and fine tuning of source-substrate relative position, was carried out to keep the non-uniformity of deposition on the substrate with the requirement limits. Subsequent to this, the design and execution of the multi-layer stack to meet the performance requirement of the customer was carried out. A bulk of the testings was carried out using in-house characterization facilities, and wherever required, central facilities available at nearby institutions were leveraged.

Extensive repeatability trials with the optimized process parameters were carried out in order to assess and establish the performance of the machine. All the factory as specified by the customer were met:

- Reflectivity of 96 % on witness sample for High Reflection (HR) coating
- Reflectivity of 5 % on witness sample for Anti Reflection (AR) coating
- Stable operation to deposit 12 alternate layers of total thickness about 15000 Å
- Film uniformity better than ± 2 % on a 3.6 “ x 3.6 “ square substrate area
- 660 nm of YF3, 8 µm of In, 200 nm of ZnS, and 100 nm of CdTe to be deposited.
- Non-uniformity of < ±3 % to be achieved for YF3, In, CdTe, and ZnS.
- Substrate temperature should not exceed 40 deg C during deposition.

These machines were then moved and commissioned at customer locations. Extensive process support was provided by qualified HHV personnel at site in order for the customers to qualify the coatings with respect to their pre-defined test procedures. These machines have then gone into production, and are performing to customer expectations at site.

Cost Effective Glove Box Integrated Coaters

Glove Boxes are concealed work spaces inside which a controlled atmosphere is created for handling and processing of specimens

Appropriate purging and filtration mechanisms are used to keep the moisture and Oxygen content to a minimum, and a slight positive pressure of inert gas is maintained in these spaces. Glove Boxes are extensively used for handling air and moisture sensitive materials, and also for hazardous substances and biological samples.

Vacuum coating units are similar to the glove boxes in the sense that a controlled atmosphere is created inside the chamber. This is done by pumping out the air in the chamber to create a negative pressure (relative to atmospheric pressure). Vacuum coating units are extensively used for carrying out physical vapour depositions and chemical vapour depositions of various types of thin films and nanostructures.

Integrating the glove box with vacuum coaters gives the advantage of being able to carry out the complete fabrication sequence from raw materials to finished devices in a controlled environment. Glove box integrated coaters finds applications in various areas such as Solar Cells, Organic LEDs, Batteries, etc.

HHV has tied up with a glove box manufacturing company from Bangalore to offer cost effective glove box integrated coaters (GBICs).

The glove boxes are constructed with SS304 or SS316. These have a modular design, and are offered with 2, 3, 4 gloves or other customized numbers. The front panels are made of chemical resistance and scratch proof polycarbonate, and can be laminated for further safety with Glass. Both main antechamber and mini antechambers options are available. The glove boxes come with a H14 class HEPA filter, industry leading low leak rate of < 0.05 % Vol/hour as per ISO 10648 Class II guidelines, and can attain oxygen and moisture impurity levels of under 1 ppm. They have an ergonomic design with foot switch provided to adjust the box pressure. The antechamber control, purge function and H2O/O2 regeneration are automated with PLC and interfaced through a 7” colour touch panel for user friendly operation. The glove boxes feature a Green Eco mode, automatically reducing power consumption by up to 90% during idle periods.

HHV’s GBICs have options of either a side-opening front door, or vertically-opening front door that allows for access from the glove box, and a hinged rear/side door that allows access for service without compromising the glove box atmosphere. The deposition source options include thermal evaporator, controlled effusion source, electron beam evaporation, magnetron sputtering, etc., and the system can be customized as per the user requirement. HHV GBICs also come with the option of integrated mask changing mechanism that allows for complete device fabrication without breaking vacuum.

Combined with the recently developed indigenous controlled effusion sources (CES), HHV is in a position to offer very cost effective solutions for GBICs.

Astronomical Telescope Mirror Coaters

Advanced astronomical telescopes are designed to peer deeper into space and expand the boundaries of the universe as we know it. The mirrors of the telescopes are amongst the most important components for sensing radiations from distant sources. These need to be coated with a reflective thin film that aids efficient light collection.

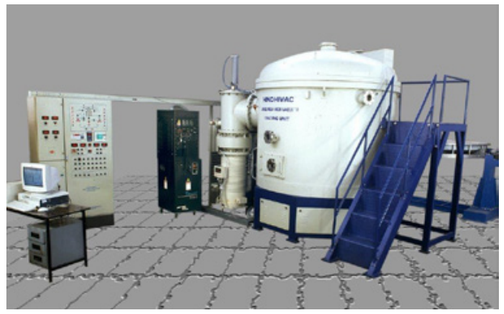
The reflective coating consists of either Aluminium or Silver thin films. Since these films are prone to environmental degradation, a subsequent protective layer of nitride or oxide materials is provided which prolongs the life of the reflective layer. Even so, over a period ranging from a few months to a few years, the reflectivity of the coated thin film degrades, which necessitates a re-coating. The existing coatings are stripped clean, and a fresh coating is then applied. These coatings are applied by vacuum deposition process to obtain the best properties in terms of reflectivity and durability. As the mirrors are sensitive, and one of the most expensive components in the telescope assembly, the coatings are carried out on-site. Thus a vacuum coater is stationed on-site astronomical observatories for coating of the mirror at regular intervals.

Astronomical telescopic mirrors coaters require a technologically advanced high vacuum equipment design, engineering, and manufacturing. HHV has been globally recognized as a trusted supplier for coaters for telescopic mirrors, and has commissioned and demonstrated its coaters at various locations including demanding high altitudes going up to ~ 14,800 feet. The telescope mirrors size of up to 3700 mm diameter and weighing in excess of 4000 kg can be accommodated in HHV coating chambers with a maximum overall dimension of 4000 × 2100 mm. HHV also offers smaller telescope mirrors diameter in 5 different chamber dimension configurations and other customized solutions to suit the requirement.

HHV's telescopic mirror coaters are based on proven chamber designs and deposition methods. The coaters offer an automated and highly reliable process for coating mirrors with aluminium, protected aluminium with dielectric layers (SiO2 or NiCrNx/SiNx), protective silver coatings with dielectric layers (SiO2 or NiCrNx/SiNx). Some of HHV's capabilities in this area include:

- Design, construction, and commissioning across the globe.
- Evaporation and sputtering technologies for coating mirrors.
- Standard and customized engineering deposition tools.
- Uniformity of better than ±5% over the surface of the mirror.
- Conceptual design and process development.

HHV is proud to be a part of several astronomical programs requiring supply of telescopic mirror coaters in India and across the world. Some of the supplied coaters are for Indian Institute of Astrophysics (IIAP), Inter-University Centre for Astronomy and Astrophysics (IUCAA), Aryabhatta Research Institute of Observational Sciences (ARIES), and Observatory of the Sternberg Astronomical Institute, Moscow State University (Russian Federation).

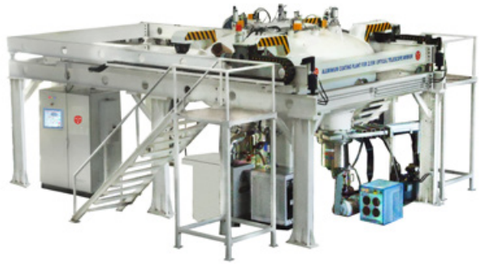


IIAP Evaporation coater for 2.1m diameter Telescope Mirror.

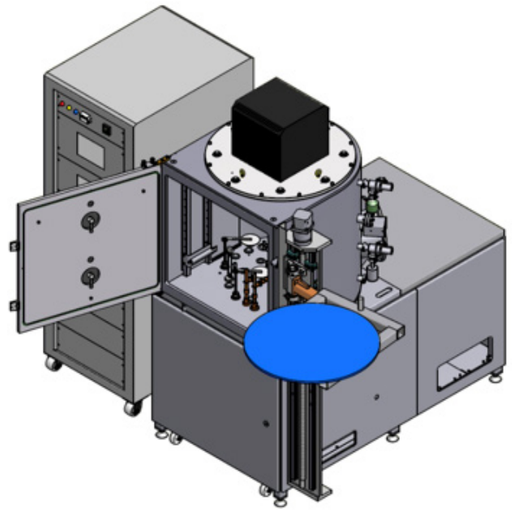
IUCAA Sputter Coater for 2.2 m diameter Telescope Mirror.

IIAP 2.1 m diameter mirror coater with PC SCADA control; Lower chamber in the load/unload position; and coater system fitted with mirror test blank.

ARIES HHV sputter coater for 3.7 m diameter telescope mirror and chamber interior showing whiffle tree mirror support.



HHV astronomical telescope mirror sputter coating system installed at Caucasus Mountain observatory, Sternberg Astronomical Institute, Russia.



Design of the mirror coater for PRL Udaipur

HHV is currently executing an order from Physical Research Laboratory (PRL), Udaipur for the build of a mirror coater for handling mirrors of different sizes going up to a maximum of 700 mm diameter based on evaporation process. This system is being built with a special mirror handling tool integrated with the box coater platform.

Based on its past track-record in the build of telescopic mirror coaters, and its proven competency in the design and development of optical coatings, HHV, in the last year, was short-listed by the Thirty Meter Telescope (TMT) International Observatory (TIO), and India TMT Co-ordination Committee (ITCC) to develop the conceptual design of the coater for secondary and tertiary mirrors of their upcoming telescope. TMT is a joint venture between scientific institutions in Canada, China, India, Japan, and the US to build a 30 m diameter optical-infra-red telescope which will be one of the largest optical telescopes ever built.

HHV was able to meet the objectives of the activity despite various technical challenges given the project requirements, and non-technical challenges imposed by covid. The TMT team was highly appreciative of the efforts put in by HHV in developing the conceptual design for the coater:

HHV is continually undertaking internal development activities in this area to integrate its coaters with proven process recipes for the deposition of highly reflective and durable thin film coating stacks and is looking forward to being a part of various such projects in the future.

Artist's rendering of the proposed telescope (Courtesy: https://en.wikipedia.org/wiki/Thirty_Meter_Telescope)

Laminated Safety Glass for Viewports

Laminated safety glass is used in temperature and pressure sensing equipment as viewports. Two or more pieces of glass must toughened and laminated together to achieve thicknesses and strength to withstand over 5 bar of pressure and 100kg/cm2 of toughness.

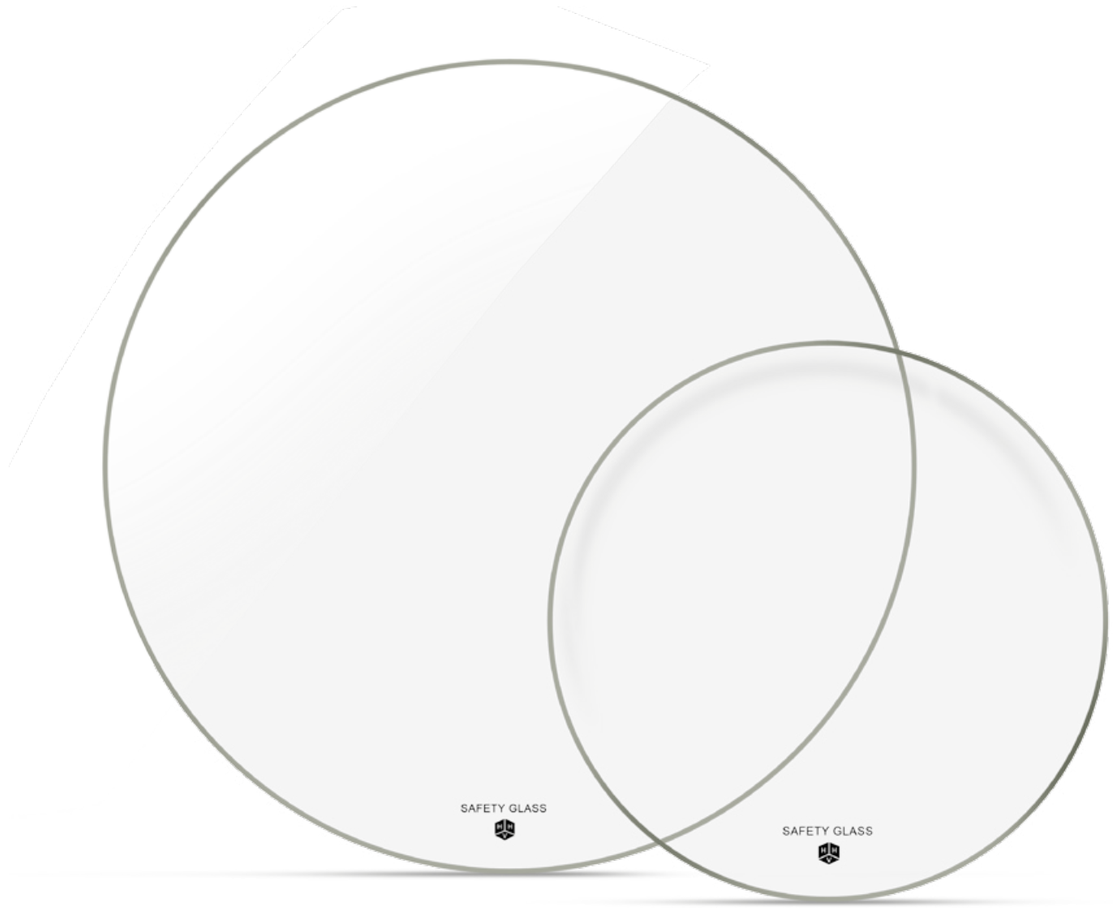
HHV Crystals has developed laminated Safety Glasses of various diameters and thicknesses that can be used as pressure gauges or viewports.

These customized laminated safety glasses are made with DO ± 0.100 mm and thickness up-to ± 0.250 mm. These laminated safety glasses (B270 / Float glass) can withstand humidity and temperature cycling from - 40° C to + 70° C, 5 bar of pressure and has good optical clarity.

After the glass is cut, it is cleaned, screen printed and laminated with PVB or PVA material. Lamination takes place in an autoclave or laminator machines where they are firmly bonded together under pressure and heat.

Since PVB and PVA materials are sensitive to temperature and moisture it is important to do the lamination in a clean environment and in uniform pressure so that no bubbles form between the glass layers. Once manufactured, glasses are tested and packed.

HHV Crystals is equipped with in-house facility for manufacturing, quality testing and trained personals to produce 10,000 glasses of different diameters per month.



ASM and HHV form a Joint Venture for Semiconductor Equipment Manufacturing

ASM Technologies and Hind High Vacuum form a Joint Venture for Semiconductor Equipment Manufacturing

ASM Technologies Ltd (BSE: ASMTEC), a global Technology Engineering provider focussed on semiconductor engineering and related industries and Hind High Vacuum (HHV), a leading vacuum technology manufacturer have formed a 50:50 Joint Venture (JV). The new entity will undertake design led engineering and manufacturing of tools, sub-systems, sub-system components and components for the semiconductor and solar industries.

About ASM Technologies Limited

ASM Technologies Limited is a publicly listed company in India. With over two decades of experience, ASM has been supporting global customers in the areas of engineering services, product R&D and manufacturing engineering. ASM has been supporting global semiconductor and electronics companies for engineering, software, prototyping, NPI, NPD and limited volume production. ASM has multiple delivery locations in India with a global presence in USA, Singapore, UK, Canada, Japan, Thailand, China and Mexico. For more information, please visit www.asmltd.com.

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Speaking on the new development, Mr. Rabindra Srikantan, Managing Director, ASM Technologies Ltd. said, “ASM and HHV have been working together successfully for several years. The joint venture is the logical next step to create a unique proposition that will thrive from the combined experience, capabilities and infrastructure in design led manufacturing for the semiconductor and related ecosystem. We are also encouraged by the recent incentives announced by the Government of India for semiconductor, electronics and packaging. This JV enables us to add the best-in-class semiconductor manufacturing capabilities to our existing semiconductor engineering expertise. We look forward to a long-standing and mutually beneficial partnership.”

Mr. Prasanth Sakhamuri, Managing Director, HHV, also shared his thoughts saying, “After being associated in various ways for many years it is now time for us to partner with an established technology leader like ASM thus opening up a whole new world of opportunities for Indian manufacturing. This JV will play a pivotal role in the country’s upcoming semiconductor landscape. We are con dent that given our respective expertise, this JV will be able to make a significant impact and drive the global semiconductor industry worldwide.

COVID 19, Vaccination Programme

At HHV, 100% of its employees have been vaccinated with both COVID vaccines by the fantastic team from Apollo Hospitals.

Laser World of Photonics, 2021 Bangalore , India

HHV’s Thin films and Optics Division showcased its latest developments and products at Laser World of Photonics, 16-18 December, 2021, Bangalore, India.

PLMSS-2021 Thiruvananthapuram, India

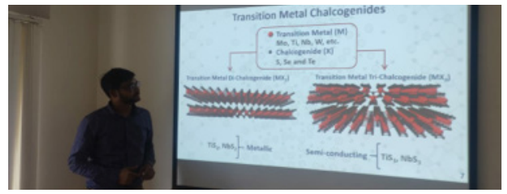
HHV’s Thermal Division has participated in the 8th International Conference on Product Lifecycle Modelling, Simulation & Synthesis (PLMSS) 17-18, December, 2021, Thiruvananthapuram, India.

IWPSD 2021 - Virtual Conference Delhi, India

HHV participated in the virtual conference IWPSD 2021 jointly organized by IIT-Delhi and SSPL

Lecture – 2021 Bengaluru , India

Talk titled Realizing Efficient Thin-Film Optoelectronics by Prof. Aditya Sadhanala and Dr Sreekant M, CeNSE, Indian Institute of Science on the 27th September 2021.



Lecture – 2021 Bengaluru , India

Talk titled Atomic layer deposition of 2D transition metal chalcogenides by Dr. Saravana Basuvalingam from the Eindhoven University of Technology, The Netherlands on the 27th October 2021.

Atlas Copco has acquired a leading provider of vacuum pumps in India January 21, 2022

Nacka, Sweden, January 21, 2022: Atlas Copco has completed the acquisition of HHV Pumps Pvt. Ltd. The company designs and manufactures vacuum pumps and systems for applications used in a wide range of industries.

HHV Pumps was founded in 2009 and is based in Bengaluru, India, and has 151 employees. In the fiscal year of 2020 the company had revenues of approximately MUSD 6 (approx. MSEK 53).

HHV Pumps is a leading provider of vacuum pumps used for chemical and pharmaceutical industries, electrical power equipment, general industry, and rotary vane pumps used for manufacturing refrigeration and air-conditioning.

The purchase price is not material relative to Atlas Copco’s market capitalization and is not disclosed.

The acquired business becomes part of the Industrial Vacuum Division within the Vacuum Technique Business Area.

Hind High Vacuum Company Pvt. Ltd.

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