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HHV WORLD

VACUUM EQUIPMENT • SPV EQUIPMENT • SPV MODULES • THIN FILMS & HOROLOGY

HHV keeps abreast of the latest

Innovating technologies through in-house R&D and association with research institutions to develop technologies in response to market demand are a way of life in HHV.

HHV's recent critically engineered system for robotized TIG welding of special materials in an argon environment, for the Defence and Aerospace sectors, is one such achievement. Details of this complex facility are given in the inside pages.

Another demonstration of HHV's innovative strength is the development of a versatile, large size (800 mm) optical coater with process tools to provide uniformity variation of under 3% with repeatability to produce large area optoelectronic products.

"Near Infrared Filters" (NIR) for biometric scanners and night vision equipment is a recent development of HHV's thin film laboratory. These products are equal in quality and durability to the best made abroad.

HHV has close relations with a number of scientific institutions like BESU, Kolkata is a strategic partner through MOU in its center for excellence in photovoltaic technology and Technology Research Centre of RV College, Bangalore. The latter has established a state-of-the-art testing laboratory to develop technology for Nano materials, MEMS/NEMS, etc.

HHV assures its users that it will continue to advance in its endeavor to catch up with the latest products developed in the advanced countries.

INSIDE

Near Infrared filters used in biometric scanners and night-vision equipment

NIR filters

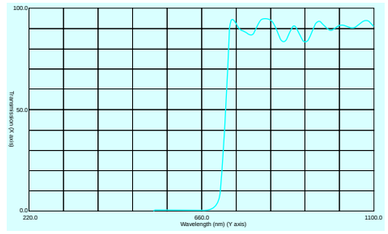
Scientists at HHV thin film laboratory has developed and producing a range of Near Infrared Filters (NIR) used in biometric scanners for identification of an individual and in night vision equipment for security in defense.
NIR filters are playing a critical role in India's ambitious Unique Identification Authority project, popularly known as Adhaar. The project uses two primary means of biometric identification of an individual - fingerprints and iris patterns. Like a fingerprint, the textural pattern of the iris is highly specific to an individual.

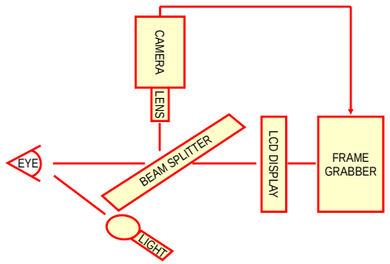
NIR filters in biometric scanners
One of the critical components used in NIR imaging is the transmitting NIR filters which reflect virtually all visible light while allowing only near infrared photons to pass through them. These are highly specialized filters which are made using advanced thin film deposition processes. Till recently, they were being imported. Now, these devices are being made by HHV at its state-of-the - art thin film laboratory.

Biometric scanner

The camera used for recording the iris pattern employs Near Infrared (NIR) imaging which uses 750nm (nanometers) wavelength low-power light. This is done because dark-brown eyes, possessed by the majority of the human population, reveal rich structure in the NIR but much less in the visible band (400 - 700nm). NIR radiation is invisible and un-intrusive. By allowing only this selected narrow band of light into the camera via filters, most of the ambient corneal reflections from a bright environment are blocked from contaminating the iris patterns.
Besides the Adhaar system, iris scanning biometric identification has wide applications across the globe such as in security screening at airports and borders, controlled access to restricted areas, identification of persons in schools, hospitals, prisons etc.

NIR filters in night vision equipment
NIR filters are also important components of inexpensive night vision devices used by security forces. In this method, the observer illuminates the scene with a standard high power lamp that is covered by the near infrared filter. This filter is designed to pass the lamp's near infrared radiation and block the visible light component. Providing supplemental infrared illumination of an appropriate wavelength not only eliminates the variability of available ambient light, but also allows the observer to illuminate only specific areas of interest while eliminating shadows and enhancing image contrast. The supplemental near infrared lighting not only improves the quality of image intensifier devices but also permits the use of solid state cameras, which also have the ability to convert near infrared images to visible.
We congratulate the entire team to bring this product for the mass production.





A view from night vision equipment

Customized equipment to process carbon composite materials

The technical advancements in space, aerospace, nuclear, defense, biomedical, semiconductor, automobile and other industries demand special materials with characteristics to suit extreme operating environments or critical strength to weight ratios or extraordinary physical and chemical properties etc.

Among such new materials that have come into the limelight in recent years and been adopted for use are carbon composites. These are truly remarkable with high flexural and tensile strength, low bulk density, very tough, highly resistant to thermal shocks, low thermal conductivity and low coefficient of thermal expansion. These composites are known to retain their strength even at temperatures as high as 2800 deg. C in non - oxidizing atmospheres.

HHV, which has always been in the forefront of dealing with new materials, is now already well advanced in the design, building, testing, installing and commissioning of the very demanding and sophisticated equipment required for processing a variety of carbon composite materials.

CVD CVI, graphitization furnace reactor

The company has recently designed and developed a vacuum induction heated reactor furnace for CVI, CVD and Graphitization. It is meant for processing carbon composite materials for high end applications such as exit nozzle cones, flaps, ducts and other components for rockets and satellite launch vehicles.

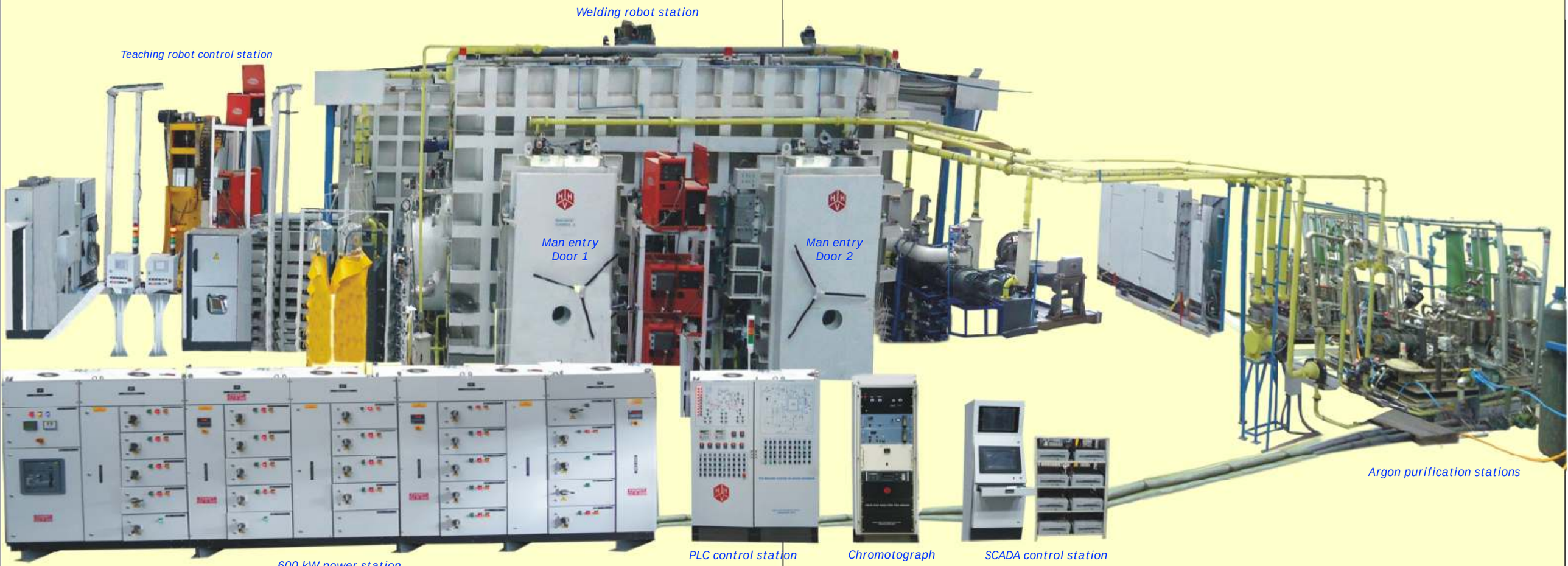
It has been engineered to accommodate a load capacity of 600 kgs with an installed power capacity of 1200 kilowatts of power to process the highest quality, carbon-carbon composites. The CVI, CVD and SiC processes involve controlled temperatures of 1200 to 1400 deg. C in an atmosphere of with reactive and carrier gases while graphitization is carried out at temperatures of 2200 - 2800 deg. C maximum with inert gases.

Siliconization furnace reactor

The other process by which the carbon composite products are made dense and strengthened is by LSI (Liquid Silicon Infiltration) or (Siliconization) which is conducted at a temperature of 1400 to 1700 deg. C under low pressure Argon atmosphere.
This LSI furnace reactor is built with a heating system which indirectly heats and melts solid silicon chunks kept in a special graphite crucible. The carbon composite components are immersed partly into the liquid silicon pool a nd the molten material infiltrates into pores by capillary action, thereby making the components very dense. HHV has made different sizes of such siliconization furnaces ranging from 25 to 75 kgs capacity with fully automated process.

A multi-purpose furnace reactor

A multi -purpose CVD Furnace reactor with process temperature capability of 1500 deg. C with a load capacity of 50 kgs, is specially designed to deposit a wide range of materials such as SIC, BN, Si3N4, HfC, TaC, and SiO2, using different reactive gases. These coatings enable development of a wide range of carbon composite materials of low density, high strength and toughness as well as ablation resistance and chemical resistance at high temperatures. The furnace is very suitable for making components for the aerospace and semiconductor industries.



Robotised Tig Welding Equipment For Special Materials In High Purity Argon Environment

Technological advancements in aerospace and other core sectors of India's development warrants welding of critical components made of special materials in a controlled atmosphere.

The equipment used in such welding is complex and involves highly sophisticated technology. HHV has been the first in India to design and supply such a critically engineered TIG welding system for joining large components. The welding in this system is done in an Argon atmosphere which ensures that there is no oxidation at the joints, a common cause for failure during use.

Robotized TIG welding

The equipment has a specially built large cubical chamber (5m (W) x 7m (D) x 3m (H)) to house a welding station which can be used by both a 6-axis vacuum/Argon compatible robot as well as a human welder. Prior to commencing the welding operation, the chamber is evacuated using multi stage vacuum pumps and then filled with Argon gas of 99.98% purity. Before being let into the chamber, the Argon is purified through series of catalytic towers to bring down the impurity level to a maximum of 2 ppm – hydrogen,

Manipulator with a job moves into Argon chamber from teaching robot station without breaking argon environment

Robot welding in an inert atmosphere

Operator wearing special protective suit performing welding inside Argon chamber

4ppm - Oxygen, 4ppm - nitrogen and 6 ppm - moisture. This purity level ensures zero defects in welding joints. A chromatograph records the purity level of argon gas inside the chamber.

The chamber has been designed with special entry and exit load/lock chambers so that the job as well as the human welder can enter and exit without breaking the internal vacuum / Argon environment. Each entry and exit load/lock chamber has inside and outside door. The manipulator with a job mounted on it enters into the load lock entry chamber by auto opening the outside door while the inside door is closed. After closing the outside door, the load lock chamber is evacuated and filled with high purity Argon gas to equalize the environment with the main chamber. The manipulator enters into the actual welding chamber opening the inside door and positioned itself for actual welding. The same operations are performed in both man entry and exit load lock chamber and manipulator with job exit load lock chamber.

Outside the welding chamber, a teaching robot station is positioned which is a twin of the one inside. It is used to “teach” the job function to the inside robot by transferring co-ordinate data to it. These data are programmed by HHV using special software tools. The robot inside the main chamber carries out the actual welding. The job is mounted on a 2-axis manipulator so as to ensure that most of the joints to be welded are accessible to the welding robot inside. The contaminated argon gas inside the actual welding chamber is pumped and purified to maintain the Argon gas purity level continuously.

Manual inspection and welding

The human welder takes care of those joints which the robot cannot access and& after the welding is completed. The human welder enters the chamber wearing a specially designed life support suit which maintains normal breathing, heartbeat and body temperature and has a walky-talky facility for communications. Human welder is insulated from argon environment as high pressure is maintained inside the suit. The suit is connected to a health monitoring instrument outside the chamber which monitors his pulse rate, SPO2 & body temperature. Utmost care has been taken for ensuring operator's safety. The entire operation is totally automated with PLC SCADA control system.

This system, employing two robots, is a trechnological advancement over the systems currently in use in the developed countries. HHV dedicates this equipment to the special equipment user community.

Teaching robot station

A "Clean Energy" Portable Power Station

A strategic PV solar mobile unit capable of harnessing the Sun's raw energy, converting it into AC power and charge the on-board batteries ready for use Any Time Any place like Disaster relief operations, Outdoor lighting, Remote communications, remote villages, to overcome power crisis in houses.

Solar Photovoltaic technology is becoming a boost for human life not to depend on the currently used one. HHV has come out with a very convenient and compact power station which does not emit any effluents and operates silently since it has no moving parts.

Called the Solarator, it is a ready-to-use light - weight and a self - contained power generator based on solar photovoltaic (SPV) energy. The power is derived from two high - efficiency, SPV modules, each of which can generate 300W of power.

The modules are housed aboard a trolley which also contains a 300 ampere-hour, sealed maintenance free battery bank to store the power generated during the daytime which can be tapped for use in the night. The battery bank offers 24V DC which can be converted to 230V AC by an inverter provided in the circuit. During the day the inverter recharges the battery when the modules produce power from incident sunlight. The electronic and electrical parts are located in the bottom of the trolley to save space. The bottom compartment also has space for luggage or extra modules which may need to be carried. The trolley containing all this equipment has wheels and can be simply towed to any desired destination. During such travel the modules are closed and sealed to prevent any damage to them. The Solarator occupies a total space of and weighs only 450 kg. Due this compactness, it can be conveniently placed even in an apartment at a place where the modules are exposed to sunlight and serve as an emergency power backup. This portable power station can also be used for providing illumination during festivals, at a public gathering, for emergency lighting during disasters, as a power source in remote areas which are off-grid and many other such applications. Because of its silent operation, it is ideally suited as a gen - set for nursing homes so that patients are not disturbed.

Technologically advanced equipment for large area and high precision optical coatings

Internal view of the chamber

Recent advances in thin film science and technology have brought in a need for multi-purpose, sophisticated thin film deposition equipment with proven process tools for research and production of high precision optoelectronic products in industries.

To meet this challenge, initially HHV teamed up with the reputed global players and acquired knowledge by building and supplying technologically advanced thin film deposition equipment. This helped HHV reach international levels of technical competitiveness in this field. HHV is able to continually upgrade the equipment it makes to match the changing technological trends and supply it products to the international market.

Further, HHV thin film research and development has developed expertise in meeting customers' needs by designing and developing optoelectronics products and demonstrate that its equipment can be relied upon for giving repeatable quality and accuracy. HHV is also able to supply not just the equipment but also process tools and know how. Currently, a range of HHV's thin film deposition equipment are being used for variety of industrial and research applications, for nano technology, MEMS/NEMS and from ultraviolet and visible coatings with ion-assisted deposition to complex infrared coatings.

One of HHV's recent developments is a large size thin film deposition system with a chamber size of 800 mm to increase productivity. It is meant for large area coatings in optics for UV reflectors, high reflective coatings and high precision coating for multiple-cavity filters, Laser mirrors, dichroic coatings etc

The totally automated equipment is configured to deposit more than 100 layers with state-of-the art 40CC Electron beam gun. An optical thickness monitor facilitates self correction of deposition rate. The equipment comes with ion cleaning, quartz crystal monitor and a planetary rotating system to provide max uniformity variation of 3% on a substrate size of 500mm, plus a wide range of process accessories. The Turbo pump based pumping system creates an ultimate vacuum of the order of 10^{-7} m.bar.

Multi-purpose large size thin film deposition system

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