Thin Film Solutions Ltd

Innovation Delivered In Thin Films

MPAS 1000
Sputtering System

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Helensburgh
Scotland

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Concept

Microwave plasma assisted pulsed DC sputter deposition coating process (**MPAS** - **M**icrowave **P**lasma **A**ssisted pulsed DC **S**puttering) offers a drum based disruptive technology providing low temperature high-throughput sputter deposition processes.

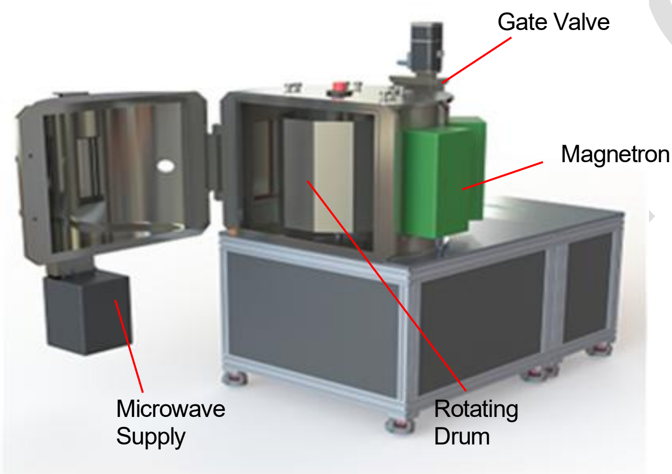
Gases are introduced into the chamber for control of target sputtering and monolayer microwave post processing. Drum rotation speed, typically 50-60 RPM is such that one to two monolayers are deposited per pass across the magnetron target with microwave reactive plasma available for post treatment of deposited monolayer.

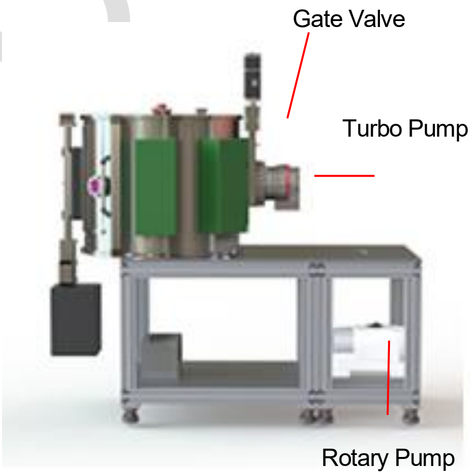
In addition MPAS provides enhanced thin film performance e.g. control of coating surface adhesion to temperature sensitive substrates, hardness, stress control, low temperature processing, single and multilayer deposition and co-deposition of two or more materials. MPAS offers performance enhancement in a wide range of non and reactive thin film sputter deposition processes for research, development and production usage.

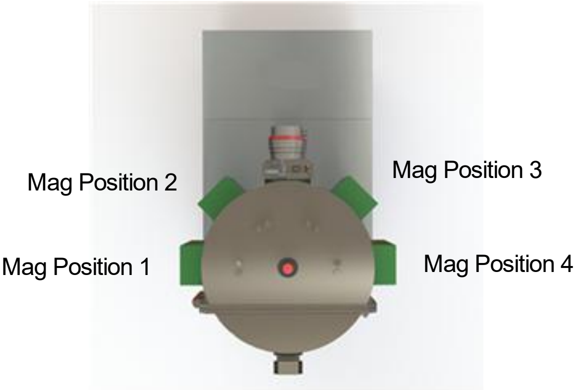
Up to four magnetrons located on the periphery of the chamber linked to complete the closed field system with a door mounted microwave plasma generator for oxidization of the substrates.

Thickness/deposition control is achieved by one of three methods:

(i) Power and time
(ii) Quartz Crystal Monitoring, option (Inficon IC6)*
(iii) Optical Monitoring, option (Intellemetrics JL570-02 (400-1100nm optical range))*
*Available as options







View From Top

MPAS features

MPAS Features are summarised as follows:-

- MPAS provides room temperature deposition, no need for separate heaters
- Multi-sputter targets provides means to separately deposit adhesion promoting coatings, single material coating deposition and/ or co-deposition of two different coatings materials including metals and/ or oxides .
- Microwave plasma (2.45GHz) provides high efficiency ionization and plasma reactivity compared with other plasma technologies such as DC & RF. Different reactive gases introduced into the microwave plasma can be used to form a variety of durable coating compounds such as oxides, nitrides, carbides at room temperature.
- Separate deposition & microwave plasma processing regions provide use of microwave plasma for effective pre-preparation of deposition chamber (esp. water vapour removal which can disrupt coating processes) and substrate microwave plasma pre-clean prior to deposition
- Control system provides single layer or multilayer deposition.
- MPAS pump configuration – turbo with cryocooler
- Optical gas control for reactive deposition processes (option)
- Flexibility in coating stoichiometric control through variation in microwave plasma conditions and gas composition, nano-structural modification & control through combination of pulsed DC/ plasma control
- MPAS co-deposition providing simultaneous deposition of two or more materials resulting in mixed and/ or graded materials
- MPAS hydrogenated processes provide method for material bandgap and optical absorption modification
- MPAS provides one axis vertical drum configuration
- One axis drum floats electrically and ion energy controlled by gas flow)

1.System Specification

1.1 Chamber

The chamber is a single walled, vertical axis, stainless steel cylinder (ST ST 304L), which is water cooled via trace cooling channels. The chamber sits on a stainless-steel base plate. Access to the drum/facets is by means of a hinged large front opening door. The pumping port is situated in the rear of the chamber to assist uniformity of deposition multiple ports for location of the rectangular magnetron sources, are situated along the length of the cylinder. The vertical geometry minimises problems with particulates.

Further ports in the chamber walls are included as follows:

- 2 off view ports, 2" diameter (these can also be used for the Infra-Red Temperature Monitor which can be supplied as an optional extra).
- 1 off 70 FC flanged port, to accommodate a mass spectrometer (not supplied).
- 7 off NW 25 flanged ports.
- 4 off NW 10 flanged ports.

Note: The NW 25 & NW10 ports are provided for vacuum gauges, gas inlets, venting etc. and provide ample spares for further accessories.

For all system options' two sets of removable shields are included to simplify chamber cleaning, the spare set can be used while the other set is being cleaned, minimising system downtime.

1.1.1 Chamber Dimensions

Description	Unit	MPAS-1000
Chamber Diameter (Internal)	mm	1095
Chamber Height (Internal)	mm	778
Chamber Diameter (external)	mm	1107
Chamber Height (external)	mm	828
Magnetron Positions		4
Microwave Position		1
Ultimate Chamber Vacuum (Clean, dry & empty)	mbar	>1X10^{-6} mbar
Chamber Leak Testing (Clean, dry & empty)	mbar	1X10^{-8} mbar l/sec
Pump Down Time 2X10-6 mbar (clean, dry & empty)*	min	<45 min
Base Vacuum With Meissner (clean, dry & empty)*	mbar	>6X10^{-7}

** Dependent upon pump types/models being used (refer to 1.4 pump section)*

1.2 Magnetron Sputter Sources

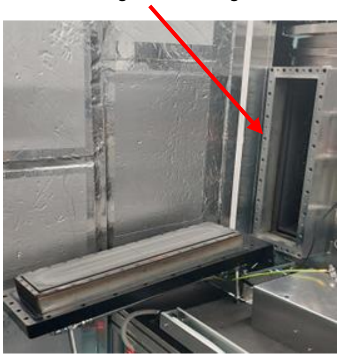
Four magnetron positions are available in the walls of the vacuum chamber. Four magnetrons are supplied as standard as shown in Figure 1. The magnetrons are directly cooled to enable efficient coating deposition and are designed to produce intense ion bombardment of the substrates during deposition. The system is wired to allow simultaneous running of and two magnetrons – example is simultaneous running of two carbon targets to maximise deposition rate.

The magnetrons are powered using pulsed DC with microwave plasma located remotely from the sputter targets - pulsed DC sputtering suppresses arcing, necessary to ensure that required coating quality

The systems enable coating deposition to be carried out using a high density of low energy bombarding ions at room temperature. This results in deposition of very dense, non-columnar amorphous coating structures with low internal stresses. The use of a low bias voltage during deposition also allows deposition of coatings with dense structures at room temperature temperatures.

The ion bombardment power drawn by the substrates during ion cleaning is very much higher than that drawn during deposition which significantly increases the efficiency of ion cleaning resulting in coatings with very high levels of adhesion.

The magnetrons are housed in a metal frame that allows for easy implementation for the magnetron(s) to be dropped to ease target material replacement. Target material is bonded onto a copper backing plate, which is then mounted onto the magnetron body.



Position 4 magnetron lowered exposing target for inspection/replacement

Two magnetrons (1 & 2 positions

Two magnetrons (3 & 4 positions)

Figure 1 Magnetron configuration

The magnetrons are a tried and proven design using a unique neodymium cylindrical magnet design – the magnet pack (aluminium frame with drilled apertures to accommodate cylindrical magnets) is populated with a stack of neodymium cylindrical magnets, enabling accurate control of magnetic flux across the magnetron target surface – the magnet pack is easily removable as shown in the following photos allowing optimization of magnetic field without removal of complete magnetron assembly.

Figure 2 below (figure a) shows a cylindrical magnet placement – local magnetic field strength can be optimized by altering number of vertical magnets - and b) fully populated magnet pack. The magnet pack is mounted on the rear magnetron face and can be removed separately for tuning/ optimisation of magnetics.

Figure a
Cylindrical magnet (n10mm)
Placement in magnet pack

Figure b
Populated Magnet Pack

Figure 2 Magnetron magnet pack

The system uses unbalanced magnetrons in an arrangement whereby neighbouring magnetrons are of opposite magnetic polarity. The deposition zone in which the substrates are located is surrounded by linking magnetic field lines. This traps the plasma region, prevents losses of ionising electrons and results in significant plasma enhancement.

The arrangement and strength of the magnetrons are optimised for each system.

The system will be supplied with 4 targets (populated magnetrons). The final configuration to be agreed with end user. Typical configuration as shown in table 1 below.

Magnetron Position	Material
1	Carbon
2	Si
3	Ge
4	Carbon

Table 1 Magnetron material and configuration

For safety reasons, the rear of the magnetrons are protected by interlocked covers. Removal of the covers will shut down the power supplies.

1.2.1 Magnetron Specifications

Magnetron specification is provided in Table 2 -

Description	Unit	MPAS-1000
Magnetron Height	mm	525
Magnetron width	mm	125
Target Height	mm	501
Target Width	mm	109
Max Power *	kW	10
Water Colling minimum	ltr/min	6
Max differential Pressure	Bar	4

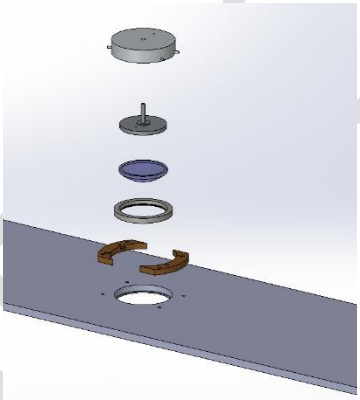
** Max Power of magnetron determined by material being sputtered*

Table 2 Magnetron specification

1.3 Drum/Substrate carrier

The Closed Field Magnetron systems are equipped with one precision single axis drum with fixturing to accommodate a range of substrate sizes. The facet size is given in the table below. The drum is removable from the system for loading and or maintenance purposes, is mounted centrally in the chamber on top of a heavy-duty bearing assembly. A magnetic fluid rotary feed-through provide for rotational vacuum sealing. The substrates are rotated by means of a geared motor giving speeds of typically 50-60rpm. This ensures <±1% thickness uniformity over the central drum surface. Drum removal tool described in Section 8.3 is recommended to automate drum handling

It is recommended that bespoke tooling as shown in Figure 3 below (substrate carriers) are used to ensure substrate stability and coating consistency.



Example of bespoke substrate

Figure 3 Typical tooling to hold substrates

Segment sizes are interchangeable to accommodate various substrate sizes. Specific segment widths to be agreed with the customer. Cylindrical drum geometries are available for coating of flexible sheet. Some mechanical changes will be required should different facet/substrate widths are required different to the facets size given in the table below. Should different size facet widths be required, please contact Thin Film Solutions for additional information

Vertical Drum

Figure 4 Single vertical axis drum with 6" wafers

1.3.1 Drum and facet Specifications

Description	Unit	MPAS-1000
Drum Diameter (max)	mm	940
Drum Speed Range	RPM	1-60
Drum Facet Height	mm	555
Drum Facet Width	mm	230
Drum Max Weight (balanced loading)	Kg	30
Uniformity (100mm centered) without uniformity mask)	%	<+/- 1
Uniformity (200mm centered) without uniformity mask	%	<+/- 3

Table 3 Drum & facet specifications

1.4 Vacuum Pumps

Vacuum pumping system consists of a dry pump, roots blower and turbo-molecular pump. The use of dry pumps eliminates the possibility of contamination due to back streaming. A “Cryochiller” is used with an evaporative surface (Meisner/cryo-coil) in addition to the mechanical pumps, which is located within the vacuum chamber. A Cryochiller is an ultrahigh performance vacuum pump capable of pumping water vapour and other condensable gases at speeds far in excess of conventional vacuum pumps.

1.4.1 Vacuum Pump Specifications

Vacuum pump specifications are provided in Table 4 -

	Manufacturer	Model	Unit	MPAS-1000
Rotary Pump displacement *	Edwards	E2S85	(m^3h^{-1})	87
Roots Pump displacement *	Edwards	EH500	(m^3h^{-1})	505
Combined Pumping Speed*	Edwards		(m^3h^{-1})	385
Turbo Pump Speed (Maglev)**	Pfeiffer	ATP2300	l/sec (N_2)	1950 (ISO250)
Meissner trap Chiller	Polycold	Maxcool 4000	l/secH_2O	220,000

**Pump data based on standard pump configurations (Edwards pumps) @50Hz.*
*** Based in Pfeiffer ATP2300M*
**** Pump model types/models subject to change without notice*

Table 4 Vacuum pump specifications

1.5 Vacuum Gauges

Pressure is monitored by a Penning/Pirani combination with an Edwards active gauge controller with digital display as described in Table 5. .

An Edwards Pirani Gauge is fitted to the backing line to monitor the backing pressure of the turbo pump

An MKS Baratron is also fitted for use in “pressure control” applications are required. The output of the Baratron is fed directly into the high vacuum valve controller. When not in use the Baratron is sealed off from the chamber

	Manufacturer	Model	Unit	Range
Chamber Pressure	Edwards	WRG-S Active	mbar	Atm – $1X10^{-9}$
Backing Pressure	Edwards	APG200	mbar	Atm – $4X10^{-4}$
Baratron	MKS	627B	Torr	0.1

** Make and model number subject to change without notice*

Table 5 Vacuum gauges

1.6 Vacuum Valves

Electro-pneumatically operated valves are used to facilitate pumping and venting of the system. The high vacuum valve is a continually variable valve between fully open and fully closed and is adjustable in 1% steps. The high vacuum valve is also utilized to control and or set the chamber pressure.

1.7 Magnetron Power Supplies

The two magnetrons are powered by one or two Advanced Energy 10KW power supplies (. High power relays switch the power from the supplies to the chosen magnetron, automatically selecting based on the specific material/magnetron being employed for deposition.. From single or two magnetrons

The power supplies will only operate when the correct vacuum is achieved, and all protective interlocked covers are in place.

1.7.1 Magnetron Power Supply Specifications

Basic specifications for the power supplies are shown in below table 6. The standard uses 2 off 10Kw supplies but an option is available to use two 5X5 dual output supplies

Advanced Energy Pinnacle P*lus*™	Unit	Single Output	Dual Output
Max Power	kW	10Kw	5kW/channel
Frequency Range	KHz	5-350	5-350
Reverse Time (dependent on frequency setting	μS	0.4 - 5	0.4 - 5
Line Regulation	%	+/- 1	+/- 1
Repeatability	%	0.1	0.1

** Make and model number subject to change without notice*

Table 6 Magnetron power supply specifications

1.8 Microwave Power supply

The microwave power supply utilizes an MKS 6kW supply. The microwave head and tuning stubs are mounted on the front door of the system. The microwaves from this supply are feed into a “wave guide” directional coupler mounted to a port located on the front door. In a surface wave plasma configuration. An argon plasma is created on the vacuum side of a quartz glass window. Microwave functions are control via the process control screen.

The wave guide and tuning stubs are covered by an interlocked cover to prevent accidental escape of harmful microwaves.

The power supply is fully interlocked to prevent operation unless correct chamber vacuum is achieved, and all protective covers are in place

1.8.1 Microwave Power Specifications

Microwave power specifications are provided in Table 7.

	Unit	Range
MKS	Model	SM1280
Output Power (max)	Kw	6
Frequency	GHz	2.45
Max Volts	v	7,800
Max Current	mA	1,200
Output Stability	%	1
Output Ripple (max) @ 300Hz	%	+/-4
Filament pre-heat time	secs	15

** Make and model number subject to change without notice*

Table 7 Microwave power specifications

1.9 Process Gas Control

Process gases are controlled via MFC's (Mass Flow Controllers) All gas lines are stainless steel and incorporate Nupro electro-pneumatic closure valves. Gas lines are configured for four(4) linear magnetrons and the microwave source. Seven (7) MFC's are fitted on total. 4 for argon and three for process gasses. Gas lines connections are made via a gas connection manifold located at the rear of the system using Swagelok™ ¼" inch connections. Two stage regulators (end user supplied) must be used for the process gasses. Regulators must confirm to local health and safety requirements.

Process gasses **must** be high purity minimum 99.998%

Reactive gas flow is maintained at the appropriate rate by a gas controller monitoring magnetron. The number of reactive gas lines can be extended on request. This system is used to control the exact composition and stoichiometry of reactively deposited coatings.
A continuously *tuneable* gate valve can be incorporated for real time active pressure control. This is feedback controlled from a baratron gauge.

1.9.1 MFC Specifications

MFC specifications are provided in Table 8 -

	Unit	Range
MKS	Model	GE50
Range (N_2 equivalent)	sccm	0 - 200
Repeatability	%	+/- 0.3
Typical accuracy	%	+/- 1
Resolution (FSD)	%	+/- 0.1
Warm up time	min	<30

** Make and model number subject to change without notice*

Table 8 MFC specifications

1.9.2 Process Gases

All process gases must be research grade, high purity, otherwise coating performance will be affected. The gas can be supplied via a bulk gas feed line or by individual cylinders. If cylinders are used, then the gas regulator MUST be a two-stage regulator. For gases, such as Oxygen and hydrogen, these must meet local health and safety standards for use with these gases.

Process Gas	Input Range
Argon*	20 - 40 PSI (1.4 – 2.8 bar)
Nitrogen*	20 - 40 PSI (1.4 – 2.8 bar)
Oxygen*	20 - 40 PSI (1.4 – 2.8 bar)
Hydrogen*,**	0-500 ml/min @ 20°C 15PSI (1 bar)

** Research grade gases*
*** Supplied by Hydrogen Generator located at rear for system*
Note: All process gases are fully interlocked

Table 9 Process gases

1.9.3 Hydrogen Process Gas Generator

Hydrogen is provided by the use of a Hydrogen Generator (electrolysis). This generates pure hydrogen through distilled water electrolysis. This is located on top of the chamber plinth.

	Unit	Range
Linde	Model	NM-H2-500
Hydrogen Flow Rate (max)	ml	0-500
Output Pressure (Max)	Bar	+/- 0.3
Pressure accuracy	%	+/- 0.5
Water Requirements		Pure/Distilled

Table 10 Hydrogen process gas generator

1.9.4 Uniformity Mask

Two types of uniformity mask can be offered, *a)* shaped mask – contoured mask along the length of the magnetron and *b)* a bar type mask – bars placed at predetermined points along the length of the magnetron.

2.0 Process/System Control

Process and system control is fully automatic and fully interlocked through a PC/PLC. This includes a suite of menus for the various coating types, automatic recording of deposition parameters, status displayed on mimic diagrams, orderly and safe shut down procedures. The system can be monitored remotely from the factory by modem link.

The control system/HMI is based on National Instruments LabView™ in conjunction with a National instrument CompaqDAC (cDAQ) input/output modules located in a chassis. The modular system allows for easy expansion should it be required

National Instruments CDAQ digital analogue acquisition)

Figure 5 National Instruments control system

A Mitsubishi PLC is employed to monitor all outputs from the cDAQ. In the event of a failure of the PC or cDAQ, the PLC automatically assumes control and safely shuts down the system.

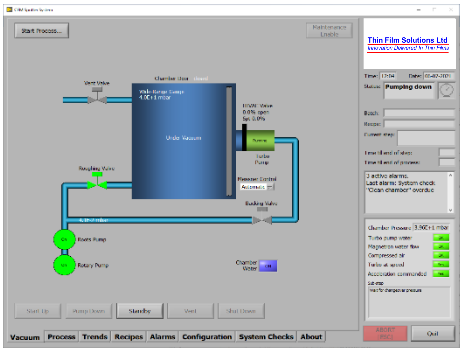
Mitsubishi Electric PLC

Figure 6 Mitsubishi PLC controller

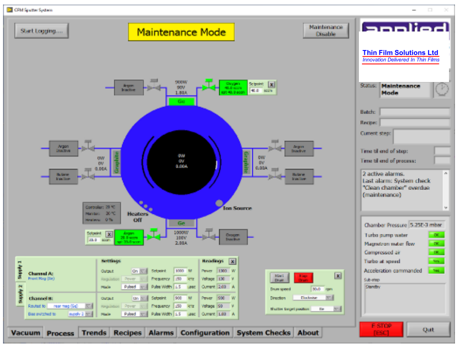
The computer fully controls the vacuum system and allows easy writing of coating sequences using the recipe writer section of the program. These coating recipes consist of a series of coating steps, each include all coating parameters (e.g. power supply settings).

When the system is in "Maintenance Mode," manual control allows the operator to manage vacuum sequencing, MFC gas selection and flow, and set up magnetron and microwave power supplies. Manual Mode is fully interlocked to prevent accidental activation of valves and power supplies.

Four off, Type K thermocouples will be provided for temperature monitoring of the chamber during process. The thermocouples will be seal via Connax™ style feed through via the base of the chamber. Thes will be located at four points (N,S,W,E) within in the vacuum chamber.



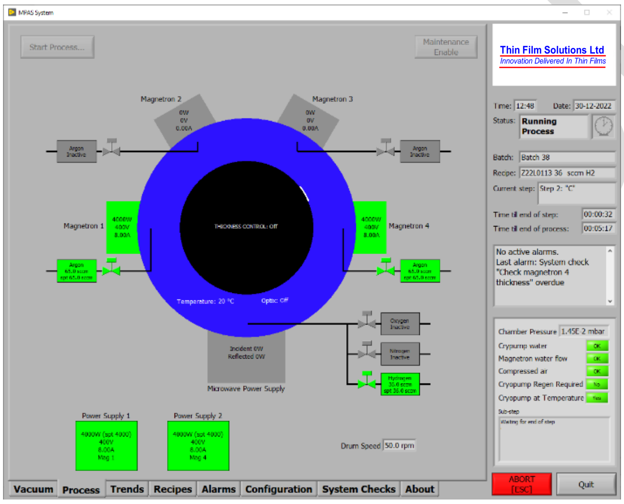
Vacuum Screen Home Page



Process/manual Operation Screen

Figure 7 Vacuum control screens

A manual coating can be performed via a manual control screen where all coating parameters can be user set. All parameters are data logged in the same way as an automated coating process. During normal operation the screen below is display showing all process parameters.



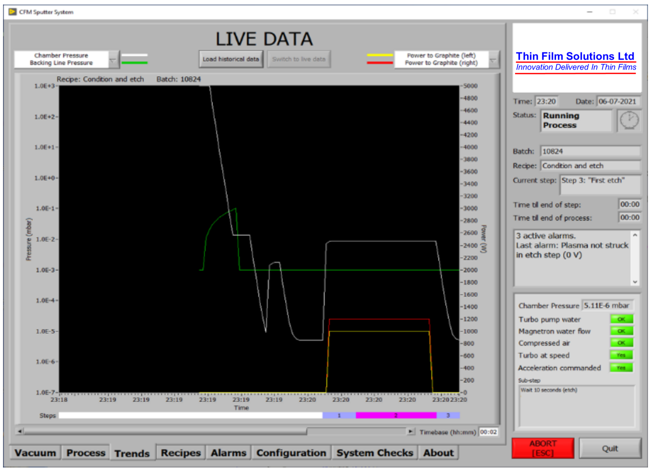
Process Screen

Figure 8 Process control screens

following data is logged and is saved as a CSV file and may be recalled for review post process run.

- Magnetrons – current, voltage, power
- Bias – current, voltage (option)
- Pressure – Chamber and backing pressure
- Real time (in one second updates)
- Rate of rise before run
- MFC's – Gas flow rates
- IC6 – deposition rate and layer thickness (if IC6 deposition controller fitted)
- Recipe Used
- Step number and step name
- Chamber temperature

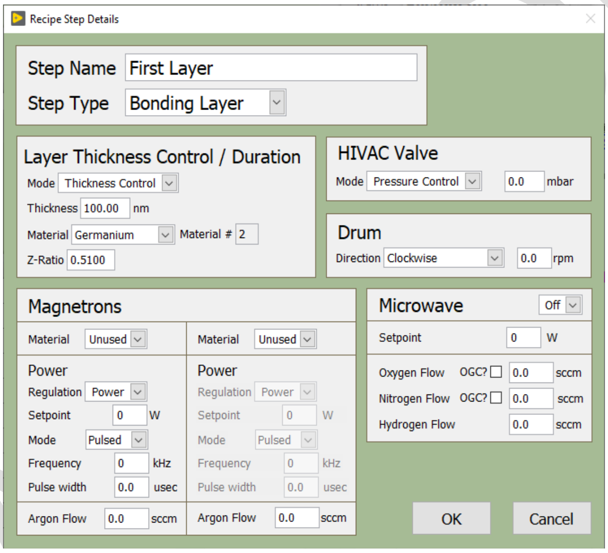
A trending (shown below) screen can be selected and displayed during the process; the data that is displayed is chosen by the operator and can be changed during the process if required. Once the run has finished, the data is logged in a spreadsheet format file. The process data is stored to hard drive at the end of the process.



Trending Screen

Figure 9 Trending screen

Recipe editing for single and multilayer layer deposition is available. This includes substrate cleaning, target conditioning stages, magnetron stabilisation, deposition and shutdown.



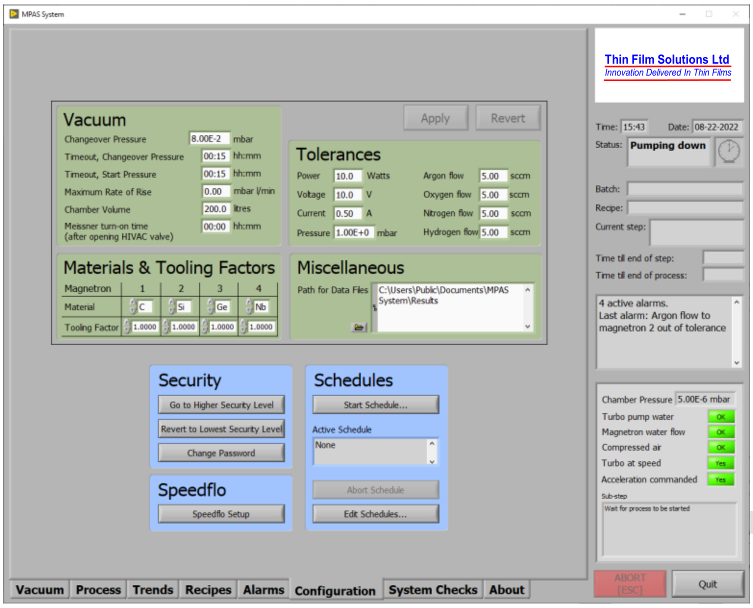
Recipe steps Generation Page with all process parameters with

Figure 10 Recipe steps generation page

Recipes (shown above) determine the type, details and number of steps that the system goes through in running a process. They are stored in Excel format in a folder called Recipes, which resides in the same location as the program itself. Existing menus can be easily modified and new menus written with no specialised programming skills.

Shown below, is the configuration page with vacuum setpoints, tooling factors and security level control and password protection is included on certain screens.

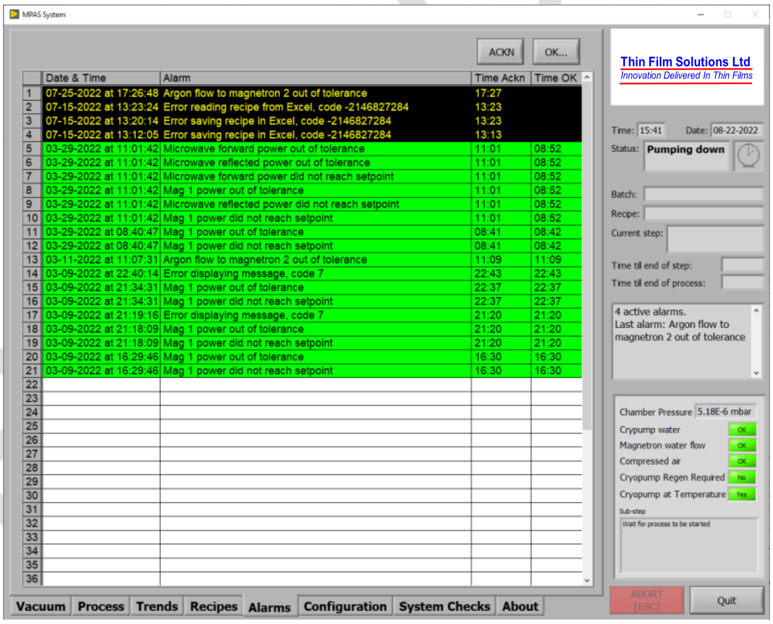
During the process, parameters are checked to see if they are within tolerance of the set parameters and the process will abort if outside of these tolerances.



Configuration Page

Figure 11 Configuration page

The alarm page logs all system alarms, categorized as non-fatal or fatal. Non-fatal alarms trigger an alert but do not interrupt the process. Fatal alarms stop the process and automatically shut down the system, sealing the chamber by closing all vacuum valves.



Alarm Page

Figure 12 Alarm page

The alarms are logged/stored to file and can be recalled later for analysis. Alarm acknowledgements are password protected.

2.1 Thickness Control

Thickness Control is achieved via two methods:

(i) Using Power time method – Deposition using the magnetron power for a pre-determined time within a recipe
(ii) Quartz Crystall monitoring – Thickness measure using of an Inficon IC6 deposition Controller

Dual, shuttered crystal heads will be mounted on flanges via the base of the chamber. Automatic change over in the event of crystal failure. Dual shuttered XTAL heads will be provided, located in front of the magnetron but behind the facets. A slot in the facet is provided for material measurement

2.1.1 IC6 Base Specifications

Inficon IC6	Unit	Range
Frequency Resolution@ 6 MHz	Hz	+/-0.0035
Thickness and Rate resolution	Å	+/-0.0043
Measurement frequency Range	MHz	6 – 4.5
Thickness Accuracy	%	0.5
Number of dual shuttered crystal Heads	ea	4

Table 11 IC6 Quartz Crystal Specification

Rate and thickness will be displayed during the run and rates and thickness will be logged for each run

2.2 Temperature Monitoring

Four(4) Type K thermocouples will be provided for temperature monitoring of the chamber during the process. The thermocouples will be sealed using Connax™ style feed-throughs located at the base of the chamber. Temperatures will be displayed and logged for each run. A single thermocouple will be placed at four points within the chamber (N,S,W,E).

3.0 System Utility Requirements

3.1 Electrical

	Range
Voltage (5 wire system)*	400-415 3Ø+N+E
Current per phase	80
Power (kW)**	55

** Alternative voltages are available but must be confirmed at time of order*
*** Assumes 1.0 power factor correction*

Table 12 Electrical Utility

3.2 Water

	Unit	Range
Cooling Water Flow (l/min)	l/min	30-40
Inlet Temperature Non-condensing	°C	18-25
Inlet Pressure (Bar)	Bar	2-3
pH		7-8
Conductivity (minimum Ω/cm)		1500
Maximum Chloride Content (mg/Kg)		150
Hardness		<7 milli-equivalent/dm^3

Table 13 Water Utility

3.3 Compressed Air

	Unit	Range
Compressed Air (Clean & dry) (psi)	Bar	5.5 - 6

Table 14 Compressed air utility

4.0 Factory Acceptance Tests

All vacuum tested to be performed with the vacuum chamber clean and dry and empty.
Test performed

- ❖ Full Functional Test of systems
- ❖ Emergency stop and interlock tests
- ❖ Chamber base vacuum. (>than 10^{-6} mbar)
- ❖ Pump Down test to a pressure of $2X10^{-6}$mbar ($2X10^{-8}$Pa)
- ❖ Process testing (after completion of vacuum testing)

Post process testing of substrates to meet the following requirements:

- Adhesion: MIL-C- 48497A (4.5.3.1)
- Humidity: MIL-C-48497A (4.5.3.2)
- Severe Abrasion: MIL-C-48497A (4.5.5.1)
- Wiper Test: TS1888
- Salt Spay: MIL- C-675C (4.5.9)
- Transmission Performance (8µm to 12µm or 3.6µm to 4.9µm)
- Thickness uniformity

Coatings will be carried out on the following substrates:

- o 8-12 λ AR on ZnS, Ge and IRG4 or 206 (3 consecutive tests).
- o 3-5 λ AR on ZnS, Ge and IRG4 or 206 (3 consecutive tests).

5.0 Training

5.1 Operator Training (including but not limited to):

- ❖ Control software overview
- ❖ Recipe handling/creation (including using EXCEL formats)
- ❖ Manual operation of system (maintenance mode)
- ❖ Target thickness measurements
- ❖ Daily checks (carried out by operator)
- ❖ Alarm handling

5.2 Maintenance Training (including but not limited to)

- ❖ Target material changing
- ❖ Simple fault-finding techniques
- ❖ Interpretation of alarms
- ❖ Target thickness measurements
- ❖ Daily checks
- ❖ Weekly checks
- ❖ Monthly checks
- ❖ Alarm handling.

6.0 Spares List *(First Line)*

A *first line* spares kit is supplied with the system:

Description	QTY
Door Main Seal	1
Target Seals	4
Microwave vacuum seal kit	2
Microwave window	1
Magnetron Seal Kits	2
Thermocouple Seal	2
Centering ring KF10	1
Centering ring KF16	1
Centering ring KF25	1
Centering ring KF40	1
Fuse kit	1
Relays (24VDC)	2

**The above is for guidance only as exact spares will be dependent upon final agreed system specifications*

7.0 Documentation

The following documentation is supplied (in English) with the system:

- Operating Manual (electronic format)
- OEM Manuals (may be supplied in paper or electronic format)
- Electrical Schematics
- Mechanical Assembly drawings

8.0 Optional Extras.

8.1 Water Chiller

Optional water chiller is available is available. The chiller is manufactured in Italy and by MTA (supported by ICS in the UK) and local support is available.

The chiller is an air-cooled compact closed system (closed water circuit) water chiller that is suitable for outdoor use. Twin axial fans are located on the top of the chiller and has been selected to meet the cooling requirements of the MPAS 1000 coating system.

At time of order the end user **MUST** confirm ambient operation conditions and steps must be taken to prevent freezing of water. It is important that water additives, of any kind (ie antifreeze) ***MUST NOT*** be used in the closed circuit cooling the MPAS1000 system. Failure to observe these conditions will result in poor performance of coating system and or permanent damage to magnetrons, pumps and other water-cooled components. Anti-freeze protection can be incorporated within the chiller **BUT** this must be specified as a requirement as this will result in additional cost.

For water requirements, refer to section 3.2 above

	Unit	Range
Model Number		TAE evo 121 Air Cooled
No of phase	Ø	3+PE
Voltage	V	400
Current/phase (Max	A	39
No of phase	Ø	3+PE
Frequency	Hz	50
Cooling Capacity @25°C	kW	35.5
Tank Capacity	ltr	255
Length	mm	761
Width	mm	1862
Height	mm	1437
Weight	Kg	656
Refrigerant		407A

8.2 Optical Gas Controller (OGC)

The optical gas controller (Gencoa Optix™) is a multipurpose instrument used for rapid gas sensing in a vacuum environment.

Separated from chemicals by an optical window, Optix uses a remote plasma spectroscopy concept which generates a small plasma within the sensor head. A built-in spectrometer analyzes the plasma, automatically interpreting the light spectrum to provide quantitative measurement of the presence and concentration of gas within the vacuum.
The Optix spectral information and sophisticated back-end software creates a range of uses for a wide range of applications, including contaminating processes involving hydrocarbons, solvents and long-chain polymers.
Small changes are made to the device in the case of sensing CVD and ALD type processes in order to prevent contamination of the plasma head. Sensing from atmosphere is also possible with a small roughing pump to bring the gases into the sensor.
Optix is very portable and easily switched between different vacuum systems or hand-carried in a small box to customer sites. It also offers an ultra-high sensitivity single gas option for dedicated leak detection. (source: Gencoa Ltd)

The OGC as a standalone unit will identify the gas species in the vacuum chamber, but it has no direct control of process gas flows and or partial pressures..

When the chamber is vented the OGC, via a vacuum valve, is isolated from the main chamber and. For “reactive sputtering” (partial pressure control of process gas) a Speedflo™ controller must be purchase at the same time as the OGC. The Speedflo™ is a multi-channel feedback control unit for the high-speed adjustment of reactive gas during the sputter process. Partial pressure of process gas(es) requirement can be set within the control system recipe.

The MPAS1000 control system will allow the user to either “fixed flow” (pre-set gas flow rates) control or reactive process control.

Note: This option **MUST** be ordered at time as the system order specified above.

8.3 Drum Removal Tool

A Drum removal tool can be provided like the one pictured below. Guide rails mounted below the frame of the system provides easy alignment with the drum.

Drum removal tool