

## FlexAL plasma, AL1-x\_415V

### FlexAL system

**ALD system console 2 frame compatible with over-hanging single loadlocks or multi-chamber handling units, PC base unit, Windows 7, TFT monitor and TFT display**

The FlexAL process module base unit houses all the electronic sub systems, control units, pneumatics, water, gas services and the turbomolecular pumps (if fitted). Also located in the base unit is the dedicated module control processor.

The module is mechanically MESC compatible and is constructed using proven OIPT hardware designs. The extensive OIPT process library supports all FlexAL configurations. The system is fully interlocked to protect the system hardware from any service failure (e.g.. failed water supply for cooling purposes) and to protect the operator from electrical shock during maintenance procedures.

The control software runs as a Windows 7 application and allows multiple levels of system control. Individual users (or class of users) are accessed by password entry. The system status is displayed on graphic mimic diagrams with all operational parameters and status displays accessible through pop-up windows. Recipe programming is provided for all major process parameters. Each gas line may be defined, with input of mass flow settings directly in sccm. The software includes full data logging capability of user-selectable run-time process parameters, allowing off-line verification and analysis of process conditions.



## **SEMI S2 and UL compliant 380V-415V 50Hz System power box**

### **Reaction chamber and substrate stage**

#### **ALD lower process chamber with 400°C electrode**

The aluminium process chambers are machined from a single aluminium block to provide highest vacuum integrity. Included with the process chamber is a MonoVAT isolation valve for connecting the process module to the selected wafer insertion device.

The chamber features two ports at 70 degree angle from the normal for ellipsometry and an additional port for analytical equipment such as RGA. The upper chamber houses the flanges for precursor injection and 65mm ICP source mounting. The hinged upper chamber is raised by gas springs for ease of access for chamber cleaning and maintenance. A 100mm pumping port is provided.

240mm diameter resistance heated aluminium electrode with temperature control to 400°C. Fixed height without wafer clamping. Electrically grounded.

The chamber is electrically heated to 150C.

### **Plasma source**

#### **Upper chamber and ICP65 plasma source (Alumina) with automatch unit for ALD**

Inductively Coupled Plasma (ICP) source for use with 300 - 600W 13.56MHz RF Generator and vacuum capacitor Automatch unit.

The ICP remote source provides the unique combination of high radical densities with low ion energies at the substrate to avoid plasma damage.

The plasma gives the following advantages;

- Widest choice of precursor chemistry available (some precursors are un-reactive towards H<sub>2</sub>O, but will react with an O<sub>2</sub> plasma)
- Lower temperature processing - O<sub>2</sub> plasma instead of H<sub>2</sub>O and better quality of film
- Higher quality films - better impurity removal
- Effective metal chemistry - H<sub>2</sub> or N<sub>2</sub> plasma reduction.
- More process control, e.g. phase/stoichiometry
- Plasma surface treatment possible
- Plasma cleaning of chamber possible for some materials



## 300W RF Generator

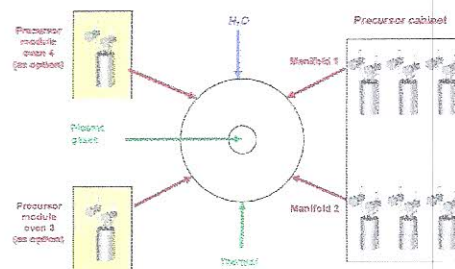
### Sources

#### Overview of precursor options

The FlexAL can accommodate a wide range of precursors and as such there are a number of precursor delivery options.

There are 7 separate inputs into the reaction chamber to avoid cross contamination of incompatible precursors. These comprise of;

- 4 inputs for metal precursors (e.g. Al, Hf, Ti, etc.)
- 1 input dedicated for water
- 1 input for plasma gases to the ICP source
- 1 input for thermal gases directly to the chamber



#### 8 line (MAX 8 LINES) externally mounted gas pod

The gas pod is ventilated and fitted with an extraction port for maximum safety. Positions are provided for up to 8 mass flow controlled gas lines, with control pneumatics and circuitry for four lines included. Fixing points are provided for wall mounting. The gas pod is mounted remote from the system console.

#### Gases: N<sub>2</sub>, H<sub>2</sub>, O<sub>2</sub>

N<sub>2</sub> for plasma nitrides and metals; H<sub>2</sub> for plasma nitrides and metals and thermal metals; O<sub>2</sub> for plasma oxides and metals and thermal metals

#### (3) Gas line without MFC bypass, excluding mass flow controller

Gas line with stainless steel VCR fittings and orbitally welded joints, including one electro-pneumatic isolation valve and one in-line 2µm filter. For use with non-toxic, non-flammable, non-pyrophoric gases. Please refer to OIPT for a detailed list of acceptable gases.



### **(3) MKS 1179A MFC with viton seals for non-corrosive applications**

MKS 1179A mass flow controller for use with non-corrosive gases. (Viton seal)

#### **100sccm N2 MKS 1179A MFC**

Detailed description of provided MFC (see above)

#### **100sccm O2 MKS 1179A MFC**

Detailed description of provided MFC (see above)

#### **100sccm Ar MKS 1179A MFC**

Detailed description of provided MFC (see above)

### **Gas line with MFC bypass, excluding mass flow controller**

Gas line with stainless steel VCR fittings and orbitally welded joints, including two electro-pneumatic isolation valves, one in-line 2µm filter and a manually operated bypass line. For use with toxic, flammable and pyrophoric gases. Please refer to OIPT for a detailed list of gases that require this gas line type.

### **MKS 1479A MFC with metal seals for corrosive applications**

MKS 1479A mass flow controller for use with corrosive gases. (Metal seal)

#### **100sccm H2 MKS 1479A MFC**

Detailed description of provided MFC (see above)

### **Bracketed water pot (included) and dose valve**

Mounting hardware for water canister (which is included) located adjacent to precursor modules. Includes 3 port fast ALD dose and purge valve.

### **Rapid bubbling and purge kit**

Separate bubbler and purge mfc's with divert system to bubblers, purge inputs and the foreline. Includes two 500sccm argon mfc and rapid divert hardware using Swagelok ALD valves.

### **Multi-bubbler cabinet populated for 3 precursors**

The precursor delivery cabinet can accommodate up to 6 bubbled precursors delivered to the chamber via two heated manifolds. Each fully purged manifold can contain a maximum of 3 precursors. Incompatible precursors or precursors to be co-injected should be placed on opposite manifolds.

This cabinet is configured with ONE manifold populated with 3 precursors. It may be field upgraded to include an additional manifold and a further 3 precursors.

The stainless steel extracted precursor cabinet with lockable doors has the following features;

- Up to 6 rapid bubbled precursors individually temperature controlled to 200°C
- 2 heated (220°C) and purged manifolds
- 3 precursors share one manifold
- Rapid pulse argon bubbling and precursor dose control achieved via software controlled rapid Swagelok ALD valves.



- High pressure isolation valve on each manifold for safety
- Nitrogen purge for use with glove panel during precursor change over

The precursor delivery cabinet houses bubbler sizes of up to 100g (contents).

### **Process control**

#### **250mTorr ALD capacitance manometer (heated version), and Penning gauge.**

Heated 250 milliTorr high resolution temperature compensated capacitance manometer with sacrificial deposition baffle to prevent membrane coating and eliminate drift and Penning gauge mounted on the chamber base plate port via a heated pipe tree.

Pressure read-back in mTorr is the default, customers that require pressure read-back in Pascal or Bar need to apply for an RSM.

#### **ALD 100mm pumping pipework plus 100mm fast APC**

Butterfly valve with built-in pressure controller, mounting directly onto pumping tee. Valve opening and closing time 0.15 seconds.

#### **ALD internal foreline heating**

The foreline is heated to avoid precursor condensation.

### **Substrate Handling**

#### **Automatic insertion load lock for up to 200mm wafers or carrier plates**

200mm capacity load lock with automatic insertion mechanism for connection to a single process chamber. Samples are loaded into the load lock via an access door on the top of the load lock chamber. Load and unload of individual samples is achieved under computer control by use of a linear robot arm. The load lock is suitable for use with wafers or carrier-plates up to 8 inch diameter (specify size required with order). Maximum sample or sample+carrier-plate thickness is 8.5mm.

#### **Adixen ACP15G Load lock dry pump**

Adixen ACP15G dry pump with N2 gas purge connection for better protection against trace amounts of corrosive gases. Suitable for use as loadlock and transfer chamber pumping.



**Integration hardware for ACP15G dry pump, including flexible tubing**

Hardware to couple a rotary pump to the system loadlock, including flexible tubing.

**Pumping Configuration**

**Adixen A300H 415V 50Hz dry pump with Roots for PECVD**

Adixen 300H Dry Pump with Roots for PECVD

**Integration hardware for A300H dry pump**

Hardware to integrate a dry pump, including purge control and digital interfacing.

**Misc**

**ASM LICENSE**

ASM licence allowing exploitation of over 280 patents including core patents on radical/plasma ALD.

**Precursor module glove box**

Glove box attachment to the front of precursor pod provides comfort and safety during bubbler change over.

**Adixen ATH500M magnetic bearing turbomolecular pump kit, corrosive compatible, including integration hardware**

Adixen ATH500M corrosive compatible magnetic bearing turbomolecular pump (needs A33CPF, A63CPF or ADP122P backing). Includes hardware to integrate the turbomolecular pump to the system, purge gas control and foreline vent facility.

**Annual maintenance kit for System100 ALD**

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