



## *Plasma Technology*

**FTMC Tender No P81, PPP 1.004, FD1**

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## **Specification No. 22102248**

# ***PlasmaPro 100 ICP-RIE***

*Reactive Ion Etching (RIE)*

*Inductive Coupled Plasma (ICP) Source (Chlorine chemistry)*

- 13 MHz supply with automatic matching at the substrate electrode.
- 3 kW Inductive Coupled Plasma (ICP 180) Source with electrostatic shielding.
- 500 l/s turbomolecular pump with dual stage rotary pump.
- 200 mm VAT gate valve with automatic pressure control.
- PC Control with OPT software under Windows 10.
- Mass Flow controlled gas lines in a sealable and purgable gas pod.
- Vacuum loadlock with turbo and dry pump.
- Visit of a process engineer from the OPT application lab  
(30 process engineers, 20 technology engineers) for process start up and training.
- Free of charge process support for the system lifetime.
- End Point Detection: Laser Interferometry/ Optical Emission.

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<b>PlasmaPro100 ICP-RIE</b>
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## **Supplier Information and Design Goals**

**Process:** The OPT application lab supports our users throughout the lifetime of the system with advise and with new processes if needed. Typically our systems are capable running a variety of processes without the need of hardware changes. New processes are permanently under development/ characterisation, so that they can be run on our existing equipment.

**Quality:** OPT is qualified according **ISO 9001 (today ISP 18002)** since 1995. In 1993 a TQM programs was started and a the position of a dedicated quality manager was created.

**Safety:** The equipment meets the European requirements like **CE mark**. The soft- and hardware is designed to ensure a safe system operation even with untrained personal.

**Software:** All the OPT systems have programmable logic controllers to ensure a safe operation. The user interface is a standard PC. OPT writes the software in house in close contact with our process engineers to ensure maximum flexibility. The software operates under Windows to allow easy communication with other software (for evaluation the datalog files or network integration etc) and to give the users a familiar environment.

### **Footprint/ Service Access:**

The OPT equipment has been designed to give minimum footprint and excellent service access (see our extensive installation documentation).

### **Modularity and Flexibility:**

Our systems are designed for easy retrofit of components like a vacuum loadlock, a variety of plasma sources (ICP65, ICP180, ICP380) or end point detectors (OE, LI, SIMS) in terms of hard- and software. The **Plasmalab 80/ 800 Plus** series single modules can be retrofitted with "slave" chambers, while the **Plasmalab System 100**, the **FlexAL**, the **Nanofab**, the **Ionfab 300 Plus** and the **Plasmalab System 400** series only include MESC compatible modules and together form our CLUSTER series, the "**System 100 Pro**".

**Installed base:** OPT supports more than 3.500 systems installed world-wide and builds > 150 new systems per year.

*OPT builds standard equipment with a variety of common components and software allowing us to carefully select and check the components. Before shipment our systems are thoroughly tested. Even the most reliable system, however, will fail some time. At OPT we consider this already in the design phase for our equipment:*

**Components:** Only components of suppliers with excellent reputation and own world-wide service network have been chosen, so that many components can be repaired locally.

**Manual:** Our manuals include the complete system documentation incl. subsuppliers manuals.

**Spares:** Common spares are shipped typically on day of order direct from our headquarter in UK.

**Service:** OPT has a world-wide service network to support its systems by telephone advise and service engineers visiting our customers. In Europe we have 12 service engineers.

# CONTENT

- (1.) PROCESS CHAMBER**
- (2.) SYSTEM CONSOLE**
- (3.) SUBSTRATE ELECTRODE**
- (4.) COMPUTER CONTROL**
- (5.) PLASMA GENERATION/ ICP SOURCE**
- (6.) VACUUM MEASUREMENT**
- (7.) GAS SUPPLY**
- (8.) PUMPING SYSTEM**
- (9.) VACUUM LOADLOCK**
- (10.) OPTICAL EMISSION**
- (11.) ADDITIONAL SUPPORT**
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**(1.) PROCESS CHAMBER**

Aluminium Process Chamber with:

- 200 mm pumping flange for very high effective pumping speed.
- front 40 mm flange with viewport.
- additional 40 mm side flange, with window for optical emission.

The chamber is made from a full block of Al.

Chamber and pumping: 100 % radial symmetric

There are no further sealings or weldings inside the process chamber for achieving very good vacuum conditions.

Electrical chamber heating (60°C).

**(2.) SYSTEM CONSOLE**

The control components are integrated in the frame.

The console contains the turbopump and the valves.

The PLC controller is mounted in the system frame.

**(3.) SUBSTRATE ELECTRODE**

**Substrate-Electrode**

Water cooled aluminium electrode, RF driven.

No water to vacuum seals.

RF power (13 MHz) as well as a heater/ chiller for temperature control can be connected to the RIE electrode.

Aluminium dark space shield (on ground potential).

Electrode diameter: 240 mm.

Heater/ chiller (-30 – +80°C) incl PC integration.

**Helium "backside cooling"**

An excellent thermal contact is achieved by a variable and controllable Helium flow through the substrate electrode. The pressure between the wafer and the electrode is a selectable process parameter and automatically controlled via its flow.

Incl. automatic, mechanical wafer clamping.

One clamp ring for a 100 mm wafer.

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**(4.) COMPUTER CONTROL**

The system is controlled by a very fast Programmable Language Controller (PLC) with digital and analogue I/O.

high speed distributed I/O that sends and receives I/O data in less than 400  $\mu$ s.

Fast data logging frequency with interval  $\leq 250$  ms.

Definition of short process steps down to  $\leq 10$  ms.

The OPT control software runs under Windows 10.

- flexible, menu-driven software, mouse.
- 22" LCD monitor.
- datalogging: The parameters to be logged can be selected from a complete list of analog/digital in- and output parameters. This selection can be stored separately from the process. The selected data will then be stored with a selectable time interval.
- DVD/CDRW drive.
- LAN card.
- indication of the actual and requested parameters.
- process control with selectable limits for the parameters.
- manual control page.
- service mode.
- automatic leak check and MFC calibration function.
- automatic CM gauge autozeroing function.
- 5 password levels: System Manager, User, Maintenance, Production, View only.

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**(5.) PLASMA GENERATION/ ICP SOURCE**

**Inductive Coupled Plasma Source (ICP): ICP180**

- Al<sub>2</sub>O<sub>3</sub> liner (inner diameter 180 mm).
- 13.56 MHz generator and automatic tuning.
- The AMU is directly coupled to the ICP source (no cables).
- Patented wide range AMU (< 2% reflected power).
- The start positions of the capacitors of the matching unit can be chosen independently for each process step.
- maximum power: 3.000 Watt.
- 25 mm flange in the top electrode for (retro)fitting a laser interferometer.
- electrostatic shielding for minimal substrate damage and wall sputtering.

**OPT ICP sources have an "electrostatic shield".**

**The ESS suppresses capacitive coupling and therefore wall and substrate bombardment.**

The chamber opening angle has been increased to 70°.

**Substrate electrode:**

- 13.56 MHz generator with automatic RF tuning.
- The AMU is directly coupled to the substrate electrode (no cables).
- Patented wide range AMU (< 2% reflected power).
- maximum power: 300 Watt.
- RF-Bias ('Self Bias') indication.
- Power/ Bias control.
- The start positions of the automatch capacitors can be independently chosen for each process step.

**(6.) VACUUM MEASUREMENT**

100 mtorr CM gauge, temperature compensated Penning gauge.

**(7.) GAS SUPPLY**

Sealable and extractable stainless steel gas pod for max. 8 gas lines.

Included are eight MFC controlled gas lines, four with a bypass line and metal sealings.

BCl<sub>3</sub> (heated), Cl<sub>2</sub>, SF<sub>6</sub>, O<sub>2</sub>, Ar, N<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>.

Gas lines electropolished, orbital welded.

Each line is equipped with the MFC, a particle filter and one electropneumatic valve, bypassed gas lines have three valves.

MFC type: MKS (others on request).

Only VCR fittings are used in the gas pod.

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**(8.) PUMPING SYSTEM**

500 l/s turbomolecular pump (Adixen/ Pfeiffer) with magnetic bearings, heated.  
33 m<sup>3</sup>/ hr dual stage rotary pump with oil filter and exhaust filter (Fomblin).  
200 mm High Vacuum Gate Valve, VAT, with automatic pressure control.  
Electrical pump pipework heating (80°C).

**(9.) VACUUM LOADLOCK**

Aluminium chamber with large top viewport.

Linear transport arm for loading wafers or carrier plates into the process chamber.  
Once the substrate has been introduced into the loadlock the whole process including substrates transfers and venting the loadlock again at the end can be done automatically.

The chamber is made from a full block of Al.  
Patented design with only 5 liter volume.  
Pumping System: 80 l/s Turbo and 15 m<sup>3</sup>/hr dry pump.  
Pressure reading: Penning and Pirani gauges.

**(10.) OPTICAL EMISSION**

**Optical Emission**

PC controlled system for taking the whole spectrum, 200 – 880 nm.  
incl automatic choice of one or more wavelengths.  
Ocean CCD1 UV/VIS CCD.

**recommended „system fingerprinting“**

**Laserinterferometry**

System for RIE with CCD camera and x/y table, 675 nm.

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**(11.) ADDITIONAL SUPPORT**

**Process guarantee.**

**Free of charge process support over the system lifetime**

**(by the OPT application lab: 35 years experience, 20 systems, 30 process engineers (mostly PhDs)).**

- preacceptance in our Yatton (UK) factory, not including any travelling expenses.
- commissioning/ final acceptance and training.
- hardware training.
- process training (during the preacceptance in the factory and the final acceptance).
- process support during and after the warranty period.
- one system manual on DVD (English).

**(12.) DELIVERY**

**Delivery:** CIP (incl packing, freight and freight insurance).

**Delivery time:** 22 weeks.

**Warranty:** 12 months after final acceptance.

**OXFORD INSTRUMENTS GmbH**  
**- Plasma Technology -**