Gambetti
Vacuum Technology and Related Solutions

ETCHING PLASMA · RIE & CLEANING

Falcon RIE+

FAL-3B-4MF

One system, infinite surfaces.

From gentle cleaning to anisotropic etching, without changing machine. A benchtop plasma reactor for microfabrication, 2D materials and frontier research.

2 modes	200 W	≥14 liters	5–8"
RIE + Cleaning	RF 13.56 MHz, 1 W step	Chamber volume	Wafers accommodated

www.plasmi.eu

CE Marked

THE PRODUCT

Two machines in one. No compromise.

Cold vacuum plasma is the fourth state of matter, put to work in the service of precision. The **Falcon RIE+** is built for those who refuse to choose between cleaning a surface and rewriting it: a benchtop reactor that combines, in a single instrument, the delicacy of plasma cleaning and the directional power of Reactive Ion Etching.

It is the platform designed for **microfabrication**, **2D materials** and frontier research, where every nanometer counts and repeatability is not optional. Its defining feature is the ability to bias, under PLC control, either the lower or the upper electrode — and switching between the two modes is handled by the software: no mechanical intervention, no manual reconfiguration.

THE HEART OF THE SYSTEM

The dual mode

You select the process from the recipe and the system sets itself up. A single relay, driven by software, decides which electrode to bias.

PLASMA CLEANING MODE

Upper electrode biased

Chemical action prevails: reactive species remove organic contaminants, activate surfaces and change their surface energy and wettability, without attacking the substrate.

RIE MODE

Lower electrode biased

Ion bombardment becomes directional: ions are accelerated perpendicular to the surface and etching turns anisotropic. You etch where you need to, in the direction you want.

From gentle cleaning to anisotropic etching, without changing machine.

PROCESS ARCHITECTURE

A confined, uniform and clean plasma

The geometry of the chamber and the electrodes is engineered for purity and repeatability: essential conditions when processing wafers or sensitive materials.

Aluminum chamber with hinged door and inspection window: planar, parallel electrodes in a dark shield configuration.

Configuration with dedicated trolley: HMI on an adjustable arm and housing for the process gas cylinders.

01 Dark-shield electrodes

Both electrodes are built in a **dark shield** configuration. The shielding confines the plasma to the useful region between the electrodes, prevents discharges on the chamber walls and drastically reduces sputtering contamination. The result is a more uniform plasma over the working area and cleaner, more repeatable processes.

02 Integrated gas distribution

The upper electrode serves a second purpose: it distributes the process gases evenly through a **network of channels** precision-machined into the body of the electrode. Gas does not enter from a single point, but reaches the entire surface to be treated uniformly.

03 Linear top-down pumping

The gas flow follows a direct, vertical path, top to bottom, from the electrodes to the exhaust. This geometry promotes the **orderly evacuation** of process species and by-products, improves plasma stability and reduces recirculation and dead zones.

04 High vacuum as standard

For processes demanding maximum ion directionality, the **turbomolecular pump** is fitted as standard. Dedicated software control manages aggressive fluorinated gases, isolating the turbo with the gate valve whenever they are used: the machine protects both itself and the operator.

DESIGNED AND BUILT BY GAMBETTI

The RF core is ours, down to the last component

The solid-state RF generator **GGK-RF15** and the automatic matching network **GGK-AM1** are designed and built in-house. The high-efficiency output stage converts energy into radio frequency with 85% efficiency: less heat and longer life.

The matching network transforms the variable impedance of the plasma load into the 50 Ω required by the generator. **Mastering this technology means mastering the plasma**: no black box, no reliance on third parties, a single point of contact.

13,56 MHz	10–200 W	85 %	50 Ω
Standard ISM frequency	Adjustable power, 1 W step	Output stage efficiency	Automatic matching

PLC control with graphic HMI

The Falcon RIE+ is fully automated by a high-performance **industrial PLC** with a 10" color touch screen. You can operate manually, acting on valves, flow sensors and generator, or automatically, letting the PLC run the entire sequence of a saved recipe.

- **50 recipes** can be stored, each with 2 programmable steps, covering power, flows, times, matching presets and mode
- **Pulsed plasma** available for fine control of the energy delivered to the process
- **3 access levels**: Administrator, Process Engineer, Operator
- **Datalogging** of forward/reflected power, flows, pressure and capacitor positions
- **Safety interlocks** that prevent damaging errors upstream

10" graphic HMI: real-time synoptic view with RF power, gases, pressure, DC bias and component status.

FIELDS OF APPLICATION

Where the Falcon RIE+ makes the difference

Simply selecting a recipe takes the system from the gentlest cleaning to the most demanding anisotropic etching.

Microfabrication

Chemical and physical etching in micro- and nanofabrication processes, with the characteristic control of ion directionality.

2D materials

Gentle etching of graphene and MoS_2, where soft etching and repeatability are decisive.

Resist removal

Photoresist descumming and ashing, removal of thin polymer layers and organic residues.

Surface energy

Modification of surface energy and wettability, surface activation for adhesion and bonding.

Texturing & patterning

Micro- and nanometric texturing and patterning, with profiles controlled via self-DC bias and reactive gases.

Dielectric etching

Etching of silicon, Si_3N_4 and SiO_2 thanks to the wide range of power density per square centimeter.

VACUUM MEASUREMENT AND GAS CONTROL

Vacuum measurement

Pressure is monitored by a set of sensors spanning the entire operating range, **from atmosphere down to 10^{-6} mbar**, complemented by an absolute capacitance manometer for high-precision measurement during the process. The same signals feed the gas and RF-power interlocks for safe operation.

Gas control

Industrial-grade digital mass flow controllers, with **500 ms** response time and **1%** accuracy. Compatible with O_2, Ar, N_2, SF_6, CF_4 and forming gas. Each line has its own shut-off valve and joins a single manifold; an additional line vents the chamber with nitrogen or air.

TECHNICAL DATA

Technical specifications

DIMENSIONS & STRUCTURE

Dimensions (W×D×H)	850×680×800-1000 mm
Net weight	110 kg
Chamber material	Aluminum
Chamber volume	≥14 L, Ø252×250 mm
Wafers accommodated	5", 6", 8"

ELECTRODES

Configuration	Planar & parallel
Shielding	Dark space shield
Useful area	Ø210 mm
Electrode gap	162 mm

RF SYSTEM

Generator	GGK-RF15
Frequency	13.56 MHz
Power	10-200 W, 1 W step
Matching network	GGK-AM1 automatic
Pulsed plasma	Available

PROCESS GASES

Gas lines	up to 4
MFC full scale	100-200 sccm
Compatible gases	O_2, Ar, N_2, SF_6, CF_4
MFC accuracy	1% · 500 ms response

VACUUM

Measuring range	atm ÷ 10^{-6} mbar
Manometer	Absolute capacitance
Turbo (standard)	High vacuum
Exhaust	NW25 ISO-KF

CONTROL

Interface	PLC · 10" color touch
Recipes	50 recipes, 2 steps
Access	3 password levels

POWER SUPPLY & COMPLIANCE

Power supply	220/240 VAC, 8 A max
Mains frequency	Single-phase+E · 50/60 Hz
Compliance	CE marking

IN SUMMARY

The Falcon RIE+ puts a complete plasma reactor in the hands of the researcher and the process engineer: **dark-shield electrodes** for purity and uniformity, **linear top-down pumping** for a stable plasma, **PLC control** for full traceability, and an RF core entirely designed and built by Gambetti Kenologia.

A system conceived, built and guaranteed by people who have always known plasma.

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