Omega® 201

Manufacturing production tools for the semiconductor industry.

TRIKON
TECHNOLOGIES


MØRI™ 200
DANGER
DANGER
AUTION
WARNING
STRONG MAGNETIC FIELDS
WARNING HOT SURFACE
DANGER
DANGER

The Omega® 201

Trikon Technologies Omega® 201 single wafer etch tools are used by many of the World's leading high volume semiconductor device manufacturers – people making the things that you use every day. Market demand for this product is increasing, based upon process performance and flexibility, production worthiness and industry leading cost of ownership. Our process chamber technology continues to keep the Omega® 201 at the forefront of mainstream semiconductor applications – whether it be the diversifying Si market or the exploding III-V communications revolution. Four main process chambers are flexible enough to cover the majority of today's applications and offer extendibility well beyond the requirements of the ITRS Roadmap.

Driving down the cost of ownership

Omega® 201 etch tools have been designed specifically with low cost of ownership in mind. Hardware commonality with PVD and CVD tools in the '200 Series' reduces spare parts inventory and training costs. Unparalleled process flexibility is combined with the smallest footprint of any tool in its class to deliver a higher number of wafers per square meter of fab space than any clustered alternative. A steady production flow results with higher overall tool availability. By completely eliminating the need for 'process kits' the Omega® 201 can tackle most applications with a minimum number of consumable parts. At the heart of each process chamber is a Trikon designed electro-static chuck. Its simple and elegant design makes it highly effective in controlling the wafer temperature (even through carriers such as sapphire). With a guaranteed lifetime of at least 50,000 wafers it is reliable enough not to be considered a consumable.

These features combine into significant customer benefits, which allow the manufacture of today's increasingly complex and functional devices with high yield and superior cost of ownership.

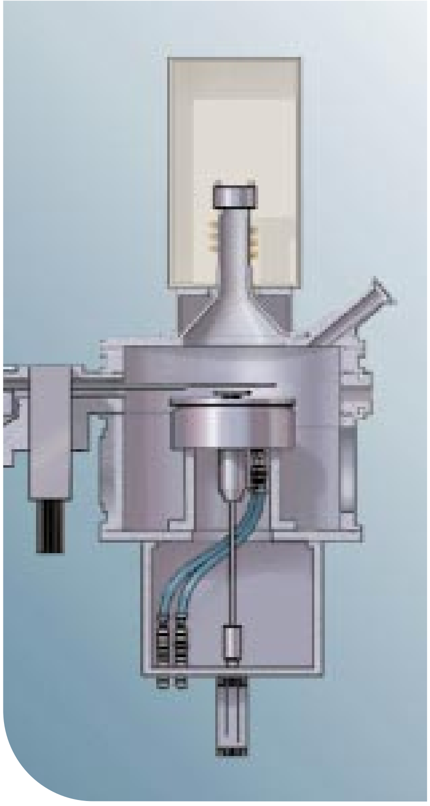
● *Omega® 201-2 ICP*

Plasma-enhanced RIE (PERIE)

The PERIE process chamber produces a medium density plasma typically in the 50-800 mtorr pressure range.

Single chamber, multi-mode flexibility

In downstream mode (top power only) an inductively coupled plasma with a high concentration of reactive neutrals is formed within a ceramic plasma tube. These neutrals result in predominantly chemical, isotropic etching at the wafer. In RIE mode (bottom power only) the wafer is subjected to anisotropic etching conditions due to ion assistance. By powering both electrodes a medium density plasma with a higher than normal flux of neutrals is created.

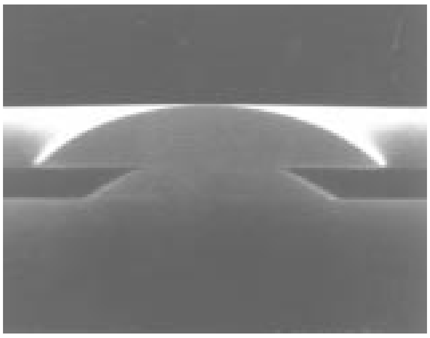


● *Omega® 201 PERIE chamber*

The Omega® 201 PERIE tool is ideal for standard applications (including oxide, nitride, polysilicon, crystalline Si & polyimide) where the minimum feature size is down to 0.5µm.

Generic, simple hardware

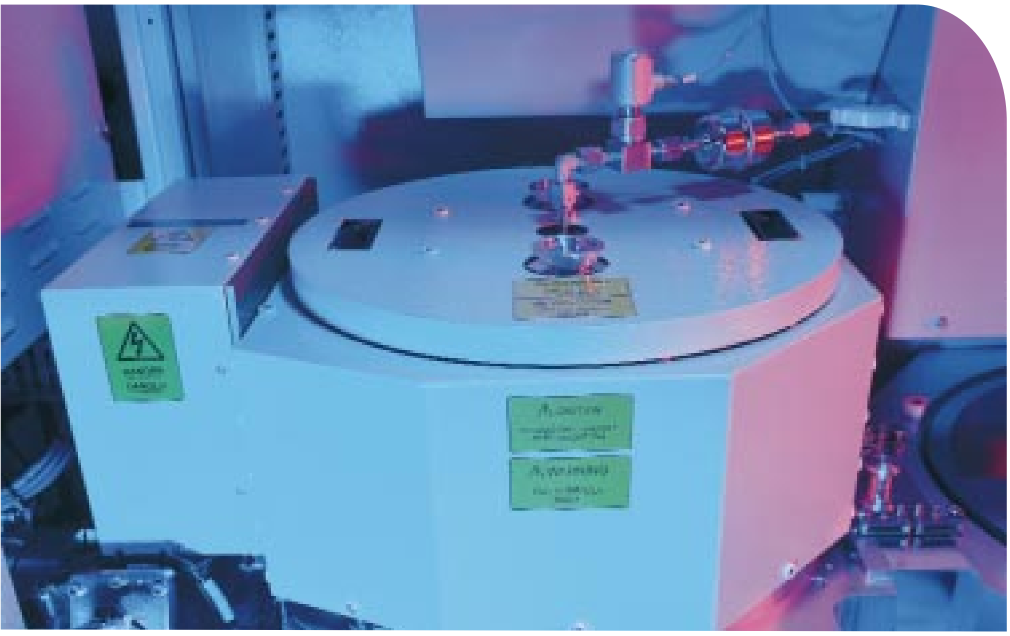
For all applications the chamber hardware remains the same – there is no need to introduce application specific ‘process kits’ like other etch vendors. It is particularly well suited to ‘recess’ etching where the requirement is to deliberately undercut the mask in a controllable fashion.



● *Polysilicon recess etch*

Inductively Coupled Plasma (ICP)

The ICP process chamber produces a high-density plasma (~10^{11}-10^{12} cm^{-3}) typically in the 3-30 mtorr pressure range. The plasma is formed by inductively coupling RF at 13.56 MHz through a ceramic chamber wall. By varying the RF bias to the electro-static chuck the degree of ion bombardment at the wafer surface can be also be varied. The low operating pressure ensures that etching is predominantly anisotropic.



- *Omega® 201 ICP chamber*

Metal etch flexibility

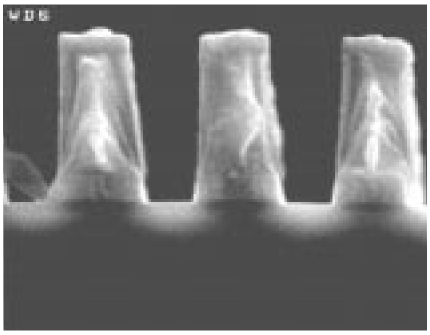
In the case of Al alloys the ICP is equally at home etching 0.25µm features, alloys with up to 4% Cu and thicknesses to ~10µm. By using a simple chemistry of Cl2 or Cl2/HBr the tool returns higher selectivities to resist and underlayers than tools competing in the same class but still maintains high etch rates and control over the etch profile. Our mini all dry post etch corrosion station ('podule') combines a downstream RF plasma with wafer heating for fast resist stripping and removal of chlorine residues from the wafer – no water treatment is needed. The result is corrosion resistance to >48 hours for a wafer left in atmospheric conditions.

Diverse applications, no 'plasma kits'

The Omega® 201 ICP tool is ideal for a range of etch applications (including Al alloys, polysilicon, nitride, crystalline Si, copper, dry develop schemes and various III-Vs). For all applications the chamber hardware remains the same – there is no need to introduce application specific 'process kits' like other etch vendors.

Generic, simple hardware

The Omega® 201 ICP has been used to etch polysilicon down to 0.35µm feature size and even for dry developing resists with feature sizes down to 25nm!



- *0.25µm Al1%Si*

m=0 Resonant Induction (M0RI™)

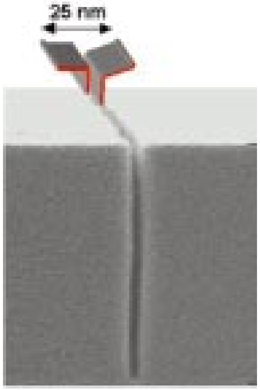
The World's most advanced plasma source

The M0RI™ is capable of stable operation in 3 principal modes without the need to change any hardware.

In 'helicon mode' a very high-density plasma ($\sim 10^{12}$-10^{13} cm^{-3}) at pressures typically in the 1-25 mtorr range is produced. A pair of electromagnets is used to create a magnetic zero helicon wave and to shape the plasma so as to fine tune the etch rate uniformity. In 'RIE mode' a set of permanent magnets is used to enhance RIE processes typically at 30-500 mtorr. 'Downstream mode' is used for cleaning the internal surfaces of the reactor.

Simply change the chemistry

This multi-mode flexibility is offered with one hardware set and without the need to bias the chemistry by loading in additional surfaces such as Si 'roofs'. The result is a simple and elegant plasma tool where the process is changed principally by changing the etch chemistry.



● *Oxide etch at 25nm, 30:1 AR*

● *Omega® 201 MORI™*

Challenging the ITRS Roadmap

The Omega® 201 M0RI™ is the only commercially available plasma system in the World to have successfully etched features in silicon oxide with 25nm width at 30:1 aspect ratio.

Meeting the low κ etch and strip challenge

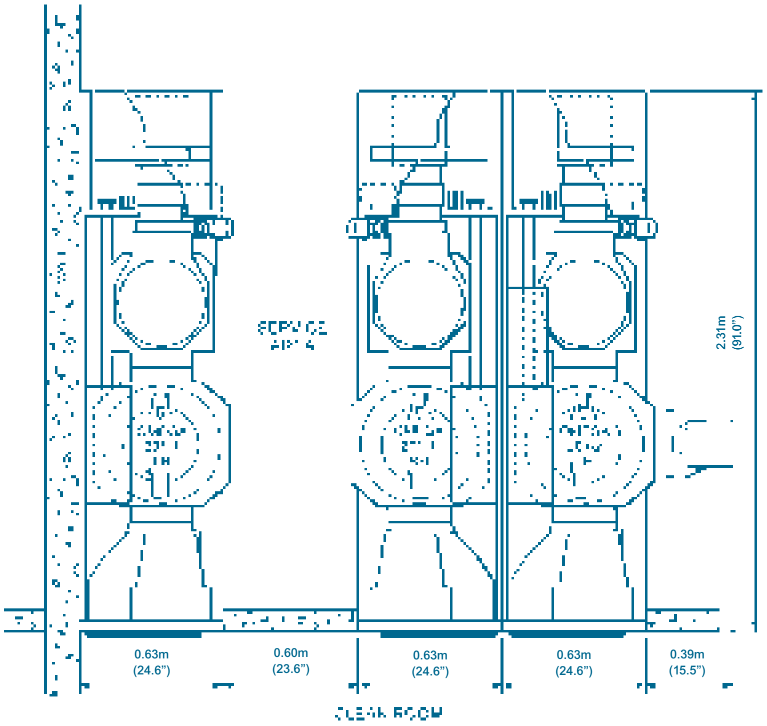
The multi-mode flexibility is ideal for the etching of dielectric stacks containing low κ layers. Features at 0.1µm and 7:1 aspect ratio have been achieved through a carbon doped oxide with a κ value of 2.7 - another World first. According to the ITRS Roadmap such features will not be required in production until ~2004.

The same hardware set is also capable of etching ~80nm gates in polysilicon.

Not Just Features – Real Benefits

Making non-consumable ESCs a reality

Trikon's electro-static chuck (ESC) is a durable, thick ceramic, bipolar device capable of clamping a range of wafers including Si, GaAs and InP - even on sapphire carriers. It is extremely reliable and this strongly differentiates it from competitors. 'Grooved' and 'flatted' variants ensure that the wafer temperature is uniform even for applications where the bias power is high (e.g. for oxide). Running downstream plasmas when no wafer is present can conveniently clean the ceramic of the ESC.



● *Tool footprint*

Efficient use of Fab Space

All Omega® 201 systems are available either left or right 'handed' and only require service access from one side and the rear. This means that tools can be positioned so as to occupy a minimum amount of fab space by sharing service chases or using spaces close to solid partitions. In fact 3 tools can easily be arranged to fit into 80% of the space normally required by a 3 chamber cluster tool - leading to a higher effective throughput per square metre of fab space and higher tool availability from the independent handlers.

Benefits Summary

- Production proven, high volume wafer processing
- 3" to 200mm compatible
- Flexible and elegant plasma sources
  M0RI™, ICP, PERIE and post etch corrosion
  Common hardware for multiple applications
- High reliability, non-consumable ESC
- Smallest footprint in its class
- Low cost consumables
- Lowest cost of ownership in the business
- World first oxide results at 25nm
- World first low κ results at 0.1µm

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