

# Surface Wave Plasma Etching Equipment "4010"

by

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## Synopsis

The small feature size of semiconductor devices makes strong demands on the processing capability of dry etching technology. Surface-Wave-Coupled Plasma (SWP) with superior process performance for the small feature size of semiconductor devices and with the advantage of easily making the generated plasma large and uniform has been developed for oxide etching by Sumitomo Metal Industries, Ltd.. We are preparing to bring this system to market and to accept orders.

## 1. Equipment

The system view is shown in **Photo 1**, the chamber components are shown in **Fig. 1**, and the system layout is shown in **Fig. 2**.

- (1) Surface wave coupled plasma source that easily permits high density and large area plasma generation.
- (2) Plug-in type multiple chamber that offers high reliability and easy maintenance.
- (3) Object oriented high performance software.

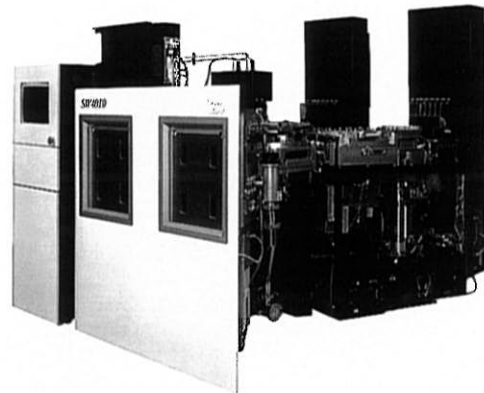


Photo 1 "4010" system

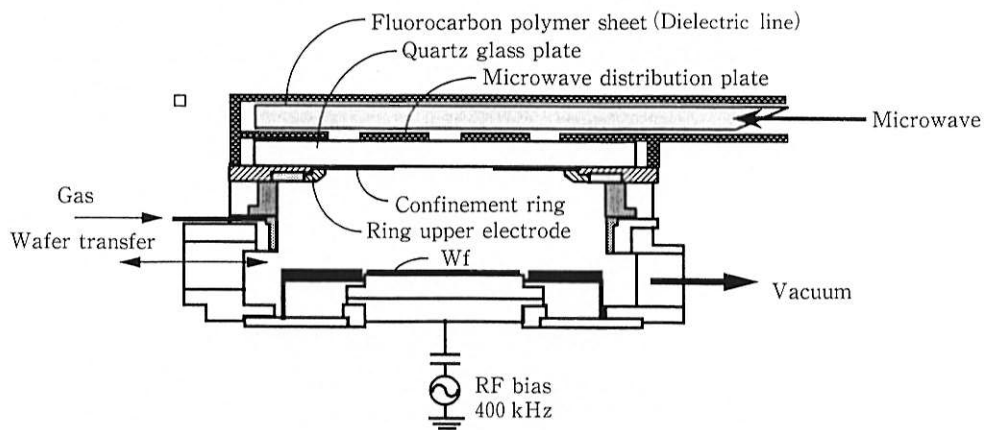


Fig. 1 Chamber components

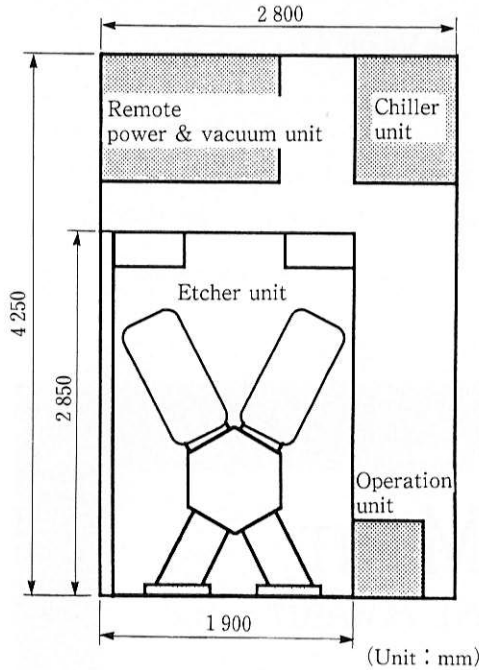


Fig. 2 System layout

## 2. Features of Surface Wave Coupled Plasma

Table 1 shows the pressure region where etching is possible.

- (1) Can be used over a wide pressure range from low pressure to high pressure.
- (2) Large areas can be easily covered by expanding the dielectric line.

Table 1 Pressure region where etching is possible

SWP Plasma Generation Capability

	RIE	IEM	SWP	ICP, ECR
1 000mT			LCD Helios	
100mT			O <sub>2</sub> cleaning recipe	
			Standard recipe	
10mT				
1mT				

## 3. Process Performance (at a pressure of 20mTorr)

Photo 2 shows the profile after contact hole etching.

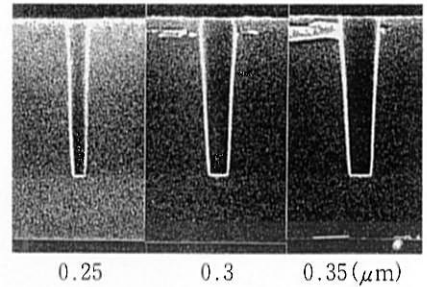
- (1) Etching rate  
High speed etching is possible. (BPSG inside the hole: >8 000/min)
- (2) Profile: Good profile can be obtained even in very small contact holes.
- (3) Uniformity: 3 to 8%
- (4) Selectivity to photoresist : 15 to 20  
Selectivity to silicon : >50

## 4. Conclusions

Surface wave coupled plasma is applied to dry etching of semiconductors as a new plasma source that has not so far been used, and its superiority is becoming established.

From now on, one of its advantages — large area — is to be realized and we are planning to promote the development of 300mm equipment.

SW 4 010 small contact hole profile



Hole depth : 1.5 μm  
Aspect ratio : 6

Film : BPSG  
CHF<sub>3</sub>/CO chemistry

Photo 2 Profile after contact hole etching

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