Phantom ICP
Failure Analysis Datasheet

System Description

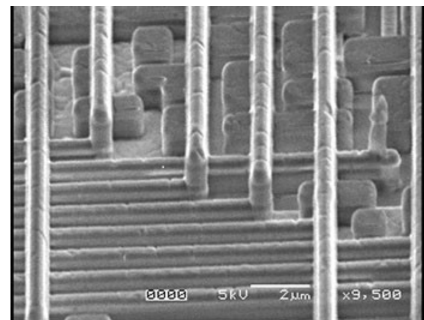
The Phantom ICP is designed to supply failure analysis laboratories with state-of-the-art plasma etch capability using single wafers, dies or parts using fluorine and oxygen based chemistries. The system has a compact, modular design built on a space-saving platform. The system uses Inductively Coupled Plasma to increase the etch rate, whilst reducing damage to devices. The system also can be run in Reactive Etch mode.

Technology	Inductively Coupled Plasma (ICP)
RF	600W 13.56 MHz on chuck
Chuck type	Water Cooled
Chuck Fluid Temperature Range	15 – 25°C
Temperature Control?	Recirculator
Gas Requirements	CF_4, O_2, and SF_6
Turbo Required?	Yes
Roughing Pump	23.3 cfm rotary vane pump

Silicon Oxide

This process will etch thermal oxide, PECVD oxide, TEOS oxide, PSG and BPSG at approximately the same rates. The process is highly ion driven, and is well suited for anisotropic removal of inter-level dielectrics during failure analysis.

Material	SiO_2
Substrate Size	Die to 8” (200mm)
Etch Rate	>1000 Å /min
Uniformity	<5 %
Selectivity to Photoresist	≥ 1:1
Selectivity to Si	≥ 7:1
Reproducibility	≤ ± 2.5%



Courtesy of Chipworks

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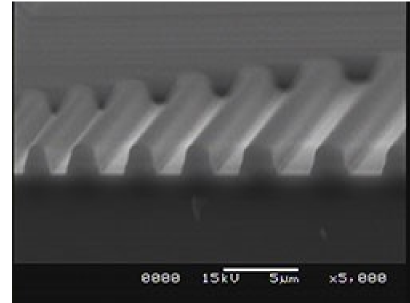
Silicon Nitride

The silicon nitride etch process is more chemical in nature than the oxide etch process.

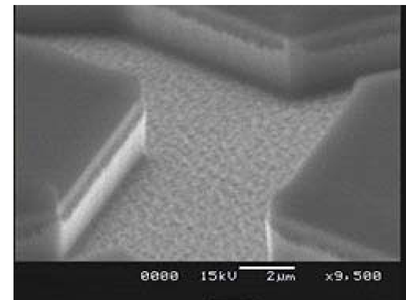
Material	SiN_x
Substrate Size	Die to 8” (200mm)
Etch Rate	>1600 Å /min
Uniformity	<5 %
Selectivity to Photoresist	≥ 8:1
Selectivity to SiO_x	≥ 2:1
Reproducibility	≤ ± 2.5%



Bulk Silicon

This process will etch Silicon using a SF_6/O2 chemistry. Higher rates are possible if selectivity, or uniformity is not critical.

Material	Silicon
Substrate Size	Die to 8” (200mm)
Etch Rate	>40,000 Å /min
Uniformity	<5 %
Selectivity to SiO_x	≥ 70:1
Reproducibility	≤ ± 2.5%



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Photoresist

This recipe can also be used to clean up any organic materials.

Material	PR
Substrate Size	Die to 8” (200mm)
Etch Rate	>4000 Å /min
Uniformity	<5 %
Reproducibility	≤ ± 2.5%

Polyimide

This recipe can also work on some encapsulation materials as well as some epoxies.

Material	PI
Substrate Size	Die to 8” (200mm)
Etch Rate	>5000 Å /min
Uniformity	<5 %
Reproducibility	≤ ± 2.5%

Definitions:

Etch Rate: Measured in Å/minute, and is determined by:

1) Partially etched film, recording the etch time,
2) Measure 5 points over the wafer surface, center point and at edge (outside of exclusion zone) at 4 points, 90 degrees apart from each other,
3) Etch rate is determined for each point by dividing the etch depth at the point by the time to perform the etch,
4) Determine the average etch rate by summing the five values and dividing by 5.

Uniformity (Within Wafer): $\frac{\text{(Maximum Etch Rate-Minimum Etch Rate)}}{2\times\text{(Average Etch Rate)}}$

Uniformity (Wafer to Wafer): For 5 consecutive wafers run, determine wafer to wafer uniformity by:
$\frac{\text{(Highest Avg. Etch Rate-Lowest Avg. Etch Rate)}}{2\times\text{(Average Etch Rate of the Five Wafers)}}$

Exclusion Zone 6mm on a 200mm wafer

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