

Phantom RIE Failure Analysis Datasheet

System Description

The Phantom RIE is designed to supply failure analysis laboratories with advanced 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.

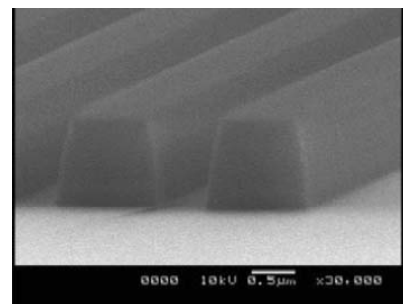


Technology	Reactive Ion Etch
RF	600W 13.56 MHz on chuck
Chuck type	Water Cooled
Chuck Fluid Temperature Range	15 – 25°C
Temperature Control?	Recirculator
Gas Requirements	CF ₄ , O ₂ , and SF ₆
Turbo Required?	Yes
Roughing Pump	23.3 cfm rotary vane pump

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	>500 Å /min
Uniformity	<5 %
Selectivity to Photoresist	≥ 1:1
Selectivity to Si	≥ 7:1
Reproducibility	≤ ± 2.5%



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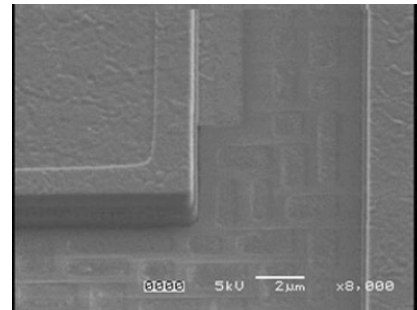
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Silicon Nitride

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

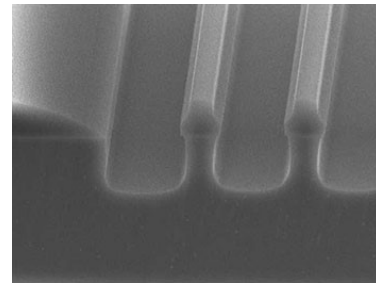
Material	SiN _x
Substrate Size	Die to 8" (200mm)
Etch Rate	>1000 Å /min
Uniformity	<5 %
Selectivity to Photoresist	≥ 8:1
Selectivity to SiO_x	≥ 2:1
Reproducibility	≤ ± 2.5%



Bulk Silicon

This process will etch Silicon using a SF₆/O₂ chemistry. Higher rates are possible if selectivity, or uniformity is not critical.

Material	Silicon
Substrate Size	Die to 8" (200mm)
Etch Rate	>5,000 Å /min
Uniformity	<5 %
Selectivity to SiO_x	≥ 50:1
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	$\leq \pm 2.5\%$

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	>1500 Å /min
Uniformity	<5 %
Reproducibility	$\leq \pm 2.5\%$

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):

(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:

(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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