ROCHESTER INSTITUTE OF TECHNOLOGY
MICROELECTRONIC ENGINEERING

Photoresist Removal Recipes

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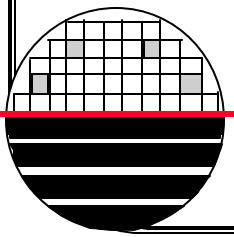

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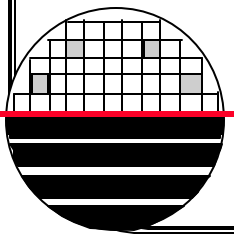
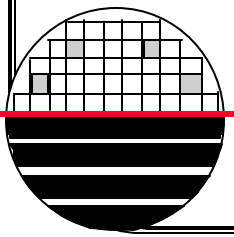


INTRODUCTION

Removal of photoresist can be achieved several ways. Positive photoresist can be removed using acetone followed by water rinse. Other less flammable and more aggressive solvents can be used on both negative and positive resists. Oxygen plasma removal of resist is the preferred approach because it uses only small amounts of oxygen and no chemical waste problems.



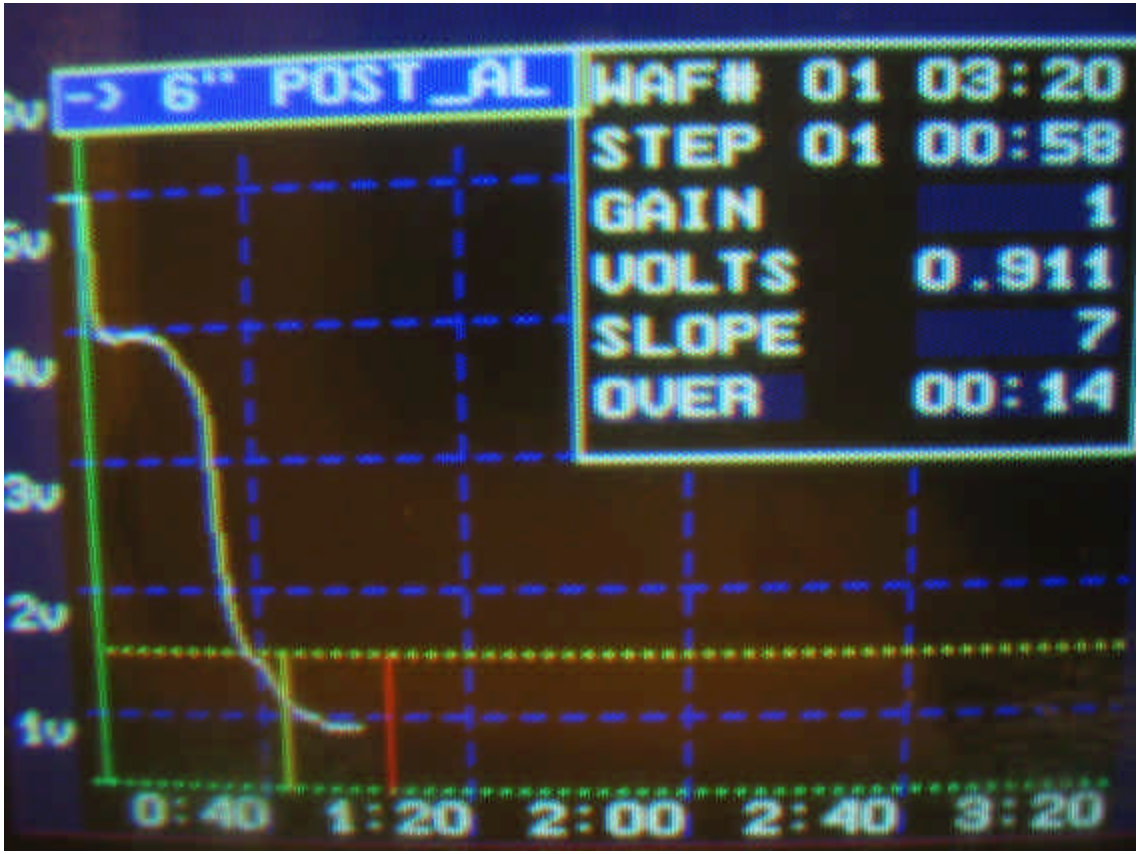
BRANSON ASHER

O_2 + Energy = 2 O

O is reactive and will combine with plastics, wood, carbon, photoresist, etc.

RF Power = 500 watts
Heat Lamp = 1800 watts for 20 sec.
O_2 Flow = 5000 sccm
Pressure = 4500 mTorr
Endpoint Detection
Time ~ 2 min./wafer with Endpoint
Max Time = 3.5 min

OPTICAL END POINT (EOP)



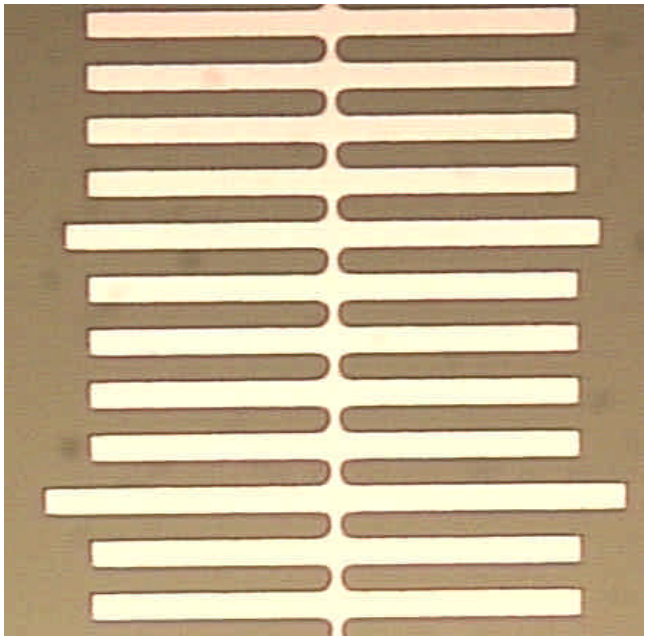
	EOP
Slope	30 mV/s
Max Value	1500 mV
Percent Drop	70%

6” FACTORY RECIPE

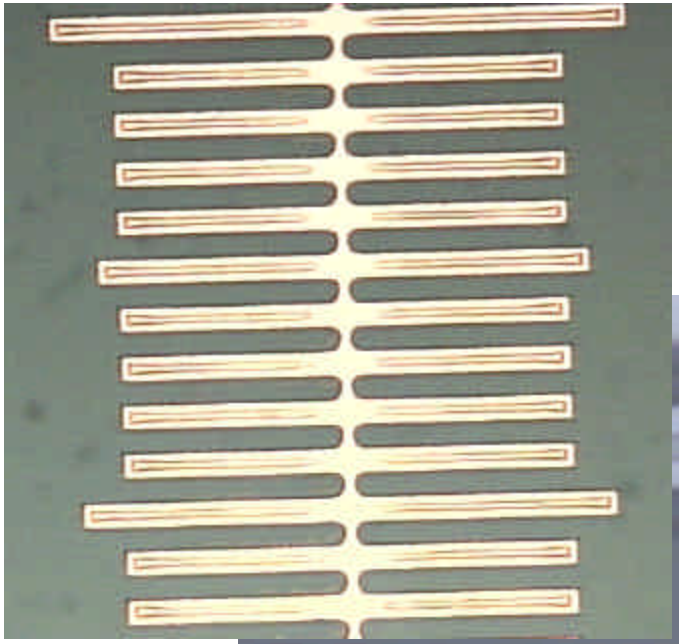
Step	1	2	3	Comment
Pump Down	Fast	Fast	None	Slow might reduce particles
Purge	Slow	None	Fast	When chamber is open flow N2 (purge) slow, fast or none
Step Terminator	EOP	Time	Time	EOP is optical endpoint
Step Time (s)	-	5	5	If step terminator is time use this value
RF Forward (W)	500	0	0	
Lamp Watts (W)	1800	0	0	
Lamp Time (s)	20	0	0	
Platen Temp (C)	40	40	40	
Platen Mode	Up	Up	Up	
Pressure (mTorr)	4500	50	8000	
Gas 1 (O2) (sccm)	5000	0	0	
Gas 2 (He) (sccm)	0	0	3000	
EOP Timeout (s)	200	-	-	If endpoint does not work stop at this time
EOP Gain	1	1	1	
EOP Delays (s)	40	-	-	
EOP Base Avg. Time (s)	0	-	-	
Max EOP Amplitude (mV)	1500	-	-	For endpoint signal must be below this value
EOP Amplitude %	0	-	-	
EOP Slope (mV/s)	30	-	-	For endpoint signal must have slope less than this value
EOP Time (s)	4	-	-	
Max Overstrip Time (s)	14	-	-	
EOP Overstrip %	70	-	-	

INSPECTING WAFERS AFTER ASHING

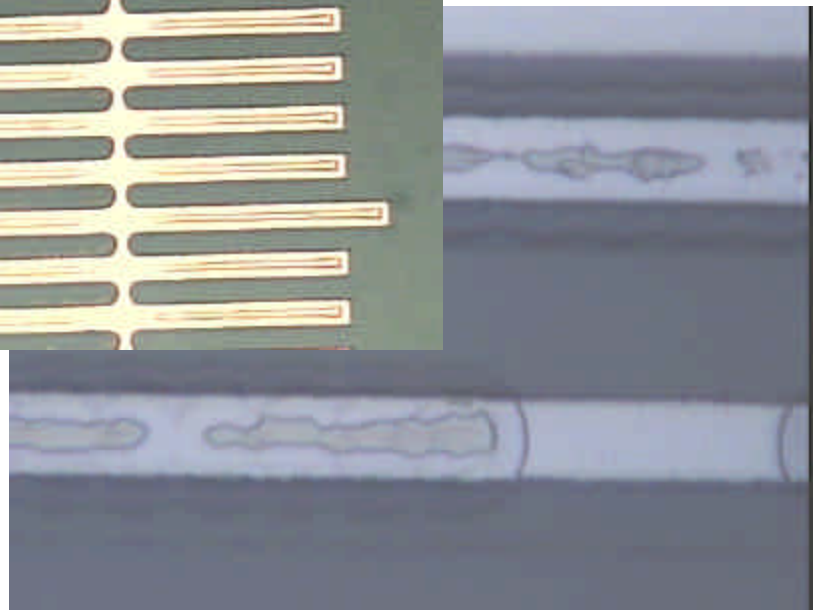
It is important to inspect the wafers after photoresist removal to verify that all of the resist is gone



No Resist

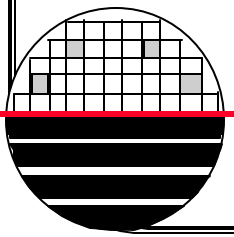


Residual Resist



RESIST REMOVAL AFTER HIGH DOSE IMPLANT

Resist removal after high dose ion implants is sometimes difficult due to resist hardening caused by heating during the ion implant.

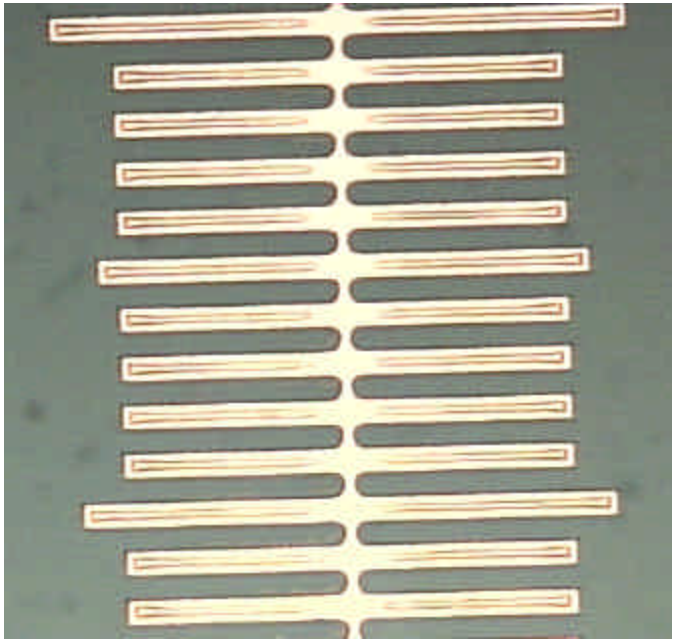


RESIST REMOVAL POST CHLORINE RIE ALUMINUM ETCH

Problem: Photoresist is hardened (and chemically changed) in Chlorine RIE during Aluminum etch and ashing is ineffective in removing the resist.

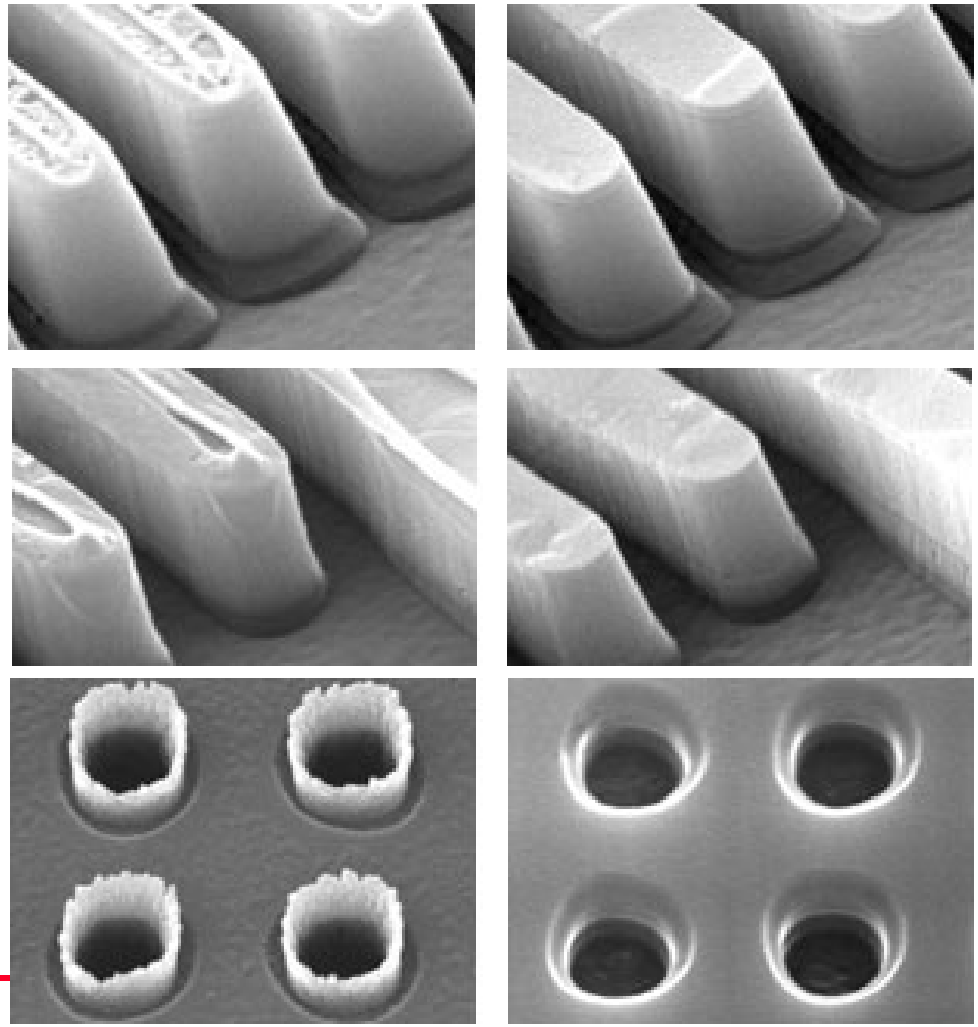
Solution: Use a Solvent based photoresist stripper process. (similar to Baseline CMOS process at U of California at Berkeley)

Picture of aluminum wafers post chlorine RIE and after ashing. Note resist remaining on aluminum. Even very long ashing (60 min.) does not remove residue.



MORE PICTURES OF RESIST SCUM PROBLEM

Pictures on left show resist residue after ashing. Pictures on right show effectiveness of ACT 935 solvent strip process.

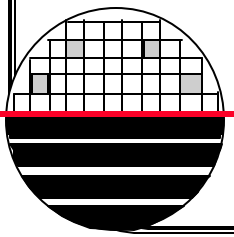


From: [ACT-CMI Data Sheet]

RECOMMENDATIONS

A solvent based photoresist stripper followed by a plasma ash is effective at removing Chlorine hardened resist.

1. Solvent strip 10 min., Rinse in DI for 5 min.
2. Spin Rinse Dry.
3. 6” Factory recipe on the Branson Asher.



LAM 490 ETCHING OF PARYLENE, CARBON FILM (DIAMOND LIKE FILM) AND PHOTORESIST STRIPPING

Etch Rate (for Resist) = 3500 Å/min
Etch Rate (for Parylene) = 3000 Å/min
Etch Rate (for Carbon) = 2500 Å/min

Step 01
Pressure = 225 mTorr
Power = 0 watts
Gap = 1.5 cm
O2 Flow = 100 sccm
He Flow = 50 sccm
Time = 60 sec

Step 02
Pressure = 225 mTorr
Power = 225 watts
Gap = 1.5 cm
O2 Flow = 100 sccm
He Flow = 50 sccm
Time = thickness/rate

Chamber clean is same etch recipe with step 02 time of 10-20 min. using bare 150 mm silicon wafer

REMOVAL OF BLUE RESIST

Solvent strip at room temperature will remove blue resist.

ImageOn from
RIT Bookstore 12”x10’x0.002” thick
for $18

Blue resist is a thick (50, 100, 150 µm) negative resist that is laminated to the substrate such as wafers, PCBs, etc.

REFERENCES

1. “Silicon Processing”, Stanley Wolf
2. EMCR650/731/732 lecture notes on line at http://people.rit.edu/lffeee