



PRX-127

ADVANCED POSITIVE PHOTORESIST STRIPPER & PLASMA ETCH POLYMER REMOVER FOR COPPER METALLIZATION

PRX-127™ Is a high performance positive photoresist stripper formulation developed by SVC to strip bulk photoresist and post plasma etch residue from advanced microelectronic devices. PRX-127 removes tenacious hard baked, high dose ion implant, deep UV baked, and plasma etched resists without damage to sensitive thin films. PRX-127 is also highly effective for stripping anti-reflective coatings (ARCs), and has proven to be effective on post etch sidewall polymers and organometallic residue.

PRX-127 has demonstrated superior performance in sub-micron wafer-fabrication with copper damascene processes, flat panel display (FPD) applications, and magnetic thin film head (MR/GMR) manufacturing.

FEATURES AND ADVANTAGES

- Rapid stripping of (+) photoresist hard baked to > 200 °C
- Bulk photoresist strip and post-etch polymer removal in one process
- Complete dissolution of anti reflective coatings-ARC films
- Advanced copper corrosion inhibitor technology (Cu Etch Rate <1-2Å/min.)
- Proven performance on dual-damascene process with standard and Low-k dielectrics (CVD & Spin-on)
- High loading capacity (> 1000-8" wafers)
- Low operation temperature 50-90 °C
- Compatible with automated immersion and chemical spray processors
- 100% Water soluble
- No SARA Title III reportable chemicals
- Non-Toxic and 100% Biodegradable with low VOC
- NFPA Hazard Code: H=1 F=1 R=0

Note: The information contained in this document is based upon research and is considered accurate to the best of our knowledge. However, no warranty is expressed or implied regarding the accuracy and/or results to be obtained.



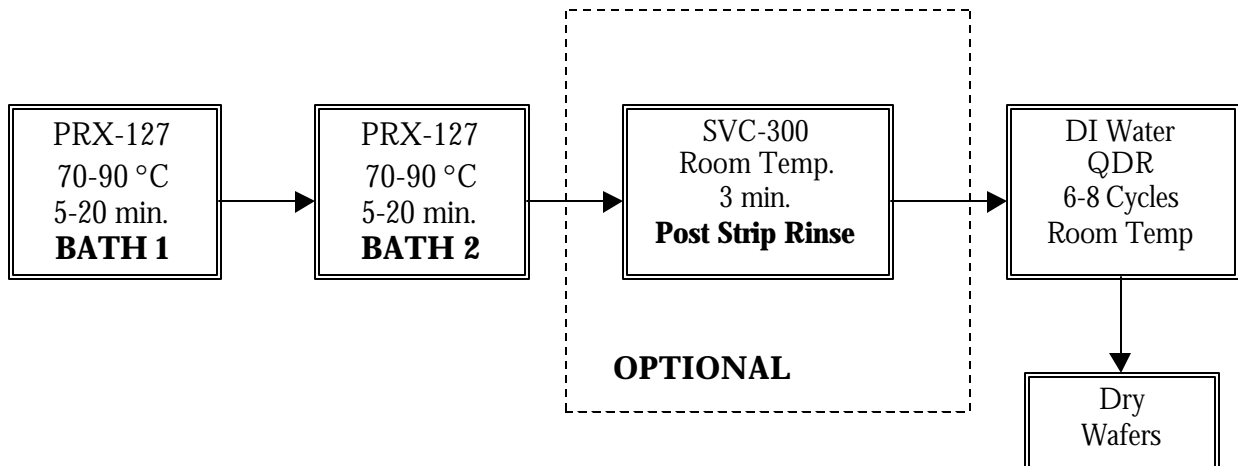


PRX-127 IC POLYMER REMOVAL APPLICATION NOTE {Wet Bench Immersion Process}

PRX-127 is a high performance post-etch polymer remover and positive resist stripper developed by SVC to strip positive photoresist and cross-linked organometallic sidewall polymer from sensitive substrates (patent pending). The following is a general guideline for immersion wet bench process setup. The operating temperature and process time may be adjusted for specific conditions and individual applications.

Recommended Process

1. Set up two stripping tanks of PRX-127 stripper solution.
2. Set solvent tank temperatures between 70-90 °C (80 °C baseline).
3. Place dry wafers in bath #1 for 5~20 minutes (mechanical or sonic agitation recommended).
4. Transfer the wafers from bath #1 to bath #2 for 5~20 minutes.
5. Remove the wafers from bath #2 and transfer to optional SVC-300 rinse for 2~3 minutes. ²
6. Transfer the wafers to a D.I. water rinse tank (quick dump rinse) for 6-8 cycles.
7. Spin-dry the wafers.



Note 1 - Wafers, boats and handles must be dry of water before entering PRX-127.

Note 2 - PRX-127 is formulated for direct DI water rinse. For sub-half-micron aluminum features SVC recommends a neutralizing rinse post strip. SVC-300 is non-flammable and non-toxic IPA





replacement for this intermediate rinse step.

PRX-127 APPLICATION NOTE FOR A SEMITOOL SPRAY SOLVENT SYSTEM (SST 2-Tank System)

The following is a PRX-127 process recipe for use with a 2-Tank SEMITOOL spray solvent system. The operating temperature and process times may be adjusted for specific conditions and individual applications.

Recommended Process

1. Fill two chemical tanks with PRX-127.
2. Insert a cassette into the process chamber.
3. Program the processor as follows
 - a. Set tank 1 temperature between 45~55 °C.
 - b. Set tank 2 temperature between 70-90 °C. (Baseline of 80 °C)
 - c. Detailed Programming

Step	Step Name	Action	Drain	RPM	Time
1	RAMP		WD	30	0:15
2	T2CHM2	Tank 2 (Man 1)	Chem2	30	0:10
3	T2RCLM	Tank 2 to Tank 2 (Man 1)		30	15-30:00
4	T1TOT2	Tank 1 to Tank 2 (Man 1)		45	0:45
5	T2RECOVER	N2 to Tank 2 (Man 1)		45	0:15
6	RINSEMI	Cold DI (Man 1)	Chem 2	45	0:10
7	M2RINSE	Cold DI (Man 2)	WD	45	1:00
8	HSRINSE	Cold DI (Man 2)	WD	500	1:00
9	N2PURGE	N2 N2 (Man 2)	WD	500	0:15
10	HSDRY	N2 (Man 3)	WD	1800	1:00
11	LSDRY	N2 (Man3)	WD	500	5:00

4. Remove dry, stripped wafers out of the process chamber.





PRX-127 APPLICATION NOTE FOR A SEMITOOL SPRAY SOLVENT SYSTEM (SST 4-Tank System) STRIP & RINSE

The following is a PRX-127 process recipe for use with a 4-Tank SEMITOOL spray solvent system where SVC-300 is used as a neutralizing post strip rinse . The operating temperature and process times may be adjusted for specific conditions and individual applications.

Recommended Process

1. Fill two chemical tanks with PRX-127 Positive Resist Stripper.
2. Fill two chemical tanks with SVC-300 Post Strip Rinse Solution.
3. Insert a cassette into the process chamber.
4. Program the processor as follows
 - a. Set tank 1 temperature between 45~55 °C.
 - b. Set tank 2 temperature between 70~90 °C. (Baseline of 80 °C)
 - c. Set tank 3 & 4 temperature to room temperature 22~24 °C.
 - d. Detailed Programming:

Step	Step Name	Action	Drain	RPM	Time
1	RAMP		WD	30	0:15
2	T2CHM2	Tank 2 (Man 1)	Chem2	30	0:10
3	T2RCLM	Tank 2 to Tank 2 (Man 1)		30	15-30:00
4	T1TOT2	Tank 1 to Tank 2 (Man 1)		45	0:45
5	T2RECOVER	N2 to Tank 2 (Man 1)		45	0:15
6	T4CHEM2	Tank 4 (Man 1)	Chem 2	45	0:15
7	T4RCLM	Tank 4 to Tank 4 (Man 1)		300	2:00
8	T4RCLM	Tank 4 to Tank 4 (Man 1)		50	2:00
9	T3TOT4	Tank 3 to Tank 4		50	0:15
10	N2PURGE	N2 to Tank4		50	0:10
10	RINSEMI	Cold DI (Man 1)	Chem 2	45	0:10
11	M2RINSE	Cold DI (Man 2)	WD	45	2:00
12	HSRINSE	Cold DI (Man 2)	WD	500	1:00
13	N2PURGE	N2 N2 (Man 2)	WD	500	0:15
140	HSDRY	N2 (Man 3)	WD	1800	1:00
15	LSDRY	N2 (Man3)	WD	500	5:00

4. Remove dry, stripped wafers out of the process chamber.





PRX-127 Post Strip Rinse Process

(D.I. Water Induced Corrosion)

SVC has conducted extensive corrosion studies with PRX-127, photoresist stripper and post-etch polymer remover, in many applications. Different sample wafers with corrosion-sensitive metal layers were tested to isolate the source of corrosion and optimize the stripping process.

PRX-127 is a high performance alkaline solvent system, which is susceptible to any contamination with water. This study indicate that the amount of water contamination in the stripper and the length and intensity of the D.I. water rinse are the major sources of metal corrosion.

Note 1: Without a post-strip rinse process, moderate aluminum etch (5-10 Å/min) was detected

when a Dump Rinse method was applied for a short period of time (<3 minutes) with a strong stream of pressurized D.I. water.

Note 2: Without a post-strip rinse process, extended immersion in a water bath or a Cascade Rinse method induced corrosion on bond pad areas, Al-Si-Cu layers, and metal undercut, due to attack by OH⁻ ion.

Note 3: In applications using extended Cascade Rinse method, an intermediate post rinse solvent, such as SVC-300 (IPA Replacement), is required. No detectable etch rate (corrosion) or metal undercut was recorded during the rinse cycle when an SVC-300 bath was utilized.

DI Water Process Recommendations:

To achieve optimum results using PRX-127, without corrosion and metal undercut, SVC recommends a post strip rinse with SVC-300, and quick dump rinse (QDR) method for 6-8 cycles.

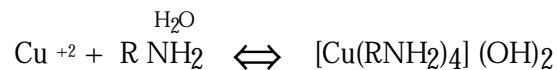




Metal Corrosion Study using PRX-127

Complex Formation

- Al/Cu alloys are more susceptible to NMP/Amine stripper corrosion than other alloys due to the formation of Cu/Amine compound complexes.

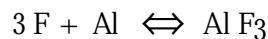


- PRX-127 showed less corrosion on Al/Cu than any other typical Amine base stripper tested.
- SVC Strippers are less corrosive than any other conventional Amine base strippers.

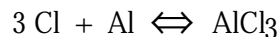
Aluminum Alloy Corrosion

Electro-galvanic corrosion (Battery Effect) plasma etch related halide formation:

- Fluoride ion is absorbed on activated Aluminum in via during the plasma metal etch process.



- Chloride ion is absorbed on sidewall aluminum if Cl_2 or BCl_3 is used.



- Aluminum halide causes cross-link of photoresist polymer to form organometallic polymer residues.
- PRX-127 dissolves organo-metallic residues and metal halides left behind in plasma etch and ash process.





- Dissolution of metals in alkaline stripper (Amine/water) solutions is related to standard electrode potential of the metals.

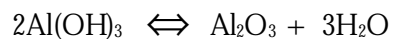
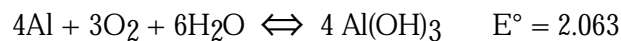
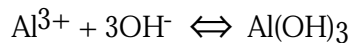
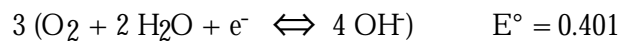
<u>Oxidation</u>	<u>Potential (V)</u>
$\text{Al} \leftrightarrow \text{Al}^{3+} + 3\text{e}^-$	$E^\circ = 1.662$
$\text{Ti} \leftrightarrow \text{Ti}^{2+} + 2\text{e}^-$	$E^\circ = 1.630$
$\text{Ti}^{2+} \leftrightarrow \text{Ti}^{3+} + \text{e}^-$	$E^\circ = 0.369$
$\text{Cu} \leftrightarrow \text{Cu}^{2+} + 2\text{e}^-$	$E^\circ = 0.342$
$\text{W} \leftrightarrow \text{W}^{3+} + 3\text{e}^-$	$E^\circ = 0.1$

- Theoretically, etch rates are expected to decrease by following order:



Water Induced Corrosion in Al Alloys

- Aluminum loses electrons to complete a cell reaction with a more electronegative oxidizing agent.



(Aluminum corrosion in water)





Material Compatibility

PRX-127 Advanced Polymer Remover & Positive Photoresist Stripper

SVC positive photoresist strippers and polymer removers are environmentally safe formulations and are replacements for standard toxic solvents. It is recommended that material compatibility should be examined in wafer process equipment. Incompatible materials have shown weight gain, weight loss, change in shape, or discoloration according to comprehensive material compatibility tests. The following table is based upon immersion tests performed at elevated temperatures (80 °C) for a period of one week. Compatibility should be verified with materials found in filters, filter housings, tank materials, process plumbing (valves, pumps, and etc.), and O-rings¹ before use. Standard PM (Preventive Maintenance) procedures need to be performed regularly to identify and replace worn components.

Compatible Materials

Stainless Steel 304
Stainless Steel 316
Pyrex® or Vycor® glass
Quartz
Teflon®
Kalrez®
Teflon FEP
Teflon PTFE
Teflon Encapsulated O-Ring
Polypropylene ²
Polyethylene ²

Incompatible Materials

EPDM
PVC (Polyvinyl Chloride)
PVDF (Polyvinyl Fluoride)
KYNAR®
Polyurethane
Viton®
Buna-N®
Polypropylene (Softens @ temp.>60 °C)
Polyethylene (Softens @ temp.>60 °C)
Polycarbonate

Glove Compatibility

SVC recommends Butyl gloves for prolonged contact with chemicals. Heavy duty Neoprene/Latex and Nitrile/Latex have shown good results in laboratory tests.

Polyurethane, Latex, and Vinyl gloves are suitable for temporary, disposable usage. However, test results indicate softening with extended chemical contact.

Pyrex® and Vycor® are trademarks of Corning Glass Works.
Teflon® , Kalrez®, and Viton® are trademarks of E.I.duPont deNemours Co.
Kynar® is a trademark of Penwalt Corporation.
Buna-N® is a trademark of Pittway Corp.

Note 1- See Polymer Compatibility Chart for details.

Note 2- Polyethylene & Polypropylene are compatible with PRX-127 at room temperature.

