	Contact Aligners (MA6, ABM, EV620)	GCA 5X g-line Stepper	GCA AS200 i-line Stepper
Shipley 1800 Series (1805, 1813, 1818, 1827)	+	+	X
AZ nLOF 2000	O	X	+
AZ4903	+	+	X
OiR 620-7i	X	X	+
OiR 897-12i	O	X	+
OiR 908-35i	O	X	+
Ultra-i 123	X	X	+
Shipley 955CM	X	X	+
Shipley SPR 220	+	+	O
Shipley SPR700	O	X	+
Brewer XHRi-16 ARC (Anti-Reflective Coating)	X	X	+
CEM 365WS (Contrast Enhancement Material)	O	X	+

+ – Preferred material for tool
O – Acceptable material for tool
X – Unacceptable material for tool

Photoresist Thickness Ranges & Developers

	Thickness Range	Developer
Shipley 1800 Series (1805, 1813, 1818, 1827)	0.4 – 3.5 µm	726 MIF
Shipley 1000 series (1045, 1075)	4 – 12 µm	726 MIF / 421K
AZ4903	7 – 25 µm	726 MIF / 421K
OiR 620-7i	0.5 – 0.9 µm	726 MIF
nLOF 2020 (negative tone**)**	1.7 – 4.5 µm	726 MIF
OiR 908-35i	3 – 5 µm	726 MIF
Ultra-i 123	0.6 – 1.2 µm	726 MIF
Shipley 955CM	0.7 – 1.5 µm	726 MIF
Shipley SPR 220	2.5 – 9 µm	726 MIF
Shipley SPR700	1.1 – 1.5 µm	726 MIF

Developer Information

Developer	Chemical Base	Normality	Concentration (wt %)
AZ 726 MIF	TMAH w/ surfactant	0.261	2.38
AZ 300 MIF	TMAH	0.261	2.38
MF-321	TMAH w/ surfactant	0.210	1.91
Micro Dev	Alkaline-phosphate	0.60	n/a
MF-312	TMAH	0.54	4.76
AZ 400K	Buffered KOH	0.480	n/a
AZ 421K	KOH	0.210	<1%
MF-319	TMAH w/ surfactant	0.237	2.14
MF-322	TMAH w/ surfactant	0.268	2.4

Image Reversal

The image reversal process was developed to produce a specific resist profile for metal lift-off. Normal exposure of the resist produces a slightly sloped resist profile due to the absorption of the photoresist coupled with the resist bleaching from the top down. Through the image reversal process, this sloped profile is employed to leave the opposite, a resist with an undercut profile.

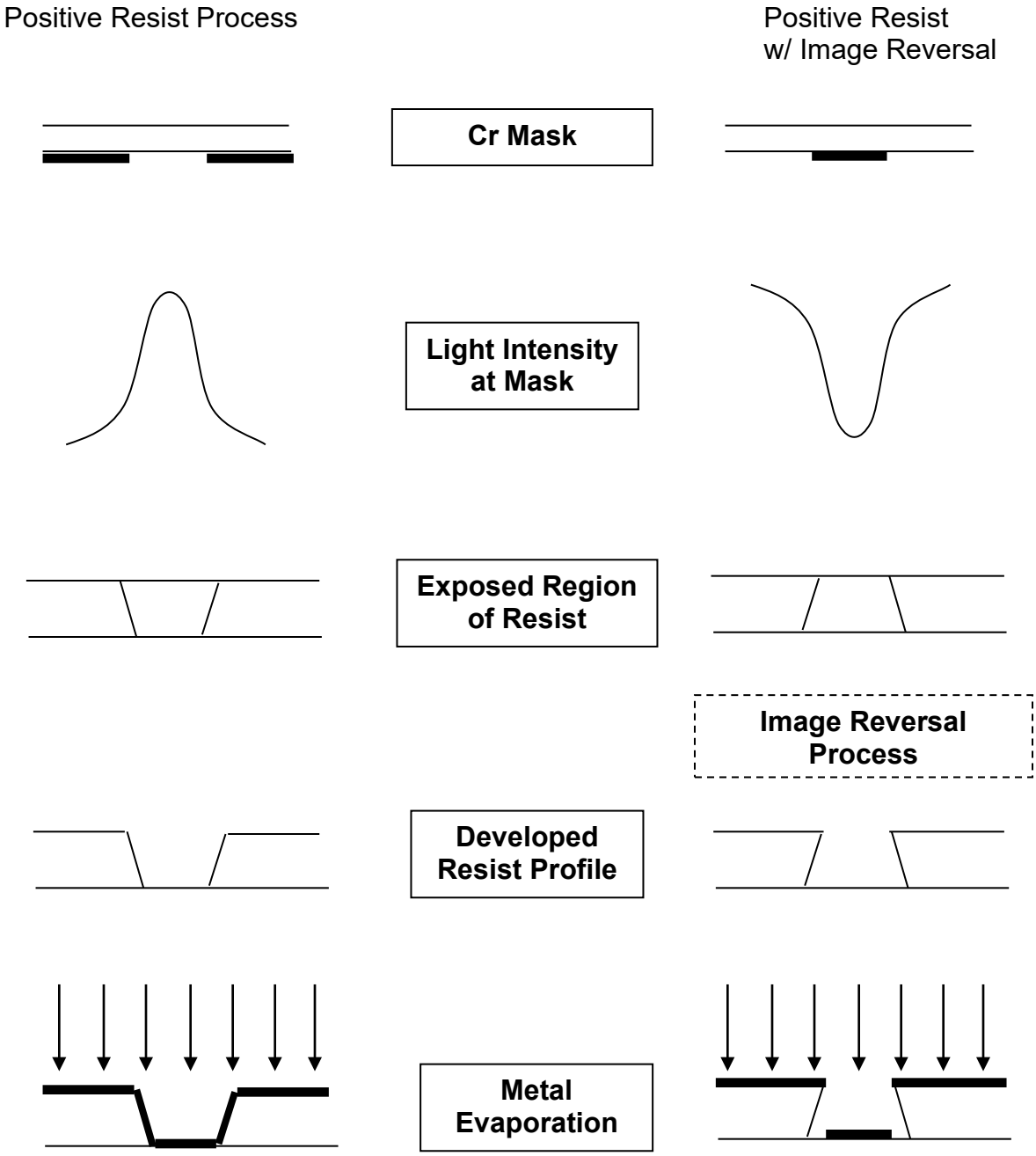

Image Reversal Process

Apply resist primer and resist as normal. Good image reversal results have been achieved with the Shipley 1800 series (1813, 1827…), 220 series (3.0, 4.5, 7.0), and AZ P4903, as well as most i-line resists. Perform resist bake at normal time and temperatures.

Expose resist on tool. Exposure time will vary based on resist, substrate, and coating process used.

Doses for image reversal sometimes run 4X to 5X the normal dose for 1800 series resists. The proper exposure dose for these can be estimated using the following procedure.

1. Run an exposure matrix on the wafer.
2. Develop the wafer using MF321 for 1 minute.
3. The best dose in this matrix should work for image reversal.

Perform ammonia bake in YES oven.

Flood expose wafer for 60 seconds using HTG. Thicker films will require longer flood expose times.

Develop in MF-321 until image has cleared (1 – 3 minutes). Very thick resists may require a stronger developer (726 MIF) to clear in a reasonable time.

Resist Priming

To improve photoresist adhesion to the wafer, wafer priming is usually performed prior to spin coating the resist. The material used is hexamethyldisilazane (HMDS). It can be applied in a vapor or liquid form to the wafer. Vapor priming generally gives the best results but requires using the YES vapor-priming oven for a 30 minute batch cycle. Liquid priming does not give optimum adhesion but is quicker and is adequate for most users' needs.

Vapor Priming

Vapor priming is accomplished by using the YES vapor-priming oven in the photolithography room. It heats the wafers and cycles through several vacuum / N_2 backfill cycles to remove any adsorbed water from the wafer surface. It then fills the chamber with HMDS vapor, which ideally absorbs on the surface in a monolayer. When the process is finished, the cooled wafers may be coated with photoresist. The wafer surface will remain hydrophobic for many days after treatment, but coating as soon as possible is recommended. DO NOT liquid prime after vapor priming. Overpriming will cause very poor adhesion.

Liquid Priming

Liquid priming is accomplished using the P-20 primer available in the photoresist cabinet. P-20 primer consists of 20% HMDS in PGMEA solvent. The wafer is placed in the spinner, the surface is covered with a thin layer of the P-20 dripped onto it, and after a 10 sec delay the liquid is spun off. The wafer can be coated with the photoresist after drying. If the wafer is solvent stripped, the primer should be reapplied before recoating with resist.

PRP Spray Photoresist

PRP Spray Photoresist
From Electrolube
Manufactured for electronic hobbyists to make their own printed circuit boards.

This is a spray can of positive photoresist for covering nonplanar substrates. The thickness is determined by the spray coverage during application. Place the substrate to be sprayed in the spinner bowl. Prime the substrate if desired and then spray the substrate in a back and forth manner without spinning the substrate. Bake the substrate at 50ºC for 20 minutes. Exposure times vary from 5 – 20 seconds depending on thickness and substrate reflectivity. Develop in AZ 421K developer until clear (1 – 3 minutes). The photoresist is best removed using the hot resist strip bath in the back photolithography hood. Resolution of 10 microns on planar substrates has been achieved with this resist.

MicroSpray

Kayaku Advanced Materials, Inc.

“MicroSpray is based on long proven, mature, novolak technology. It is ideally suited for developmental applications including perforated, 3-dimensional and other substrates that have severe topography, deep V grooves, back side wafer protection or other difficult MEMS features.”

MicroSpray is effectively S1800 series photoresist in a spray can package. Reasonable results may be obtained with some practice. Typical process parameters are below.

- Prime wafer with HMDS
- Hold can 3 inches from surface
- Spray surface using 6 overlapping patterns
- Wait 5 minutes (micro-bubbles will disappear)
- Bake coated substrate for 3 minutes at 110ºC
- Expose coated substrate to UV light (350-450 mJ/cm2)
- Develop for 4-6 minutes in 2.38% TMAH (or NaOH)

Recommended processes is to spray a wafer mounted on a static spin chuck in the spin bowl. Spray a few passes covering the wafer from left to right. Turn the wafer 90 degrees and repeat.