DATA SHEET

Clariant

AZ® P4000 Thick Film Photoresist

Description

AZ® P4000 series photoresists provide unmatched capabilities in demanding applications requiring film thicknesses ranging from 3 to over 60 µm. These production proven photoresists set the standard in MR and inductive thin film coil plating, wafer bumping processes, ceramic packaging, air bearing/slider applications and permanent insulation layers. The photoresists can be fully cross-linked to act as a dielectric and remain part of a permanent device structure.

The rapid evolution in the packaging market along with higher resist performance requirements have led to the development of a version of this resist that meets demanding ultra-thick film needs of 60 µm with single coat processes.

Spin, spray, and roller-coat versions of the AZ P4000 series photoresists are available.

Features	Benefits
Steep wall profiles and excellent adhesion on a wide variety of substrates	• Ideal for up-plating • No underplating even in thick films
Sensitive to g-, h-, and i-line wavelengths	• Sensitive to all popular exposure tools
Available in viscosities that allow coating thicknesses greater than 60 µm	• Single resist series that can be used in a wide range of applications
Excellent ion-milling properties	• High yields • No cracking, peeling, or bubbling
Exceptionally stable cured films	• Provides an excellent, easy to use permanent insulator layer for critical high reliability applications in thin film recording heads
Cast in PGMEA safer solvent with no co-solvent	• Toxicity hazard is extremely low • Provides excellent coating properties

Recommended Process

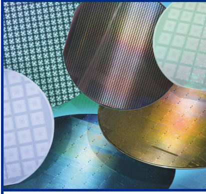
20+ µm Process for AZ® P4620 Photoresist: Single coat for track and hotplate

Single coating using either SVG track or Flexifab

Step	Event	Time (sec)	Speed (rpm)	Accel (krpm/sec)
1		4	500	20
2	Dispense resist	5	0	0
3	Spread	3 - 5	300	20
4	"Spike"	0.2	2000	50
5	EBR	20	400	20
6	EBR dry	10	400	20

Bake: hotplate

Step	Time (sec)	Temp. (°C)	Gap Height (µm)
1	60	120	0.050 (approx. 70°C)
2	60	120	0.025 (approx. 100°C)
3	120 - 180	120	Full contact



AZ® P4000 Thick Film Photoresist

Recommended Process

24 µm Process for AZ® P4620 Photoresist: Double coat for track and hotplate

First Coat: Target 10 µm Film Thickness

Step	Event	Time (sec)	Speed (rpm)	Accel (krpm/sec)
1	SpinLS	2	300	50
2	Dispense resist	10	0	
3	SpinLS	3	300	50
4	SpinHS	60	2500*	50
5	EBR	10	500	50
6	SpinHS	10	1000	50

**Estimated rpm: change for thickness requirements*

First Softbake

Step	Event	Time (sec)	Temp. (°C)	Gap Height (µm)
1	Gap*	10	110	0.001
2	Bake	80	110	Full contact

**Gap used to imitate slow heating of substrate.*
Use 85 sec bake if gap function not available.

Second Coat: Target 24.0 µm Total Film Thickness

Step	Event	Time (sec)	Speed (rpm)	Accel (krpm/sec)
1	SpinLS	2	300	50
2	Dispense resist	10	0	
3	SpinLS	3	300	50
4	SpinHS	60	1600*	50
5	EBR	10	500	50
6	SpinHS	10	1000	50

**Estimated rpm: change for thickness requirements*

Second Softbake: 110°C

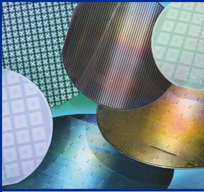
Step	Event	Time (sec)	Temp. (°C)	Gap Height (µm)
1	Gap*	10	110	0.001
2	Bake	80	110	Full contact

**Gap used to imitate slow heating of substrate.*
Use 165 sec bake if gap function not available.

Develop: Constant Spray at 27°C

Step	Event	Time (sec)	Temp. (°C)	Accel (krpm/sec)
1	Spray*	260	250	50
2	Rinse	20	300	50
3	Dry	15	4000	50

**140 ml of developer per min*



AZ® P4000
Thick Film Photoresist

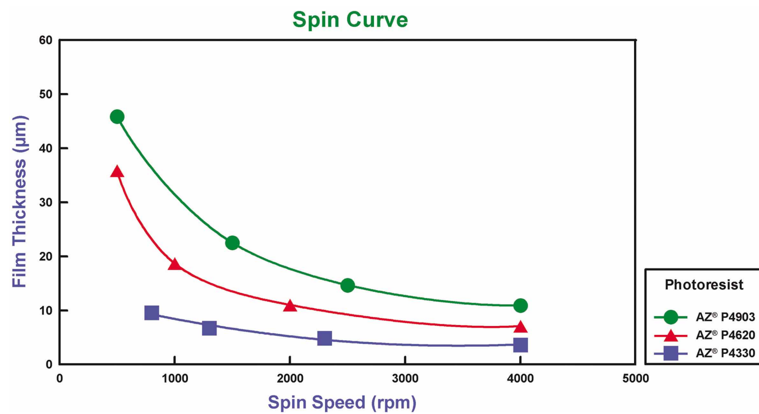
Modeling Parameters (AZ® P4000 Photoresist at 435 nm)

Refractive Index

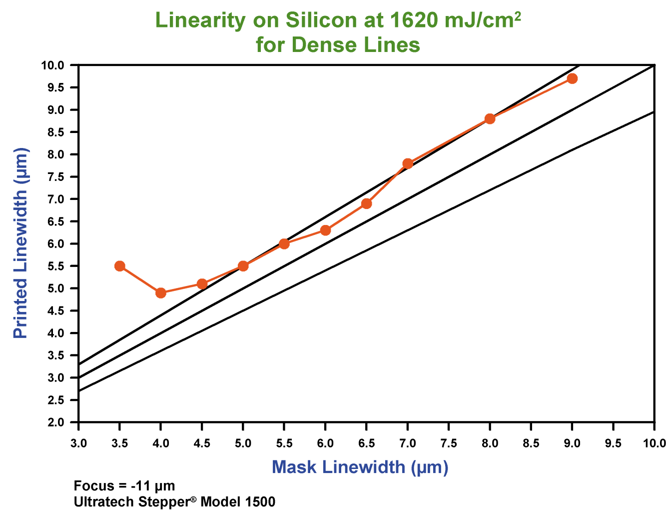
Unbleached		Bleached	
n	1.6963	n	1.6796
k	0.0150	k	0.0100

Cauchy Coefficients	A	B	C
Unbleached	1.6154	$1.0340 \times 10^{-2}\ \mu m^2$	$8.16 \times 10^{-4}\ \mu m^4$
Bleached	1.6207	$2.9136 \times 10^{-3}\ \mu m^2$	$2.78 \times 10^{-3}\ \mu m^4$

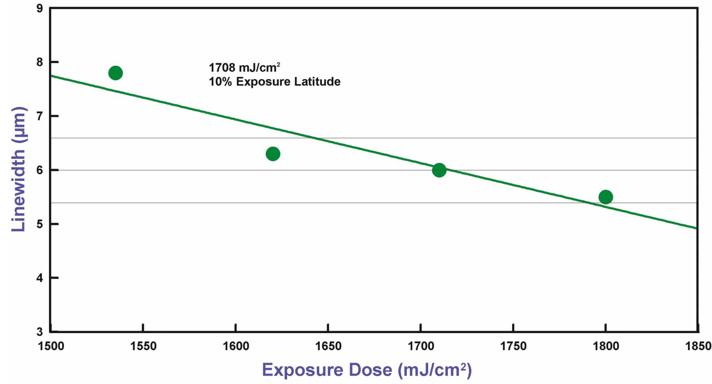
Dill Parameters	A	B	C
	$0.3697\ \mu m^{-1}$	$0.0243\ \mu m^{-1}$	$0.0203\ cm^2/mJ$

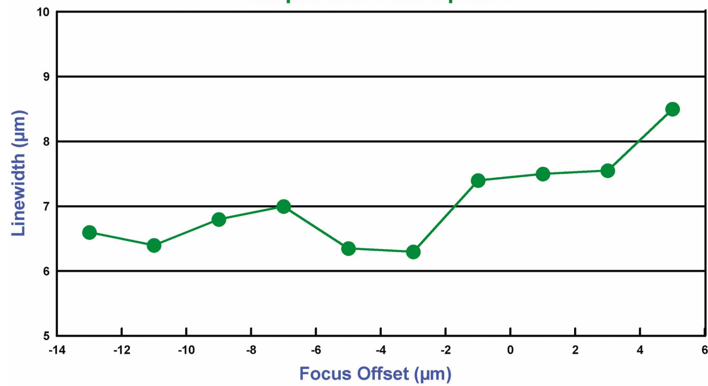


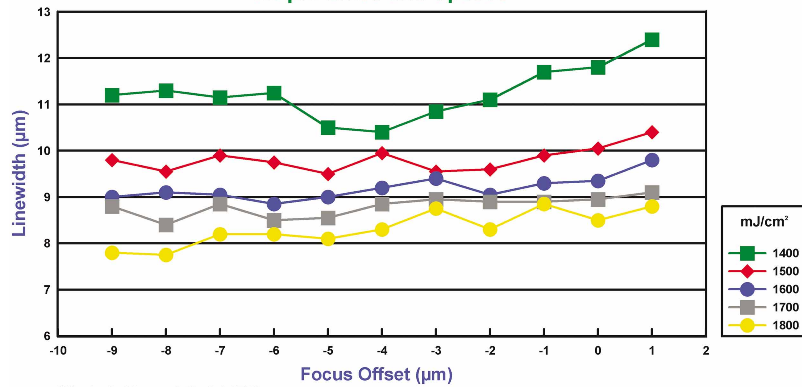
Performance of AZ® P4620 Photoresist



Performance *(continued)*



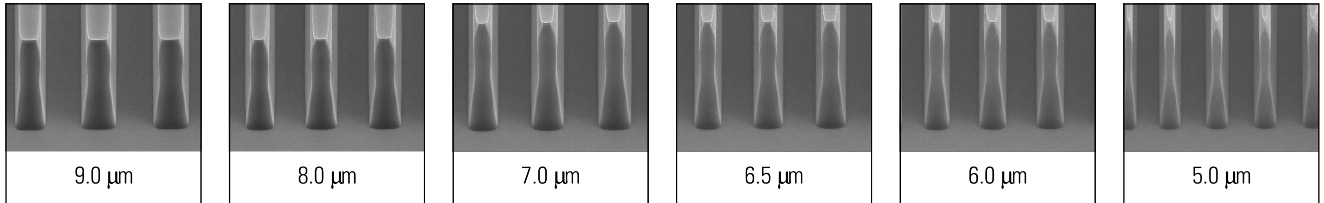




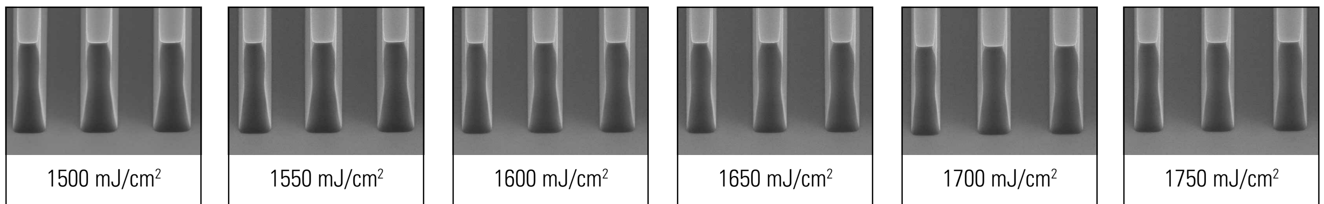
Performance *(continued)*

24 µm film thickness, double coat/bake at 110°C, on Ultratech Stepper® model 1500, AZ® 400K 1:4 Developer, 260 sec spray

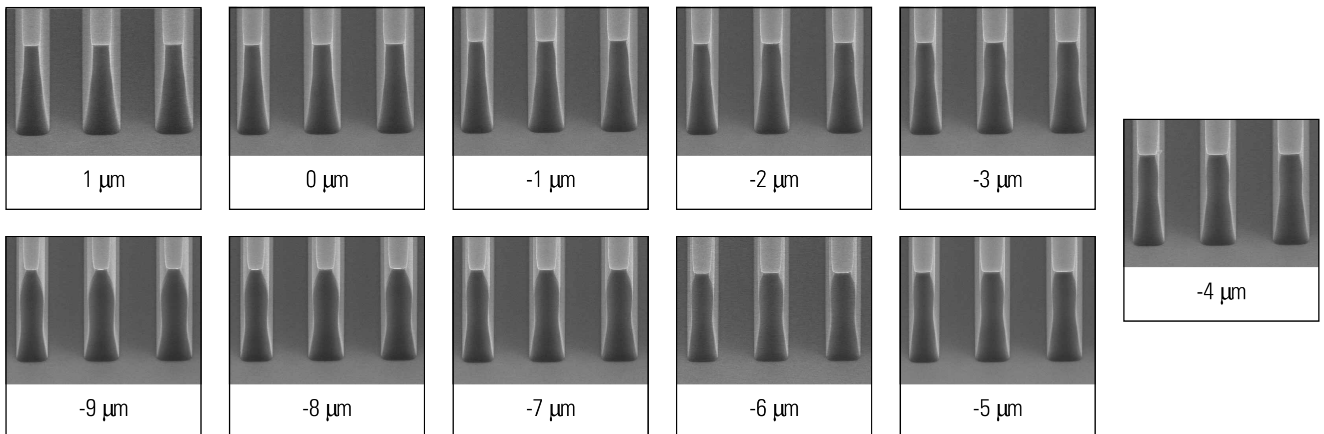
Linearity (1600 mJ/cm²)

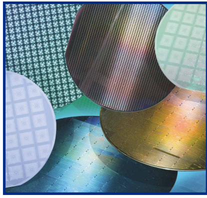


Exposure Latitude (9 µm lines and spaces)



Focus Latitude (9 µm lines and spaces, 1600 mJ/cm²)





AZ® P4000 Thick Film Photoresist

Companion Products

Adhesion Promoter
AZ® Adhesion Promoter is highly purified HMDS recommended to promote adhesion of photoresist to semiconductor wafers.

Edge Bead Removers
AZ® EBR 70/30 edge bead remover and AZ EBR solvent are recommended for AZ® P4000 photoresist for both front- and back-side edge bead removal.

Developers
AZ® 400K series and AZ 421K developers are recommended for thick films of AZ P4000 photoresists. These developers may be used for both spray and immersion processes. AZ 400K is a buffered potassium-based developer that provides the process latitude associated with inorganic developers while minimizing risk associated with mobile ion contamination. AZ 421K developer is unbuffered. An alternative sodium-based developer, AZ Developer, has a very low etch rate on aluminum and can also be used with AZ P4000 photoresist. Developer bulletins with additional processing details are available.

Strippers
AZ® 400T and 300T strippers are recommended for removal of AZ P4000 photoresist. AZ 400K developer concentrate can also be used for stripping when a corrosion resistant substrate is used. Using this developer for stripping provides the added benefit of an all-aqueous (organic-solvent-free) system. This results in a quantitative reduction of organic residues as evidenced by the hydrophilic surface obtained after resist removal. Gold surfaces are an exception: they are not hydrophilic after stripping because they are hydrophobic by nature.

Solvent Safety
AZ P4000 photoresist is formulated with propylene glycol monomethyl ether acetate (PGMEA) solvent, which is patented for use in photoresists by Clariant AG (U.S. patent number 4,550,069).

Equipment Compatibility
AZ P4000 photoresist is compatible with all commercially available wafer and photomask processing equipment. Recommended materials of construction include stainless steel, glass, ceramic, PTFE, polypropylene, and high density polyethylene.

Storage
Keep in sealed original containers away from oxidants, sparks, and open flames. Refrigerate until use, and bring to ambient temperature prior to use. Protect from light and heat. Empty container may contain harmful residue and vapors.

Handling Precautions/First Aid
Refer to the current Material Safety Data Sheet (MSDS) for detailed information prior to handling.

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