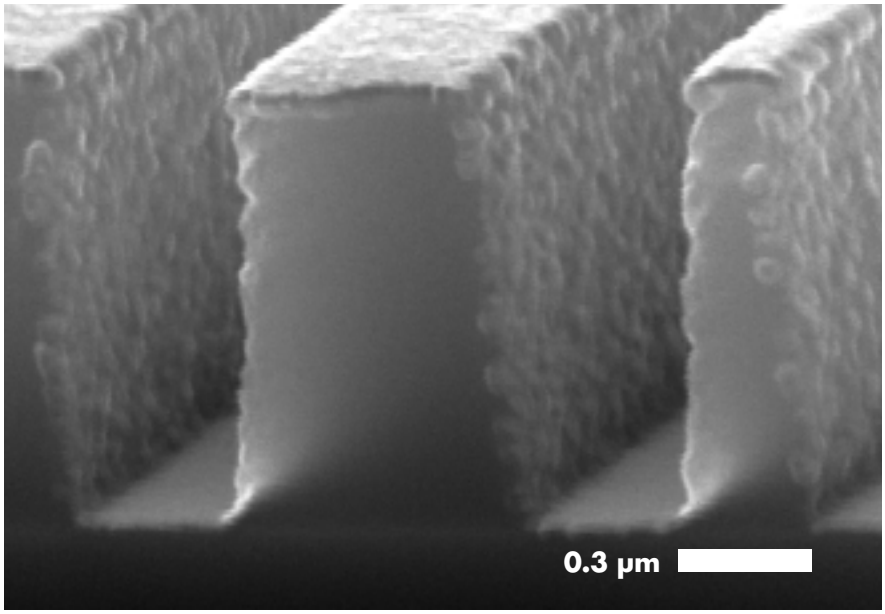


AZ® 7900 Photoresist

High Resolution i-Line Resist

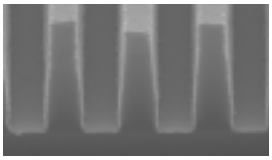
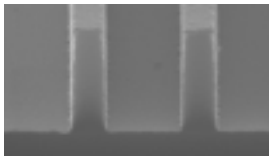
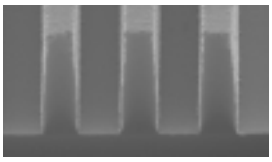
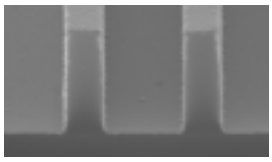
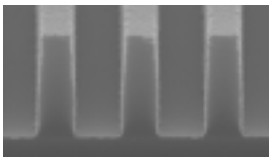
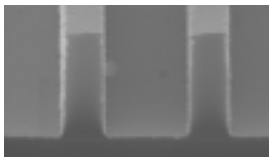
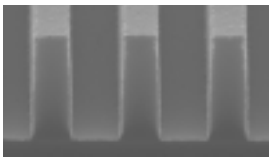
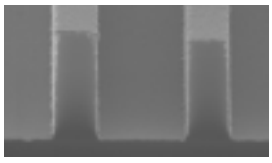
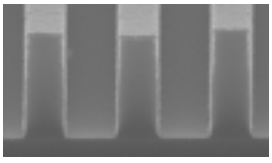
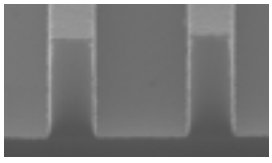
AZ® 7900 photoresist is a high resolution i-line resist designed for use on critical layers where resolution, critical dimension control and depth of focus are key performance parameters. This resist series is available in an optimized range of viscosities allowing typical film thicknesses in a range of 0.5 to 1.2 µm. When used alone this resist is capable of production resolution down to 0.30 µm. This performance may be further enhanced with the use of either a top anti-reflecting AZ® Aquatar® coating or a bottom anti-reflecting AZ® BARLi® coating. Exposure requirements range from 140 to 270 mJ/cm^2 depending on bake, develop conditions, substrate and the use of any anti-reflective coatings.

The use of top or bottom anti-reflective coatings will reduce the effect of the swing curve by at least a factor of three and enhance the performance of the resist. A bottom anti-reflective coating alone will also suppress reflective notching due to underlying highly reflective topography and increase resolution capability.

A wide range of TMAH developers in the normality range of 0.24 to 0.30 are recommended. The preferred developer for high resolution is AZ® 300 MIF developer, a standard non-surfactant containing developer. Surfactant containing developers may also be used as required.

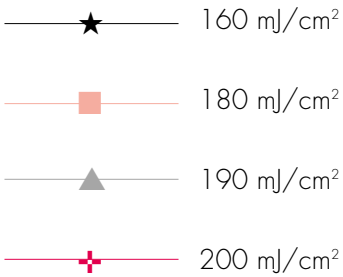
Optimum bake cycles are in a range of 90 to 120°C for 60 seconds. Thermal stability up to 120°C is achieved with these bake cycles. Enhanced thermal stability up to 130°C may be reached by using a FLASHBAKE™ cycle of 140°C, 5 to 10 seconds as a PEB bake.

Clariant

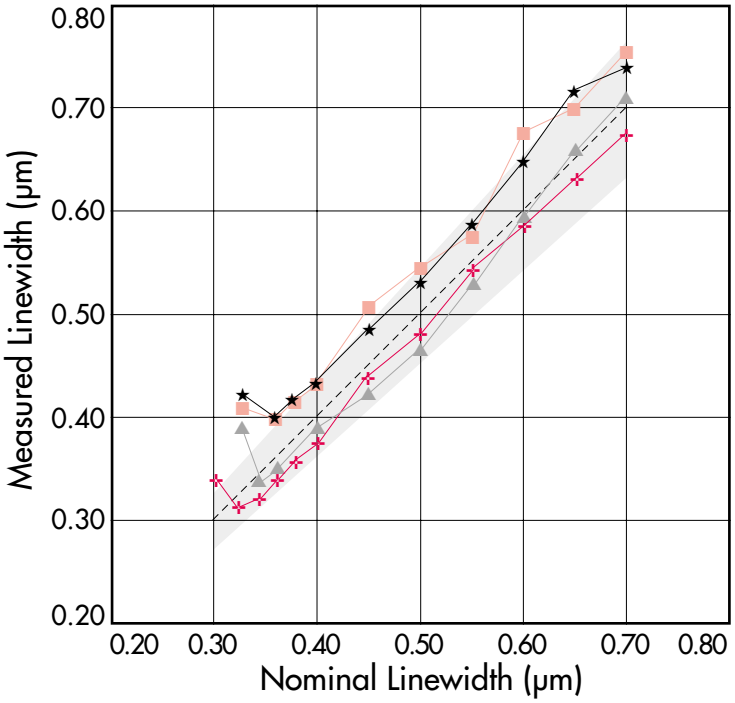
Line Width [µm]	Linearity	
	dense lines	isolated lines
0.32		
0.34		
0.36		
0.38		
0.40		

AZ® 7908 Photoresist
Film Thickness = 0.975 µm
Softbake Hotplate 90°C, 60 sec
Exposure NIKON® 0.54 NA i-line stepper, 200 mJ/cm²
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer,
5 sec spray, 55 sec puddle at 21°C

Linearity on Silicon
AZ® 7908 Photoresist



AZ® 7908 Photoresist
Film Thickness = 0.975 µm
Softbake Hotplate 90°C, 90 sec
Exposure NIKON® 0.54 NA i-line stepper
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer,
5 sec spray, 65 sec puddle at 21°C



Typical Process for 0.975 µm Film Thickness	
Prime	HMDS
Coat	Dispense: static or dynamic @ 600 rpm Spin: 2 600 rpm, 40 sec
Edge Bead Removal	Rinse: 1 000 rpm, 6 sec Dry: 2 000 rpm, 10 sec
Softbake	90°C, 90 sec (range 90 to 110°C)
Exposure	i-line stepper
Post Exposure Bake	110°C, 60 sec (range 110 to 140°C; higher temperatures with reduced time)
Development	AZ® 300 MIF Developer (Normality = 0.26), 5 sec spray, 55 sec puddle dispense temperature 20 to 30°C (21°C preferred) Rinse: 500 rpm, 20 sec Dry: 3 000 rpm, 15 sec

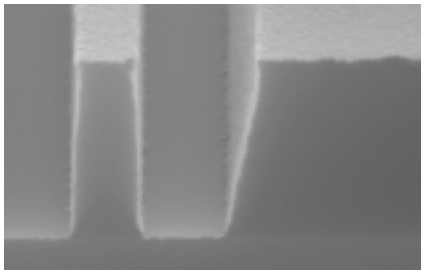
Film Thickness	2 000 rpm	2 500 rpm	3 000 rpm	3 500 rpm
AZ® 7905 Photoresist 3 cP	7 400 Å	6 600 Å	6 000 Å	5 600 Å
AZ® 7908 Photoresist 6 cP	11 300 Å	10 100 Å	9 200 Å	8 500 Å

Typical Performance on a 0.54 NA i-Line Stepper	lines	contacts
Film Thickness	0.975 µm	0.975 µm
Critical Dimension	0.34 µm	0.40 µm
Exposure	200 mJ/cm^2	480 mJ/cm^2
Linearity	0.30 µm	0.34 µm
Exposure Latitude	24 %	20 %
Open Depth of Focus	1.00 µm	1.75 µm
Emask:E_0 Ratio	> 1.95	> 4.5

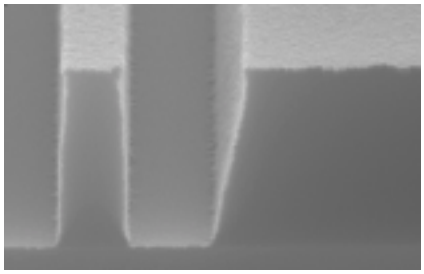
Modeling Parameters			
Cauchy Coefficients	N_1 = 1.60665	N_2 = 0.00650 µm^2	N_3 = 0.00140 µm^4
Dill ABC Parameters	A = 0.7166 µm^{-1}	B = 0.0437 µm^{-1}	C = 0.0158 cm^2/mJ
PROLITH™ Enhanced Modeling Parameters	R_{max} = 140 nm/sec n = 5.062	R_{min} = 0.01 nm/sec l = 9.941	R_{resin} = 25 nm/sec

Thermal Stability

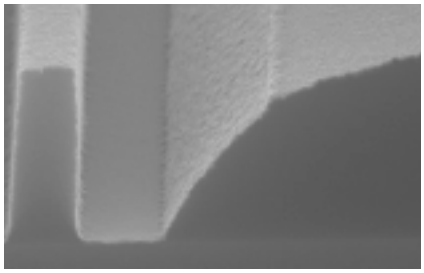
Hotplate 120 sec
0.4 µm line; 200 µm pad



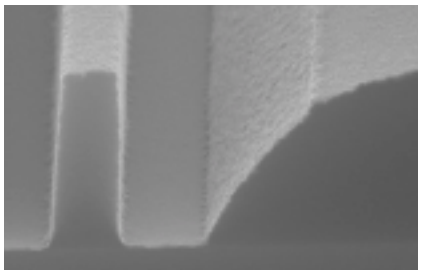
no hardbake



115°C



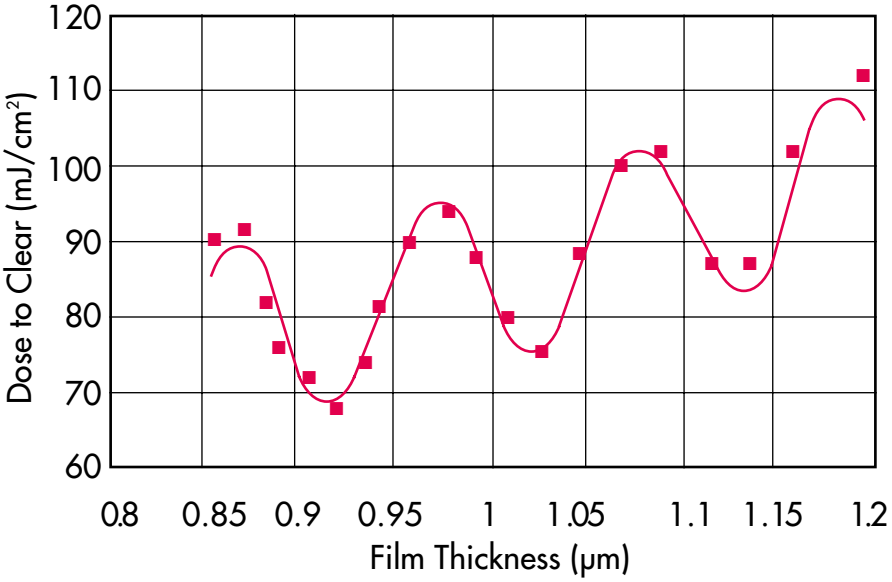
120°C



125°C

Swing Curve AZ® 7908 Photoresist

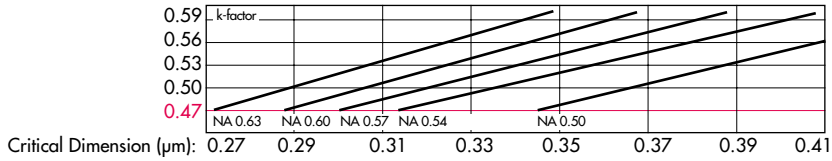
AZ® 300 MIF developer
5 sec spray, 55 sec puddle

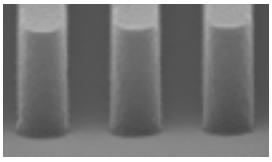
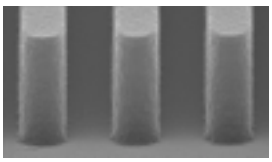
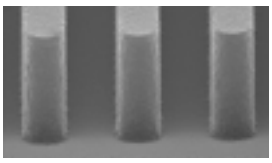
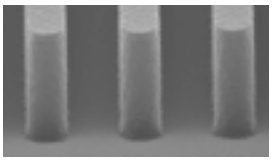
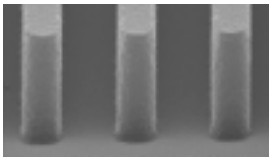


AZ® 7908 Photoresist
Film Thickness = 0.975 µm
Softbake Hotplate 100°C, 60 sec
Exposure NIKON® 0.54 NA i-line stepper
Post Exposure Bake Hotplate 120°C, 60 sec
AZ® 300 MIF Developer, 5 sec spray, 55 sec puddle at 21°C

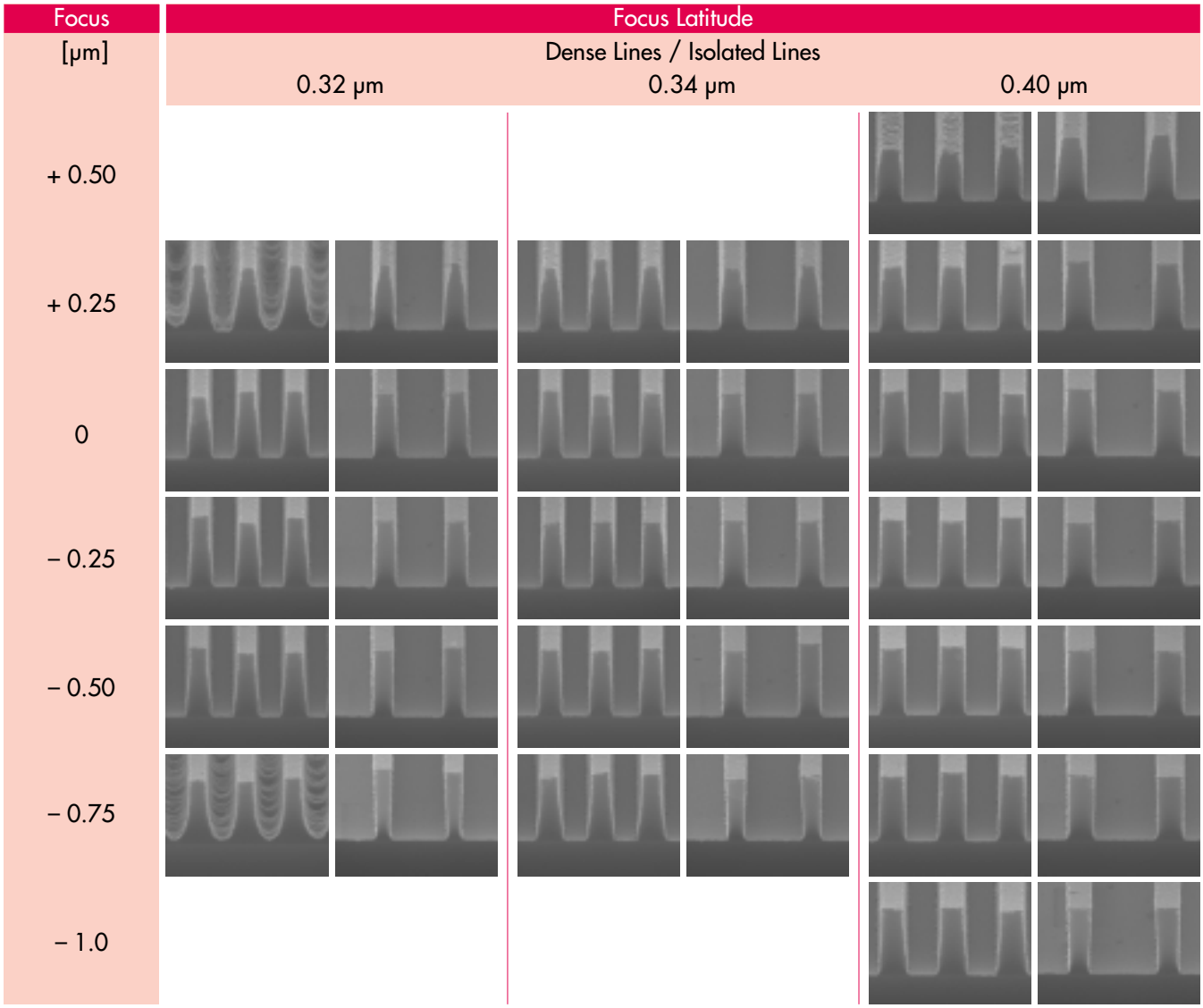
Corresponding Linewidths for different NA

AZ® 7900 Photoresist



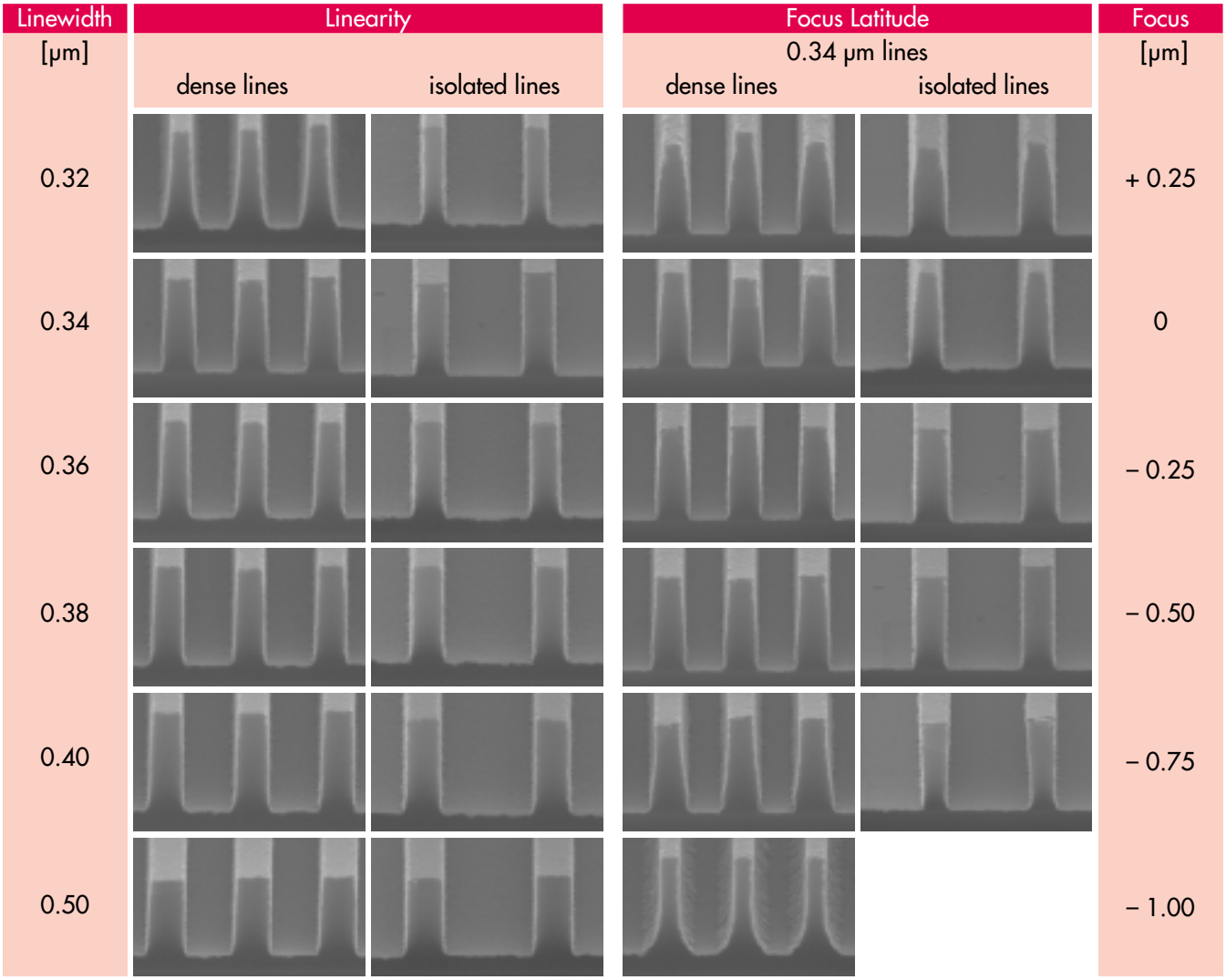
Exposure [mJ/cm²]	Exposure Latitude 0.40 µm lines
170	
185	
200	
215	
230	

AZ® 7908 Photoresist
Film Thickness = 0.975 µm
Softbake Hotplate 90°C, 60 sec
Exposure NIKON® 0.54 NA i-line stepper
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer, 5 sec spray, 55 sec puddle at 21°C



AZ® 7908 Photoresist
Film Thickness = 0.975 µm
Softbake Hotplate 90°C, 60 sec
Exposure NIKON® 0.54 NA i-line stepper, 200 mJ/cm²
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer, 5 sec spray, 55 sec puddle at 21°C

AZ® 7900 Photoresist on BARLi® Anti-Reflective Coating



Film Thickness AZ® BARLi® anti-reflective coating = 1920 Å
Bake 170°C, 60 sec
Film Thickness AZ® 7908 Photoresist = 0.975 µm
Softbake Hotplate 90°C, 60 sec
Exposure NIKON® 0.54 NA i-line stepper, 270 mJ/cm²
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer, 5 sec spray, 55 sec puddle at 21°C

Swing Curve and Reflectivity Control Using AZ® BARLi® Anti-Reflective Coating

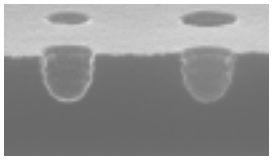
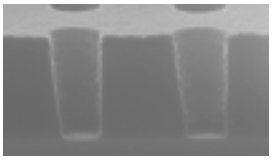
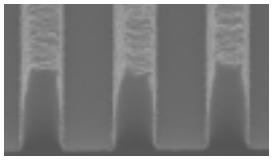
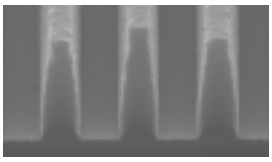
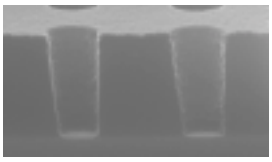
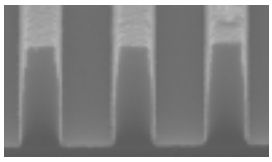
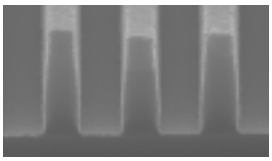
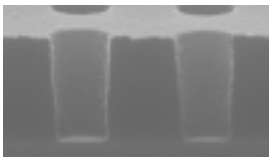
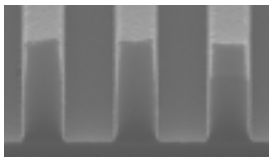
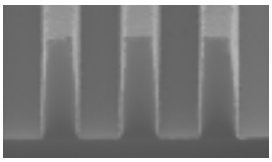
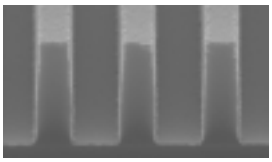
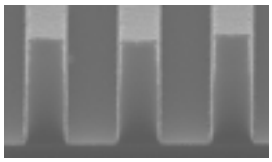
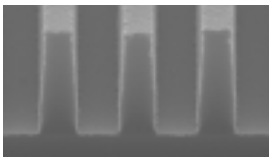
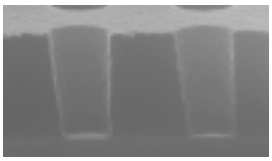
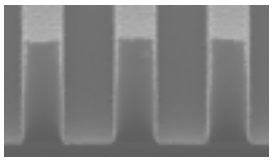
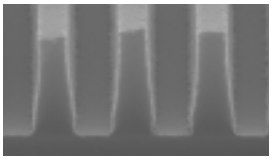
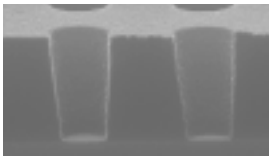
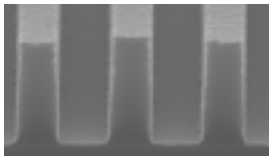
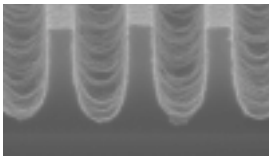
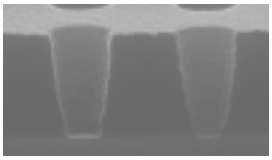
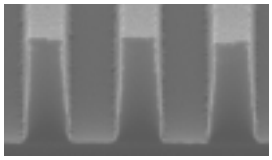
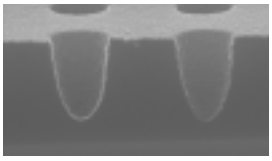
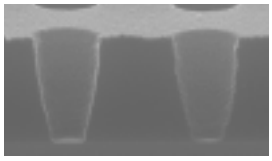
AZ® BARLi® is an organic anti-reflective coating layer intended for use under the photoresist layer. To achieve maximum absorption there is an optimized film thickness of 1920 Å. The high viscosity and low solids content of the anti-reflective coating solution ensures that coatings are conformal not planarizing. This reduces the degree of plasma overetch required to remove the anti-reflective coating prior to substrate etch. During plasma etch the anti-reflective coating etches faster than the resist coating which aids dimension control. At the proper film thickness, the anti-reflective coating layer will dramatically reduce reflected light from the substrate.

This achieves two important goals:

- The swing curve amplitude is dramatically reduced leading to improved critical dimension control over topography where resist film thickness changes.
- Reflective notching caused by reflected light from the substrate is essentially eliminated.

AZ® BARLi® anti-reflective coating is used in processes where the critical dimension is below 0.35 µm and an organic anti-reflective coating is preferred. In a typical process the AZ® BARLi® anti-reflective coating is applied and baked at a temperature above 170°C on a hotplate. The resist is then processed normally. A plasma etch process is then used to etch the anti-reflective coating and the substrate.

For more information on AZ® BARLi® anti-reflective coating please refer to the individual data sheet.

Focus [µm]	Focus Latitude Contact Holes 0.34 µm	0.36 µm	0.40 µm
+ 0.75			
+ 0.50			
+ 0.25			
0			
– 0.25			
– 0.50			
– 0.75			
– 1.00			
– 1.25			

AZ® 7908 Photoresist
Film Thickness = 0.975 µm
Softbake Hotplate 90°C, 60 sec
Exposure NIKON® 0.54 NA i-line stepper, 480 mJ/cm²
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer, 5 sec spray, 55 sec puddle at 21°C

Swing Curve Control Using AZ® Aquatar® Anti-Reflective Coating

The amplitude of the swing curve for AZ® 7900 resist can be reduced dramatically through the use of an aqueous top anti-reflective coating. This coating has a controlled index of refraction so that when coated at a film thickness of 64 nm there is a maximum reduction in the swing curve. This is important for critical dimension control below 0.7 µm.

At the optimum AZ® Aquatar® anti-reflective coating film thickness, the phase of the swing curve is inverted, E_{max} becomes E_{min} and vice versa. This leads to an increase of photospeed if the resist thickness was targeted for E_{max} or a decrease in photospeed when the resist was targeted for E_{min}. The overall effect on critical dimension control is to create a greater exposure overlap as resist film thickness changes. As can be seen from the pictures, the exposure requirement over a resist film thickness range of 1800 Å is reduced to a variation of only 10 mJ/cm^2. As well as increased photospeed, there is also a reduction in process contrast which leads to lower dense/isolated feature bias.

The AZ® Aquatar® anti-reflective coating is applied after resist softbake. The target film thickness is 64 nm. After coating there is no bake required before exposure. After exposure and post exposure bake (PEB) the coating is removed in the initial stages of development before bulk resist development. Alternatively the anti-reflective coating may be removed before post exposure bake in a separate step using a water rinse and spin dry. This process is preferred for processes requiring a post exposure bake above 110°C, 60 seconds.

For more information on the AZ® Aquatar® anti-reflective coating please refer to the individual data sheet.

Focus [µm]	Focus Latitude with AZ® Aquatar® Anti-Reflective Coating Dense Lines / Isolated Lines 0.4 µm			
Exposure	160 mJ/cm²	160 mJ/cm²	170 mJ/cm²	170 mJ/cm²
Film Thickness	8 150 Å	8 780 Å	9 262 Å	9 836 Å
+ 0.50				
+ 0.25				
0				
– 0.25				
– 0.50				
– 0.75				
– 1.00				
– 1.25				

AZ® 7908 Photoresist; 3100, 3400, 3800, 4200 rpm spin speed
Softbake Hotplate 90°C, 60 sec
AZ® Aquatar® anti-reflective coating, 2300 rpm spin speed
Exposure NIKON® 0.54 NA i-line stepper
Post Exposure Bake Hotplate 110°C, 60 sec
AZ® 300 MIF Developer, 5 sec spray, 55 sec puddle at 21°C

Solvent Safety

AZ® 7900 photoresist is formulated with a mixture of ethyl lactate and n-butyl acetate both of which are safer solvent products.

Equipment Compatibility

AZ® 7900 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. Protect from light. Must be kept refrigerated. The preferred storage temperature is between 4 to 10°C. 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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