AR™602 DEVELOPABLE ANTI-REFLECTANT

For Microlithography Applications

Regional Product Availability

- North America
- Europe, Middle East and Africa
- Latin America
- Asia-Pacific

Description

AR602 is a developable organic bottom anti-reflectant for use in both KrF and ArF applications. AR602 is designed for improved performance of critical implant layers while minimizing the negative effects of other implant solutions. AR602 has excellent reflection control and improves profile and CDU concerns of a traditional top anti-reflectant coating (TARC). AR602 eliminates the need for a BARC open etch minimizing substrate damage and reducing additional process steps of a more traditional bottom anti-reflectant coating.

AR602 has been formulated to work as a system with a wide range of KrF and ArF photoresists. It also acts as a chemical barrier between photoresist and substrate, presenting a common substrate for all layers. AR602 has a tunable dissolution rate with cure temperature and photoresist profile can be optimized by cure temperature and develop time.

AR602 is available in one dilution: AR602-510 which is formulated for coatings in the range of 450 – 600Å over reflective substrates.

Advantages

- Optical density at 248nm = 7.5/µm and at 193nm = 10.4/µm
- First minimum thickness = 520Å over reflective substrates
- Tunable Dissolution rate with cure temperature
- Product Dilution Targeted at 510Å
- Compatible with many common EBR solvents
- Excellent CD and Profile Control

Table I. Process Conditions	
Thickness*	450Å–600Å depending on substrate stack
Cure Temperature*	180°C - 225°C/sec. Proximity Hotplate

*Optimum AR602 film thickness and cure temperature will depend on substrate reflectivity, topography, transparency, exposure wavelength and desired profile.

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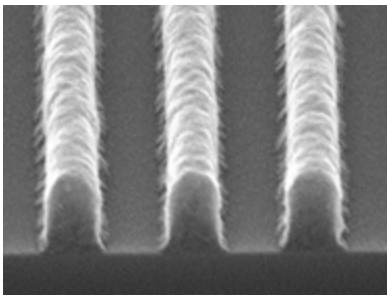
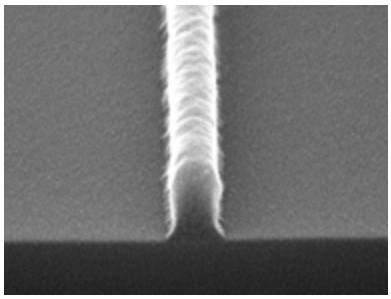
Advantages (cont'd)

Figure 1. Lithographic Performance with KrF type Photoresist



140nm 1:1 Lines/Spaces



140nm Isolated Lines

Equipment Preperation

When converting plumbing from prior BARC material, first flush lines with compatible solvent to thoroughly remove previous BARC residues. Next, flush lines again with an AR602 compatible solvent listed in Table 2. The lines should now be clear of prior residues and AR602 can be installed.

Table 2. Compatible Solvents	
Ethyl Lactate	γ-Butyrolactone
Propylene Glycol Methyl Ether	Cyclohexanone
Propylene Glycol Methyl Ether Acetate	
70% PGME/30% PGMEA	

Substrate

AR602 is compatible with a wide range of substrates, including silicon, SiO_2, polysilicon, Si_3N_4, TiN, and aluminum. An adhesion promoter, such as hexamethyldisilazane (HMDS), is recommended prior to AR602 coating.

Table 3. Adhesion Promotion	
Hexamethyldisilazane (HMDS)	120°C/30sec. vacuum vapor deposition

AR602 Coat

AR602 is spin bowl compatible with common spin-coating and EBR solvents (see *Table 2*). Dedicated spin bowl and drain lines are not required.

Figure 2 shows the relation between spin speed and AR602 film thickness for 8-inch substrates. AR602 is available in one dilution level targeted at 1500rpm. Nominal film thickness may vary slightly due to process, equipment, and ambient conditions.

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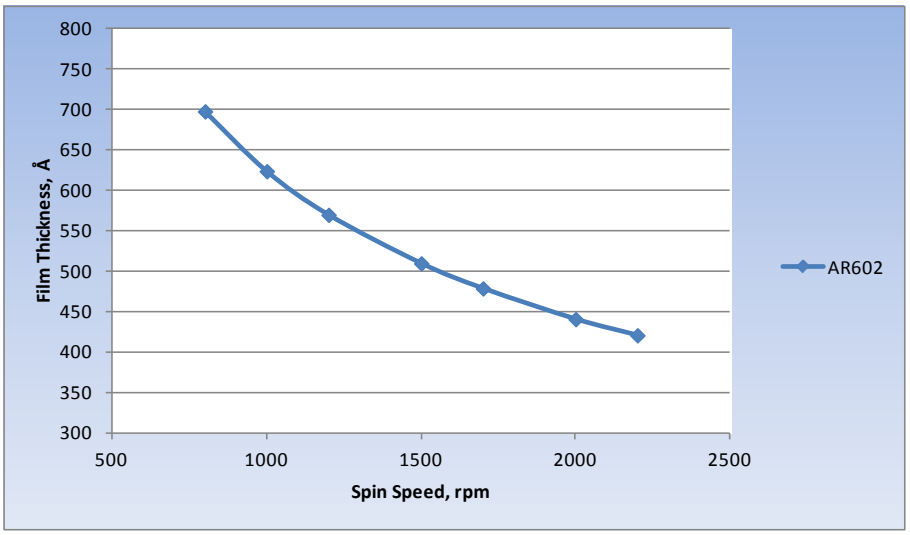
AR602 Coat (cont'd)

Figure 2. Spin Speed Curves AR602



Resist Coat

During resist coating it is noted that some common RRC solvents can cause removal of the BARC coating. Those solvents include γ-Butyrolactone and any solvent blends that include γ-Butyrolactone. Compatible RRC solvents are listed in Table 4.

Table 4. Compatible RRC Solvents	
Ethyl Lactate	Cyclohexanone
Propylene Glycol Methyl Ether Acetate	

Cure and Dissolution Rate

Figure 3 shows the dissolution rate of AR602 in relation to cure temperature. The AR602 film is set at a cure temperature of 180°C and the dissolution rate increases at higher temperatures. A cure temperature between 180°C and 225°C is recommended for photoresist profile tuning.

Figure 4 shows the profile performance of a DUV implant resist through cure Temperature using a 30 second develop time and Figure 5 shows the profile performance of a DUV implant resist through develop time at a 210°C Cure temperature.

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Cure and Dissolution Rate (cont'd)

Figure 3. Dissolution rate of AR602 through Cure Temperature

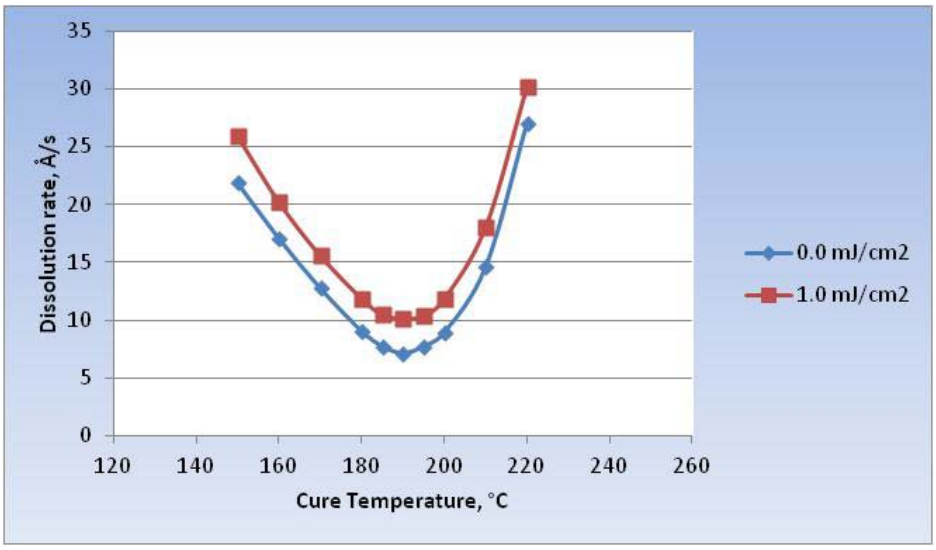
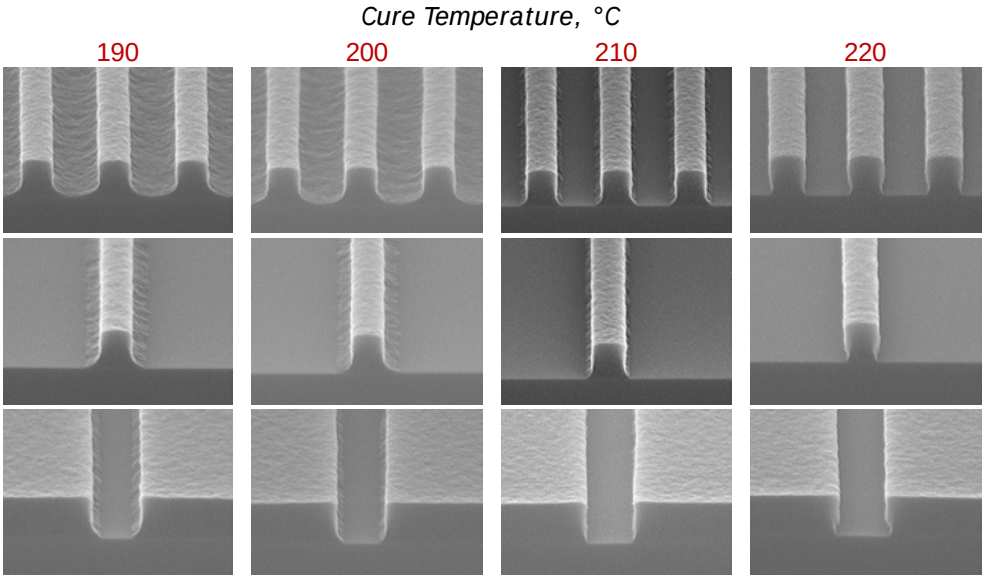


Figure 4. AR602 Cure Temperature (30s Single Spray Puddle)



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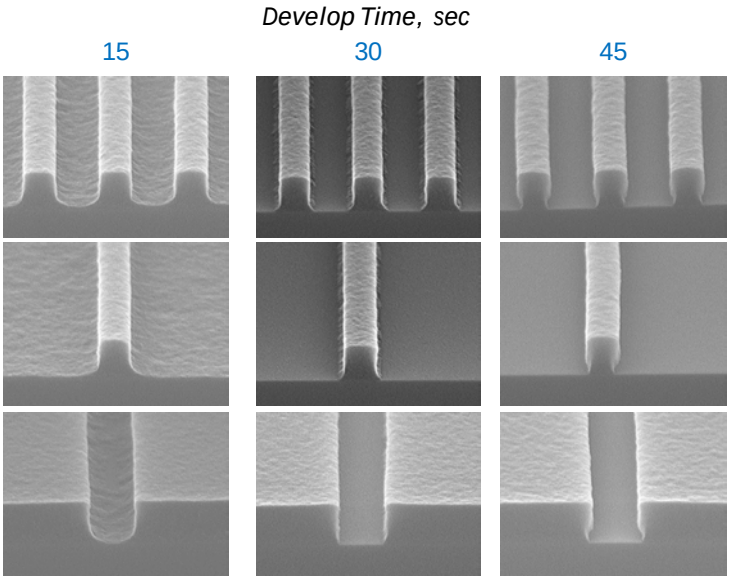
Cure and Dissolution Rate (cont'd)

Figure 5. AR602 Develop Time (210°C Cure Temperature)



Film Thickness Measurement

Optical constants, n and k, at 248 nm, 193nm and Cauchy coefficients of AR602 are found in Tables 5, 6 and 7 respectively. *Figure 6* shows the dispersion curve of AR602.

Table 5. Optical Constants @ 248 nm	
n	1.727
k	0.343

Table 6. Optical Constants @ 193 nm	
n	1.648
k	0.370

Table 7. Cauchy Coefficients	
n_1	1.5619
n_2	9.81e+5
n_3	8.65e+12

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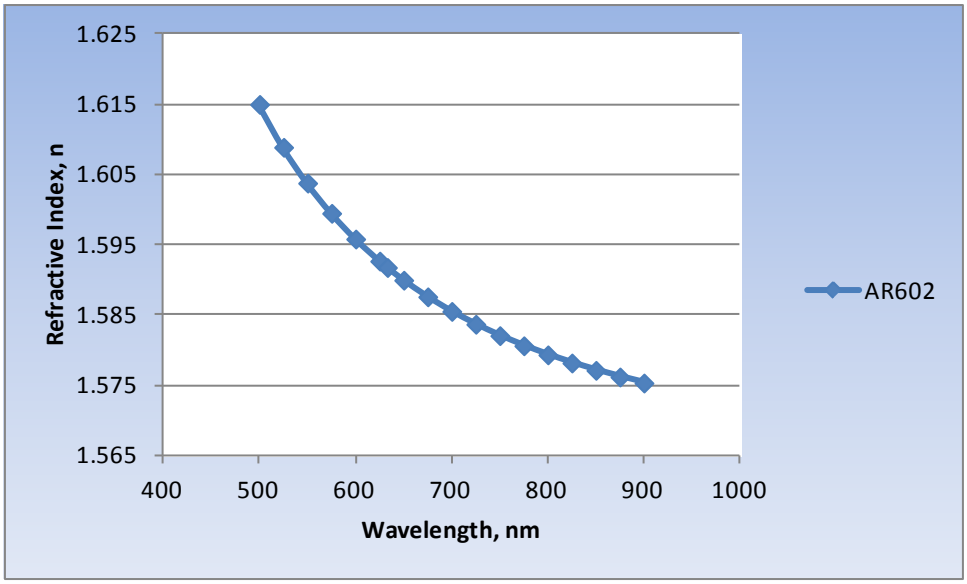
Film Thickness Measurement (cont'd)

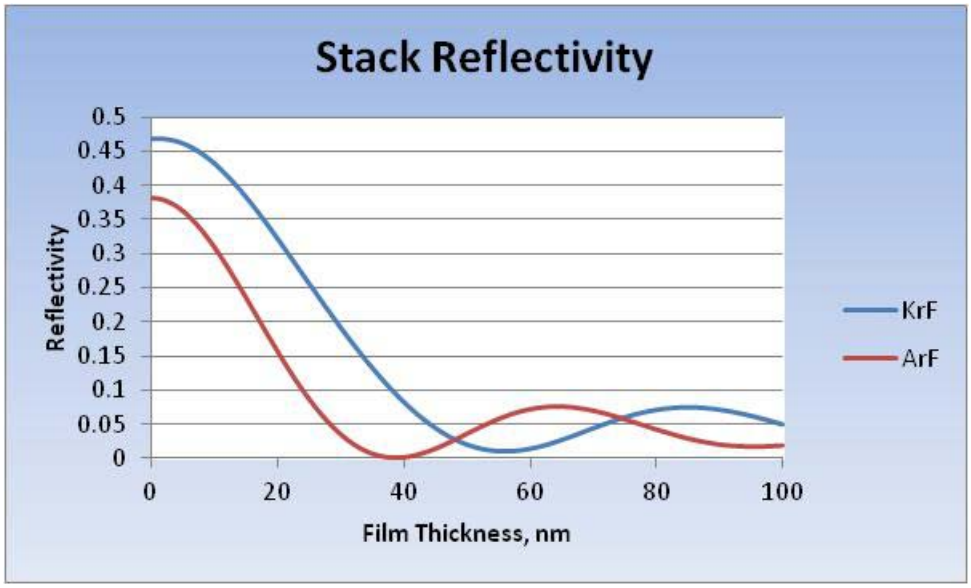
Figure 6. AR602 Dispersion Curve



Reflection Control

*Figure 7*show the modeled reflectivity of AR602 for KrF and ArF wavelengths. Reflectivity was generated using Prolith Version 14.1.1.1.

Figure 7. AR602 Reflectivity over Silicon



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Handling Precautions

Before using this product, associated generic chemicals or the analytical reagents required for its control, consult the supplier's Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on material hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

Storage

Store products in tightly closed original containers at temperatures recommended on the product label.

Disposal Considerations

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

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