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Anti-Reflective Coating
Advanced 193 nm Materials

# *PRELIMINARY PRODUCT USAGE INSTRUCTIONS*

## AR40A™ 193nm Anti-Reflectant

AR40A Anti-Reflectant is an organic, thermally cross-linking, fast-etching bottom anti-reflectant designed for methacrylate-based 193 nm (ArF) photoresists for use with planar and dual damascene applications. AR40A reduces CD swing and reflective notching, leading to higher resolution, larger process latitudes, and reduced line edge roughness. AR40A is designed to provide similar reflection control to AR19™, with improved process windows. AR40A is typically used in the range of 60 nm – 150 nm over reflective and transparent substrates.

### *Features:*

- Very fast etch (50% faster than AR19™ with most etch chemistries)
- Improved Via Fill
- Optical density = ~14/µm
- Planarizing
- Improved Process Window Compared with AR19 using Shipley Photoresists
- Low Sublimation

***Figure 1: EPIC 2210 Resist/AR40A, 85nm Lines/240nm pitch (0.75NA, 0.75$_o$/0.50$_i$ sigma)***

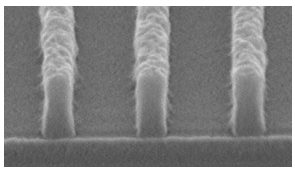
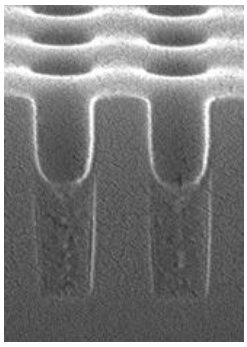


***Figure 2: Via Fill: 150nm 1:1, 630nm Deep Vias (AR40A nominal film thickness = 800 Å)***



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## *Equipment Preparation*

When converting from another BARC to AR40A, first flush lines with a universal solvent like gamma-butyrolactone, unless the matrix solvent for the previously installed BARC is ethyl lactate, cyclohexanone, HBM, or a blend of any of these solvents. Once previous BARC residues have been thoroughly removed, flush again with ethyl lactate, cyclohexanone, or HBM to provide a compatible solvent medium for AR40A. Line flushing with PGME, PGMEA, acetone, or any blend of these solvents is not recommended. When finished, flush lines with AR40A.

## *Substrate*

AR40A is compatible with a wide range of substrates, including silicon, $SiO_2$, polysilicon, $Si_3N_4$, TiN, and aluminum. Do not use adhesion promoters such as hexamethyldisilazane (HMDS) on silicon or $SiO_2$.

## *Coat*

Do not use adhesion promoters, such as HMDS between AR40A and resist layers. AR40A is compatible with the following EBR solvents (see *Table 1*).

***Table 1. Suggested EBR Solvents***

| | |
|---|---|
| *Methyl-2-Hydroxyisobutyrate (HBM)* | *Cyclohexanone* |
| *Ethyl Lactate* | *40% PGMEA : 60% Cyclohexanone* |
| *Gamma-Butyrolactone* | |

AR40A is spin bowl and drain line compatible with the following solvents (see *Table 2*).

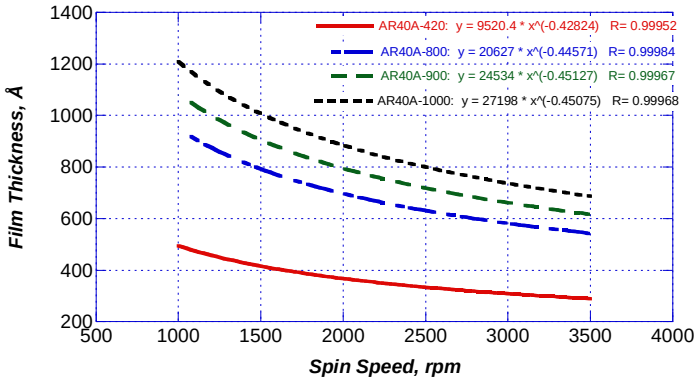
***Table 2. Suggested Line Flushing Solvents***

| | |
|---|---|
| *Methyl-2-Hydroxyisobutyrate (HBM)* | *Cyclohexanone* |
| *Ethyl Lactate* | *40% PGMEA : 60% Cyclohexanone* |
| *Gamma-Butyrolactone* | *Tetrahydrofuran* |
| *NMP* | |

***Table 3. Incompatible Line Flushing Solvents***

| | |
|---|---|
| *PGME* | *Acetone* |
| *PGMEA* | *Blends of PGME, PGMEA, Acetone* |

***Figure 4. AR40A-420, AR40A-800, AR40A-900, and AR40A-1000 Spin Speed Curves***




*215°C/60s cure, 200mm bare Si. Nominal film thickness may vary slightly due to process, equipment, and ambient conditions.*

## *Optical Parameters*

***Table 3. Optical Constants at 193 nm***

n = 1.7965
k = 0.5192

***Table 4. Cauchy Coefficients***

n1 = 1.5355
n2 = 7.81E+5
n3 = 2.10E+12

***Table 5. Reflectivity Minima on Si***

1st = 32nm
2nd = 88nm

***Figure 5. AR40A Dispersion Curve***

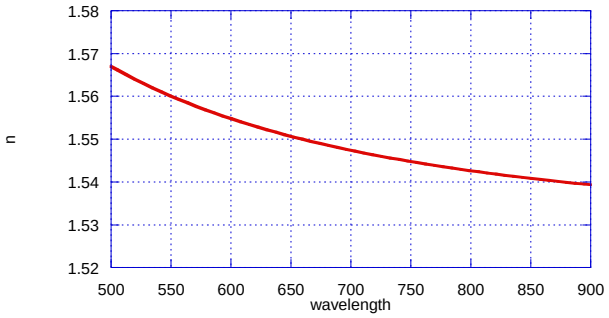
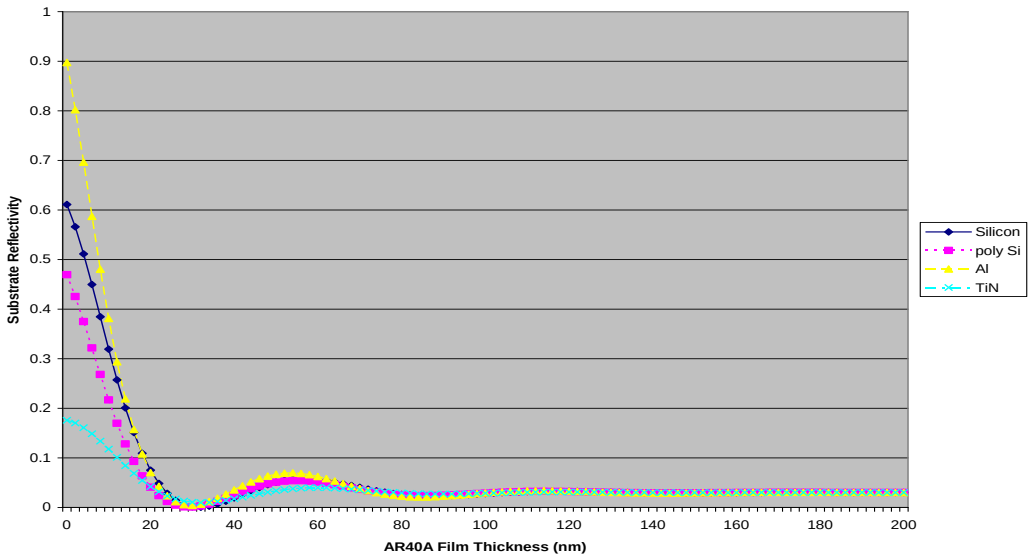


***Figure 6. AR40A Reflectivity over Reflective Substrates***




## *Cure*

No significant profile effect is seen by adjusting cure temperature.

***Table 6. Recommended Process Conditions***

AR40A Film Thickness*: 60 nm – 150nm, depending on substrate stack
AR40A Cure: 195°C – 225°C / 60 sec Proximity Hotplate

*Optimum AR40A film thickness will depend on substrate reflectivity, topography, transparency and thickness, and desired etch performance.

## *Storage*

Store AR40A in an upright, sealed original container in a dry area at 30-50°F away from heat and sunlight. Keep away from alkaline materials, acids, and oxidizers.

## *Trademarks*