AZ 193nm/248nm
Top Anti-Reflective Coating

General Products Update
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## AZ 193nm/248nm T.A.R.C. Series
### Category and Capability

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<th>Category and Capability</th>
<th>AZ AQUATAR-III Coating</th>
<th>EXP AQUATAR-VIII-A Coating</th>
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<th>Experimental Material (TBD)</th>
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<td><strong>Application</strong></td>
<td>248nm Process</td>
<td>248nm Process Applicable for 193nm Process</td>
<td>193nm Process</td>
<td>193nm Process</td>
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<td><strong>Features</strong></td>
<td>Existing Standard Material for 248nm Process (POFS contained)</td>
<td>Newly Developed PFOS/A Free Material</td>
<td>Existing Standard Material for 193nm Process (PFOS contained)</td>
<td>Newly Developed PFOS/A Free Material</td>
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<tr>
<td><strong>Refractive Index</strong></td>
<td>n@248nm : 1.43 k@248nm : 0.00</td>
<td>n@248nm : 1.44 (n@193nm : 1.51) k@248nm : 0.00 (k@193nm : 0.0043)</td>
<td>n@193nm : 1.45 (n@248nm : 1.44) k@193nm : 0.084 (k@193nm : 0.0043)</td>
<td>n@193nm : 1.4x (TBD) k@193nm : 0.0x (TBD)</td>
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<tr>
<td><strong>Cauchy Coefficients</strong></td>
<td>A = 1.381 B = 0.00647µm² C = 0.00µm⁴</td>
<td>A = 1.3839 B = 0.0050346µm² C = 0.00µm⁴</td>
<td>A = 1.379 B = 0.00262µm² C = 0.00µm⁴</td>
<td>A = (TBD) B = (TBD) C = (TBD)</td>
</tr>
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</table>

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AQUATAR-III & EXP AQUATAR-VIII-A Series
Spin Curve

Spin speed (rpm) w/ 8 inch wafer

Film thickness (nm)

EXP AQUATAR-VIII-A Coating 30
AQUATAR-III Coating 33
AQUATAR-III Coating 45
Comparison of n/k value
EXP AQUATAR-VIII-A vs. Competitive TARC

EXP AQUATAR-VIII-A

Ellipsometer : J. A. Woollam VUV-VASE
Film thickness: 45nm
n@248nm : 1.440
k@248nm : 0
Cauchy parameters(0.5um-0.65um):
A=1.3839, B=0.0050346, C=0

TARC-A
n@248nm : 1.48
k@248nm : 0.00

TARC-B
n@248nm : 1.48
k@248nm : 0.0049
Swing Suppression Effect

EXP AQUATAR-VIII-A vs. AZ AQUATAR-III

Swing Suppression
EXP AQUATAR-VIII-A: 86.5%
AZ AQUATAR-III: 86.5%
TARC-A: 65.0%
EXP AQUATAR-VIII-A
Resist Compatibility – Acetal Type

**Line & Space Patterns:** CD=180nm

- **w/o TARC**
  - Pitch=360nm
  - Pitch=450nm
  - Pitch=720nm
  - Isolated line

- **with AQUATAR-VIII-A**
  - Pitch=360nm
  - Pitch=450nm
  - Pitch=720nm
  - Isolated line

**Process Conditions**
Film thickness: 45nm (TARC), 510nm (PR), 80nm (BARC)
SB: 90°C/60sec. (TARC), 90°C/90sec. (PR), 180°C/60sec. (BARC), PEB: 110°C/60sec
Exposure: 0.63NA/0.65sigma, Mask: Binary, Development: 2.38%TMAH 60sec.

**Contact Patterns:** CD=200nm

- **w/o TARC**
  - Pitch=400nm
  - Pitch=600nm
  - Pitch=1200nm

- **with AQUATAR-VIII-A**
  - Pitch=400nm
  - Pitch=600nm
  - Pitch=1200nm

**Process Conditions**
Film thickness: 45nm (TARC), 585nm (PR), 80nm (BARC)
SB: 90°C/60sec. (TARC), 90°C/60sec. (PR), 180°C/60sec. (BARC), PEB: 120°C/60sec
Exposure: 0.63NA/1/2annular, Mask: HT-PSM, Development: 2.38%TMAH 60sec.
EXP AQUATAR-VIII-A
Resist Compatibility – ESCAP Type

Line & Space Patterns: CD=180nm

w/o TARC

with AQUATAR-VIII-A

Process Conditions
Film thickness: 45nm (TARC), 540nm (PR), 80nm (BARC)
SB: 90°C/60sec. (TARC), 130°C/60sec. (PR), 180°C/60sec. (BARC)
PEB: 110°C/60sec
Exposure: 0.63NA/0.65sigma, Mask: Binary, Development: 2.38%TMAH 60sec.

Contact Patterns: CD=200nm

w/o TARC

with AQUATAR-VIII-A

Process Conditions
Film thickness: 45nm (TARC), 522nm (PR), 80nm (BARC)
SB: 90°C/60sec. (TARC), 120°C/90sec. (PR), 180°C/60sec. (BARC)
PEB: 130°C/60sec
Exposure: 0.63NA/1/2annular, Mask: HT-PSM, Development: 2.38%TMAH 60sec.

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AZ AQUATAR-III Coating
CD Uniformity Improvement Effect

without AZ AQUATAR-III

Process Conditions:
14 wafers with topography
Oxide thickness increment of ~250Å per wafer for 3000Å range across all 14 wafers (worst CMP lot to lot process variation prediction)
DUV resist process without TARC.

Mean: 0.294μm
Min:   0.273μm
Max:   0.316μm
3 Sigma: 0.0246μm

Tar: 0.29μm
LSL: 0.261μm
USL: 0.319μm

Cp 1.178
Cpk 0.967

248nm DUV process: ASML 5500/550
Annular illumination
0.53 NA
Outer σ 0.80
Inner σ 0.35

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AZ AQUATAR-III Coating
CD Uniformity Improvement Effect

without AZ AQUATAR-III

Measured CD Uniformity With AZ®Aquatar®III
14 wafers(8”), 56 sites/wafer, 0.29μm VIA on Product

Mean: 0.287μm
Min:  0.265μm
Max:  0.304μm
3 Sigma: 0.0165μm

Tar: 0.29μm
LSL: 0.261μm
USL: 0.319μm

Cp  1.807
Cpk  1.651

248nm DUV process:
ASML 5500/550
Annular illumination
0.53 NA
Outer σ 0.80
Inner σ 0.35

70% Improvement in Cpk

Process Conditions:
14 wafers with topography
Oxide thickness increment of ~250Å per wafer for 3000Å range across all 14 wafers (worst CMP lot to lot process variation prediction)

DUV resist process with AZ AQUATAR-III

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Optical Parameters, n/k value

AZ AQUATAR-VI-A

Wavelength (nm)

n-value

k-value

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Swing Suppression Effect

AZ AX1050P with and without AZ AQUATAR-VI-A

AZ AX1050P with AZ AQUATAR-VI-A-30

AZ AX1050P without AZ AQUATAR-VI-A-30

Photoresist film thickness (nm)