AZ® P4620 Photoresist Data Package

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**AZ’s Thick Film Photoresist Roadmap**

<table>
<thead>
<tr>
<th>Lift-off</th>
<th>TSV / Etch Implant, Plating</th>
<th>Copper/UBM Plating</th>
<th>Gold Plating</th>
<th>Solder / Metal Plating</th>
<th>MEMS / Ink Jet</th>
<th>DUV TFRH/Implant</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT : 2-10 µm</td>
<td>FT : 3-15 µm</td>
<td>FT : 5-30 µm</td>
<td>FT : 10-30 µm</td>
<td>FT : &gt;30 µm</td>
<td>FT : &gt;30 µm</td>
<td>FT: 3 - 8 µm</td>
</tr>
</tbody>
</table>

**Commercialized materials**

- **AZ® nLOF Series**
  - AZ® N4000
  - AZ® 9260/10XT
  - AZ® 2008HS
  - AZ® PLP30/PLP40
  - AZ® 50XT
  - AZ® TX 1311
  - AZ® VS-01HJ

- **AZ® 125nXT Series**

- **Materials under development**
  - AZ® IPS-528
  - AZ® 125nXT-AD Series

*Red=Neg, Blue =Pos; nLOF, N4000, 15nXT, 12XT, 40XT = chemically amplified; 125nXT = photopolymer; 10XT, 9200, P4620, 2008HS, PLP, 50XT, 4500 = DNQ*
# AZ® Electronic Materials

## Thick Photoresist Product Summary

<table>
<thead>
<tr>
<th>Thick Film Product</th>
<th>Platform</th>
<th>λ</th>
<th>FT Range (μm)</th>
<th>Maximum Single coat</th>
<th>Aspect Ratio</th>
<th>Application</th>
<th>Developer Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4000 Series</td>
<td>DNQ</td>
<td>g-h</td>
<td>2 - 55</td>
<td>25</td>
<td>2:1</td>
<td>Solder, Cu, Au</td>
<td>400K / TMAH</td>
</tr>
<tr>
<td>4500 Series</td>
<td>DNQ</td>
<td>g-h</td>
<td>2 - 55</td>
<td>25</td>
<td>2:1</td>
<td>Solder, Cu, Au</td>
<td>400K / TMAH</td>
</tr>
<tr>
<td>9200 Series</td>
<td>DNQ</td>
<td>g-h-i</td>
<td>3 - 50</td>
<td>25</td>
<td>3:1</td>
<td>Solder, Cu, Au</td>
<td>400K / TMAH</td>
</tr>
<tr>
<td>10XT</td>
<td>DNQ</td>
<td>g-h-i</td>
<td>4 - 50</td>
<td>25</td>
<td>3:1</td>
<td>Solder, Cu, Au</td>
<td>400K / TMAH</td>
</tr>
<tr>
<td>50XT</td>
<td>DNQ</td>
<td>g-h</td>
<td>15 - 65</td>
<td>65</td>
<td>3:1</td>
<td>Solder, Cu, Etch</td>
<td>400K</td>
</tr>
<tr>
<td>12XT Series</td>
<td>CA</td>
<td>g-h-i</td>
<td>5 - 20</td>
<td>20</td>
<td>4:1</td>
<td>Si, Cu, Au, TSV</td>
<td>TMAH</td>
</tr>
<tr>
<td>40XT Series</td>
<td>CA</td>
<td>g-h-i</td>
<td>20 - 100</td>
<td>60</td>
<td>4:1</td>
<td>Etch, Solder, Cu</td>
<td>TMAH / 400K</td>
</tr>
<tr>
<td>125nXT Series</td>
<td>PP</td>
<td>g-h-i</td>
<td>20 - 120</td>
<td>120</td>
<td>6:1</td>
<td>Cu, Au, Solder</td>
<td>TMAH / 303N</td>
</tr>
<tr>
<td>15nXT Series</td>
<td>CA</td>
<td>g-h-i</td>
<td>5 - 20</td>
<td>20</td>
<td>3:1</td>
<td>Cu, TSV Etch</td>
<td>TMAH</td>
</tr>
<tr>
<td>TX 1311</td>
<td>CA</td>
<td>DUV</td>
<td>3 - 5</td>
<td>5</td>
<td>15:1</td>
<td>Cu, NiFe, Si</td>
<td>TMAH</td>
</tr>
</tbody>
</table>

- **Platform:** DNQ = Novolak, CA = Chemically Amplified, PP = Photopolymer
- **Wavelength:** Red font indicates better performance.
- **Developer Compatibility:** Bold font indicates most compatible developer, resulting in shorter develop times and lower exposure energies.
AZ P4620 Process Conditions:

Optitrac Coat/ Bake
Coat: Static dispense on Silicon
Target Film Thickness: 15 µm
Softbake: 110 C hotplate/ 180 sec. HP
Exposure: PLA-501F ghi line Aligner
Develop: AZ 400K 1:4, Immersion for 300 sec., 23 C
Plating liquid: MICROFAB Cu200 (EEJA)
Plating height: 7.0um, Plating: 25 C / 30 min.

Analysis:

Amray SEM
AZ P4620  Copper plating

**Plating process condition**

- Photoresist thickness: **15um**, Prebake: 110 C / 180 sec (Hotplate)
- Exposure: PLA-501F (Soft contact, ghi-line aligner)
- Development: AZ 400K 1:4, Immersion for 300 sec, 23 C
- Plating liquid: MICROFAB Cu200 (EEJA)
- Plating height: 7.0um, Plating: 25 C / 30 min.
AZ P4620  Copper plating

Before plating (Development)  Cu plating  Resist Stripping

10um L/S

10um L/S

Plating process condition
Photoresist thickness: **15um**, Prebake: 110C/180 sec. (Hotplate)
Exposure: PLA-501F (Soft contact, ghi-line aligner)
Development: AZ 400K 1:4, Immersion for 300 sec., 23 C
Plating liquid: MICROFAB Cu200 (EEJA)
Plating height: 7.0um, Plating: 25 C / 30 min.
AZ® P4620 Gold Plating Process

FT: 28um, Single Coat
Softbake:
1) 100ºC / 500 sec. (Hotplate)
2) 90ºC / 180 min. (Oven)
Rehydration time: 60 minutes
Exposure: UTS-SS-III (ghi-line)
Develop: AZ 400K 1:3, 21.5ºC
Plating: Cyanide Gold Plating Solution
AZ® P4620 Gold Plating Process

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AZ® P4620 Gold Plating Process

Photoresist Mask CD = 93.5um;  Au Bump CD = 96um.
AZ P4620  Lithography performance

Process Conditions:

Optitrac Coat/ Bake
Coat: Static dispense on Silicon
Target Film Thickness: 12 µm
Softbake: 110C hotplate/ 80 sec. full contact
Exposure: Ultratech 1500 gh line Stepper
Develop: AZ® 300 MIF, continuous spray for 200 sec. @ 23 C

Analysis:

Amray SEM
## AZ P4620  Lithography performance

### Summary of Results:

<table>
<thead>
<tr>
<th></th>
<th>(µm)</th>
<th>DTP 10 µm (mJ/cm²)</th>
<th>Exposure Latitude 10 µm (%)</th>
<th>DOF 10 µm (µm)</th>
<th>Linearity (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense Lines</td>
<td>12</td>
<td>893</td>
<td>91</td>
<td>16</td>
<td>4.0</td>
</tr>
<tr>
<td>Contact Holes</td>
<td>12</td>
<td>927</td>
<td>91</td>
<td>&gt;8</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>
AZ P4620  Lithography performance

893 mJ/cm²
91% Exposure Latitude
AZ P4620  Lithography performance

Film Thickness: 12 µm
Optitrac coat and Bake
SB: 110 C/80 sec
Ultratech 1500 gh line Stepper
AZ 300 MIF, 200 sec continuous spray @ 23 C
Film Thickness: **12 µm**
Optitrac coat and Bake
SB: 110 C / 80 sec
Ultratech 1500 gh line Stepper
AZ 300 MIF, 200 sec continuous spray @ 23 C
AZ P4620  Lithography performance

Film Thickness: **12 µm**
Optitrac coat and Bake
SB: 110 C / 80 sec
Ultratech 1500 gh line Stepper
AZ 300 MIF, 200 sec continuous spray @ 23 C
**AZ P4620 Lithography performance**

<table>
<thead>
<tr>
<th>800mJ/cm²</th>
<th>900 mJ/cm²</th>
<th>1000 mJ/cm²</th>
<th>1100 mJ/cm²</th>
<th>1200 mJ/cm²</th>
</tr>
</thead>
</table>

10.0 µm Contact Holes  1:1 Pitch

Film Thickness: **12 µm**
Optitrac coat and Bake
SB: 110 C / 80 sec
Ultratech 1500 gh line Stepper
AZ 300 MIF, 200 sec continuous spray @ 23 C

10.0 µm Contact Holes  1:0.3 Pitch
AZ P4620  Lithography performance

1:1

1:0.7

1:0.3

-6.0 µm  -4.0 µm  -2.0 µm  0.0 µm  2.0 µm
AZ P4620  Lithography performance

Process Conditions:

- Optitrac Coat/ Bake
  Coat: Static dispense on Silicon
  Target Film Thickness: 24 µm

- Softbake: 1st layer 110 C hotplate/ 80 sec. full contact
  2nd layer 115 C hotplate/ 180 sec. full contact

- Exposure: Ultratech 1500 gh line Stepper

- Develop: AZ® 400K 1:4, continuous spray for 260 sec. @ 27 C

Analysis:

Amray SEM
AZ P4620  Lithography performance

Summary of Results:

<table>
<thead>
<tr>
<th></th>
<th>(μm)</th>
<th>DTP 10 μm (mJ/cm²)</th>
<th>Exposure Latitude 10 μm (%)</th>
<th>DOF 10 μm (μm)</th>
<th>Linearity (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense Lines</td>
<td>24</td>
<td>1742</td>
<td>29</td>
<td>16</td>
<td>5.0</td>
</tr>
<tr>
<td>Contact Holes</td>
<td>24</td>
<td>1574</td>
<td>39</td>
<td>&gt;8</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>
Film Thickness: 24 µm
Optitrac coat and Bake
SB: 1st layer 110 C / 80 sec
  2nd layer 115 C /180 sec
Ultratech 1500 gh line Stepper
AZ 400K 1:4, 260 sec continuous spray @ 27 C

AZ P4620 Lithography performance

1742 mJ/cm²
29% Exposure Latitude

Measured Linewidth (µm) vs Exposure Dose (mj/cm²)
**AZ P4620 Lithography performance**

<table>
<thead>
<tr>
<th>Exposure Intensity (mJ/cm²)</th>
<th>Lithography Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1650</td>
<td></td>
</tr>
<tr>
<td>1750</td>
<td></td>
</tr>
<tr>
<td>1850</td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td></td>
</tr>
</tbody>
</table>

**Film Thickness:** 24 µm

Optitrac coat and Bake

SB: 1st layer 110 C / 80 sec

2nd layer 115 C /180 sec

Ultratech 1500 gh line Stepper

AZ 400K 1:4, 260 sec continuous spray @ 27 C
AZ® P4620 Lithographic Performance Summary

Process Conditions

Substrate: Bare-Si
Film-thickness: 17µm
Softbake: 120°C / 240 sec. (DHP)
Exposure: Canon PLA-501F (ghi-line)
Dose: 630 mJ/cm²
Development: AZ 400K Developer 1:4, Immersion - 300 sec., 23°C
AZ® P4620 Lithographic Performance Summary

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AZ P4000 Series resist(s)
Ellipsometric Absorbance
Normalized to 1/µm

Absorbance (\textit{k})

Wavelength (nm)

BU Electronic Materials
AZ® P4000 Unbleached Absorbance Curve

AZ P4000 Series resist(s)
Ellipsometric Absorbance
Normalized to 1/µm

'B' ellipsometric: P4000

BU Electronic Materials
AZ® P4620 Spin Speed Curve

Substrate: 150 mm Silicon
Softbake: 110°C/180 sec hotplate
SEVERAL GRADES AVAILABLE

Film Thickness (Å)

Spin Speed (RPM)

P4903  P4620  P4400  P4330-RS  P4210  P4110

BU Electronic Materials