SOLVENTS AND SOLUBILITIES

With microstructuring, the solubilities of materials often play a crucial role in addition to etching processes. This concerns not only the structuring of materials soluble in organic solvents such as organic films, but all wet-chemical etching processes: In addition to the actual etching process, it is important to bring and to keep the etched substances in solution.

Interactive Forces Involved in the Solution Process

Etching and Dissolving

With both the wet-chemical etching and dissolution of solids, the bonds between atoms or molecules must be broken. While this is done during etching in the context of a chemical redox reaction with a charge transfer between the ions of the etching medium and the particles (atoms or molecules) of the solid to be etched, the dissolution can be regarded as a purely physical process without charge exchange and breaking of chemical bonds.

Therefore, when a solid is dissolved, only the interaction forces which do not act on the chemical valence bonds within a molecule but between the molecules of the solid and the solvent play a role, as explained in the following sections and shown comparatively in Fig. 114 in their distance-dependent magnitude.

Ionic Interactions

Ions, i.e., electrically charged atoms and molecules, are not only found in salts or electrolytes. In pure water at room temperature, one of approx. $1,000,000,000 \text{H}_2\text{O}$ molecules is dissociated in $\text{OH}^-$ or $\text{H}_3\text{O}^+$. In aqueous mixtures of organic solvents with acidic (e.g. ethyl lactate) or alkaline character (e.g. NMP), the concentration of oxonium or hydroxide ions can be orders of magnitude greater.

The electrostatic force between two ions coincides with the square of their distance between each other. The corresponding interaction energy between adjacent ions, i.e. their bonding energy, is typically a few eV and thus lies in of the order of magnitude of intra-molecular chemical bonds.

Interaction between Permanent Electric Dipoles

The different electro negativity of the atoms in polar molecules causes a spatial shift between the centre of the valence electron distribution and the centre of the positive nuclear charges. As a result, the molecule has an electric dipole moment (Fig. 111).

In liquids, adjacent dipoles can align anti-parallel to each other so that an attractive force acts between the positive pole of one dipole and the negative pole of the other, decreasing with the fourth power of the distance. The corresponding interaction energy between molecules is a few 100 meV, in the case of hydrogen bonds up to approx. 0.5 eV which explains the high boiling point of water.

Interaction between Induced Electric Dipoles

In all polar and non-polar atoms and molecules, the valence electron charge distribution permanently fluctuates due to interactions between the molecules with each other as well as electromagnetic radiation. As a consequence, temporary electric dipoles are steadily formed. These temporary dipoles interact with the valence electron orbitals of neighboured atoms/molecules and hereby induce temporary anti-parallely orientated electric dipoles resulting in a weak interaction (Fig. 112). This process is the more pronounced the higher its polarizability, i.e. the relocatability of the valence electron cloud is.

The resulting energy of the interaction is comparatively weak even for nearby particles with $<100$ meV, the attractive force derived from it drops with the 7th power of the distance between two molecules and is thus very short range.
The Pauli Repulsion

The interactions mentioned in the above sections result at least in an approximate force acting with different reciprocal powers $N$ of the distance ($1/R^N$) of two particles, which increases with increasing approximation. As solids and liquids have a finite density and their particles thus a certain average distance, there must be an interaction which counteracts a further approximation below a certain distance between the two particles.

This is the so-called Lennard-Jones Potential which is derived from the Pauli exclusion principle: If two particles approach each other so far that their electron shells overlap, the electrons must evade energetically higher orbitals in order not to pairwise occupy the same quantum state. This evasion requires all the more energy, the more the two particles approximate, the corresponding repulsive force increases accordingly.

Mixed Interactions

Mixed interactions are those between e.g. ions and dipoles (which play a role in the dissolution of salts in polar solvents such as water) or between permanent and induced dipoles in solvent mixtures.

Solubilities: Energy and Entropy

Some Thermodynamics

The molecules, atoms or ions of liquids or solids possess a negative bonding energy. This is precisely why they are not gaseous at a given temperature and pressure. In order to dissolve these substances, therefore, this bonding energy must first be overcome.

However, since the interactions described in the last section also occur between the substance and the solvent, the sum of the bonding energies can be further reduced during the dissolving process (exothermic mixing heat). An example of this is the heating during the dissolution or dilution of KOH or sulphuric acid in water.

However, when dissolving, for example, sodium chloride (NaCl) in water, the mixture cools below the temperature of the starting materials, the mixture is endothermic, i.e. energy must be supplied: During the hydrogenation of Na$^+$ and Cl$^-$ ions by water molecules, less energy is released than is required during the dissolution of the NaCl crystal (Fig. 113).

The reason why - in this example NaCl - is water-soluble despite the necessary internal energy increase $\Delta U$ lies in the simultaneous entropy increase $\Delta S$ of the total system: Dissolved ions have more degrees of freedom with respect to location and velocity, and thus entropy (disorder) than ions bound in the crystal.

At constant volume and pressure, a closed system of temperature $T$, tends to minimise the free (mixing) enthalpy $F = U - T \cdot S$, i.e. a solubility is only given if: $\Delta U - T \cdot \Delta S < 0$.

The Hansen Diagram

The condition $\Delta U - T \cdot \Delta S < 0$ mentioned in the last section as a prerequisite for a sufficient solubility of two substances (e.g. a photoresist
and solvent or two solvents with each other) can be derived
from Hansen model by the appearance and size of the dif-
ferent intermolecular interactions.

The solubility of two media A and B with each other is all
the greater the better the different interaction energies be-
tween A and B are coincident.

If, as shown in Fig. 115, the medium A to be dissolved and
various solvents B are shown in a diagram over their respec-
tive molar interaction energies of permanent (σₚ) and indi-
cated dipole moments (σᵩ), as well as the hydrogen bonding
energies (σₘ), suited solvents are shown (green points with-
in the green sphere) near A and unsuitable solvents (red
points) farther away from it.

Important Characteristics of Organic Solvents

Vapour Pressure, Evaporation and Boiling Point

In order to pass from the liquid into the gaseous phase, an
atom or molecule has to overcome its bonding energy Eₚ to
neighboured molecules with its kinetic energy Eₖin. In order
to fulfil this condition for all molecules in water or many typ-
ical organic solvents at the same time, a temperature of sev-
eral 1000°C would be required. At lower temperatures (also
at the boiling point!), only a very small fraction of the mole-
cules fulfils the condition Eₖin > Eₚ via the Maxwell-Boltzmann energy distribution (Fig. 116) even consid-
ering the comparable small energy gain caused by the interactions between the evaporated molecules.

Without external energy supply, the molecules remaining in the liquid after the high-energy
molecules passed to the gaseous phase have a lowered average Eₖin corresponding to a lower tempera-
ture (→ evaporative cooling).

The evaporated atoms or molecules in the gaseous phase also have a Maxwell-Boltzmann energy distri-
bution, so that molecules with Eₖin < Eₚ return to the liquid (condensation).

The equilibrium condition between the two transitions defines the temperature dependant vapour
pressure of the liquid. If the vapour pressure exceeds the atmospheric pressure at the so defined boiling
point, the liquid starts boiling. At lower temperatures, the liquid evap-
orates.

Since polarisability and (in case of polar molecules) dipole strength
roughly increase with the molec-
ular size, liquids with 'large' polar molecules such as NMP bear a low vapour pressure and high boiling
point, while liquids with 'small' mol-
ecules such as acetone have a high vapour pressure and, respectively, low boiling point.

Fig. 115: The Hansen diagram represents sub-
stances in the parameter space set by the
different interactive forces of the molecules.
These substances which are readily soluble
with each other are located close together; dif-
ficult to dissolve ones far away from each oth-
er.

Fig. 116: With increasing temperature, an increasing (but still small) frac-
tion of the molecules of a fictitious solvent has enough kinetic energy to
convert from the liquid into the gas phase.
The TLV value (threshold limit value) is the maximum concentration of a gas, vapour or particulate matter in the air at the workplace to which it is believed a worker can be exposed day after day for a working lifetime without adverse effects. Usually, the TLV value is averaged over periods of time up to one working day or work shift.

Also to comply with TLV values, you should be generally seek to minimise the level of the chemicals in the air at the workplace as far as possible.

**Flash Point**

The flash-point is the lowest temperature at which a liquid will yield vapours, under the conditions defined in the test method, in such an amount that a flammable vapour/air mixture is produced in the test vessel. The flash point of many organic solvents such as methanol, ethanol, isopropyl alcohol and acetone is < 20°C, and therefore form flammable or explosive vapour at room temperature and even below.

**Explosive Range**

The explosive range is the range of concentration between the lower and the upper explosion limits. The lower and upper explosive limits denote the two limit values of the fuel gas content in the fuel gas/air mixture in which an independent flame propagation from the ignition source no longer occurs. The lower explosive limit can be below 1 %; the upper explosive limit of many organic solvents is typically some 10 %.

**Ignition Temperature**

The ignition temperature represents a measure of the auto-flammability, as the inflammation without an external ignition source. The auto-ignition temperature is the lowest temperature at which the test substance will ignite when mixed with air under the conditions defined in the test method. The ignition temperature of most organic solvents is located above 200°C.

**Characteristics of Selected Organic Solvents in Comparison**

<table>
<thead>
<tr>
<th></th>
<th>( \rho ) (g/cm(^3))</th>
<th>( T_\text{s} ) (°C)</th>
<th>( P_\text{s} ) (hPa)</th>
<th>( T_\text{F} ) (°C)</th>
<th>( T_\text{Z} ) (°C)</th>
<th>( D_\text{E} ) (10(^{-3}) C·m)</th>
<th>( \alpha ) (10(^{-4}) m(^2)As/V)</th>
<th>LEL (%Vol)</th>
<th>UEL (%Vol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>0.79</td>
<td>56</td>
<td>246</td>
<td>-18</td>
<td>527</td>
<td>9.6</td>
<td>6.4</td>
<td>2.2</td>
<td>14.3</td>
</tr>
<tr>
<td>Isopropanol</td>
<td>0.78</td>
<td>82</td>
<td>43</td>
<td>12</td>
<td>425</td>
<td>5.5</td>
<td>7.9</td>
<td>1.9</td>
<td>13.4</td>
</tr>
<tr>
<td>MEK</td>
<td>0.81</td>
<td>80</td>
<td>105</td>
<td>-7.5</td>
<td>475</td>
<td>9.2</td>
<td>9.1</td>
<td>1.5</td>
<td>12.6</td>
</tr>
<tr>
<td>Methanol</td>
<td>0.79</td>
<td>65</td>
<td>129</td>
<td>9</td>
<td>440</td>
<td>5.7</td>
<td>3.6</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Ethanol</td>
<td>0.79</td>
<td>78</td>
<td>58</td>
<td>12</td>
<td>400</td>
<td>5.8</td>
<td>5.7</td>
<td>3.1</td>
<td>27.7</td>
</tr>
<tr>
<td>PGMEA</td>
<td>0.97</td>
<td>149</td>
<td>3.1</td>
<td>45</td>
<td>315</td>
<td>14.6</td>
<td>1.5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Ethyl lactate</td>
<td>1.03</td>
<td>154</td>
<td>1.6</td>
<td>46</td>
<td>400</td>
<td>12.6</td>
<td>1.5</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>0.89</td>
<td>77</td>
<td>98</td>
<td>-4</td>
<td>470</td>
<td>6.3</td>
<td>9.9</td>
<td>2</td>
<td>12.8</td>
</tr>
<tr>
<td>Butyl acetate</td>
<td>0.88</td>
<td>127</td>
<td>10.7</td>
<td>27</td>
<td>390</td>
<td>13.9</td>
<td>1.2</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>MIBK</td>
<td>0.80</td>
<td>116</td>
<td>18.8</td>
<td>14</td>
<td>475</td>
<td>13.2</td>
<td>1.2</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>NMP</td>
<td>1.03</td>
<td>203</td>
<td>0.32</td>
<td>86</td>
<td>265</td>
<td>4.1</td>
<td>11.8</td>
<td>1.5</td>
<td>9.5</td>
</tr>
<tr>
<td>DMSO</td>
<td>1.1</td>
<td>189</td>
<td>0.06</td>
<td>88</td>
<td>270</td>
<td>13</td>
<td>8.9</td>
<td>1.8</td>
<td>n.d.</td>
</tr>
</tbody>
</table>

Table 5: The characteristics of density (\( \rho \)), boiling point (\( T_\text{s} \)), vapour pressure at 20°C (\( P_\text{s} \)), flash point (\( T_\text{F} \)), ignition temperature (\( T_\text{Z} \)), molecular electric dipole moment (\( D_\text{E} \)), static polarizing capability (\( \alpha \)), lower (LEL) and upper explosion limit (UEL) of selected organic solvents from our portfolio.
### Our Photoresists: Application Areas and Compatibilities

<table>
<thead>
<tr>
<th>Recommended Applications¹</th>
<th>Resist Family</th>
<th>Photosists</th>
<th>Resist Film Thickness²</th>
<th>Recommended Developers³</th>
<th>Recommended Removers³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive</strong></td>
<td><strong>AZ 1500</strong></td>
<td>AZ® 1505</td>
<td>≈ 0.5 µm</td>
<td>AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td>TechniStrip® P1316, TechniStrip® P1331</td>
</tr>
<tr>
<td>Improved adhesion for wet etching, no focus on steep resist sidewalls</td>
<td>AZ® 1512 HS</td>
<td>AZ® 1514 H</td>
<td>≈ 1.0 - 1.5 µm</td>
<td>AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® 1518</td>
<td></td>
<td>≈ 1.2 - 2.0 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® 4500</td>
<td>AZ® 4533</td>
<td>≈ 3 - 5 µm</td>
<td>AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® 4562</td>
<td></td>
<td>≈ 5 - 10 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spray coating</td>
<td>AZ® P4000</td>
<td>AZ® P4110</td>
<td>≈ 1 - 2 µm</td>
<td>AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® P4330</td>
<td></td>
<td>≈ 3 - 5 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® P4620</td>
<td></td>
<td>≈ 6 - 20 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® P4903</td>
<td></td>
<td>≈ 10 - 30 µm</td>
<td></td>
<td></td>
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<tr>
<td>Dip coating</td>
<td>AZ® PL 177</td>
<td>AZ® PL 177</td>
<td>≈ 5 - 8 µm</td>
<td>AZ® 351B, AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® 4999</td>
<td></td>
<td>≈ 1 - 15 µm</td>
<td>AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td><strong>Positive (chem. amplified)</strong></td>
<td><strong>AZ 2000</strong></td>
<td>AZ® 12 XT-20PL-05</td>
<td>≈ 3 - 8 µm</td>
<td>AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td>TechniStrip® Micro D2, TechniStrip® P1316, TechniStrip® P1331</td>
</tr>
<tr>
<td>Improved adhesion, steep resist sidewalls and high aspect ratios for e. g. dry etching or plating</td>
<td>AZ® 12 XT-20PL-10</td>
<td>AZ® 12 XT-20PL-20</td>
<td>≈ 6 - 10 µm</td>
<td>AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® 40 XT</td>
<td></td>
<td>≈ 10 - 30 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AZ® 701 MR</td>
<td>AZ® 701 MR (14 cPs)</td>
<td>≈ 6 - 20 µm</td>
<td>AZ® 400K, AZ® 326 MIF, AZ® 726 MIF</td>
<td>TechniStrip® P1316, TechniStrip® P1331</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AZ® 701 MR (29 cPs)</td>
<td>≈ 2 - 3 µm</td>
<td></td>
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<tr>
<td><strong>Image Reversal</strong></td>
<td><strong>AZ 5200</strong></td>
<td>AZ® 5209</td>
<td>≈ 1 µm</td>
<td>AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td>TechniStrip® Micro D2, TechniStrip® P1316, TechniStrip® P1331</td>
</tr>
<tr>
<td>Elevated thermal softening point and undercut for lift-off applications</td>
<td>AZ® 5214</td>
<td></td>
<td>≈ 1 - 2 µm</td>
<td></td>
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<tr>
<td></td>
<td>Ti</td>
<td>Ti 356SX</td>
<td>≈ 3 - 4 µm</td>
<td>Az® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ti xLift-X</td>
<td>≈ 4 - 6 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Negative (Cross-linking)</strong></td>
<td><strong>AZ 8200</strong></td>
<td>AZ® nLOF 2000</td>
<td>≈ 1.5 - 3 µm</td>
<td>AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td>TechniStrip® NIS55, TechniStrip® NF52, TechniStrip® MLO 07</td>
</tr>
<tr>
<td>Negative resist sidewalls in combination with no thermal softening for lift-off application</td>
<td>AZ® nLOF 2035</td>
<td>AZ® nLOF 2070</td>
<td>≈ 3 - 5 µm</td>
<td>AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td></td>
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<td></td>
<td>AZ® nLOF 5500</td>
<td>AZ® nLOF 5510</td>
<td>≈ 0.7 - 1.5 µm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved adhesion, steep resist sidewalls and high aspect ratios for e. g. dry etching or plating</td>
<td>AZ® nXT</td>
<td>AZ® 15 nXT (115 cPs)</td>
<td>≈ 2 - 3 µm</td>
<td>AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td>TechniStrip® P1316, TechniStrip® P1331, TechniStrip® NF52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AZ® 15 nXT (450 cPs)</td>
<td>≈ 5 - 20 µm</td>
<td></td>
<td>TechniStrip® MLO 07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AZ® 125 nXT</td>
<td>≈ 20 - 100 µm</td>
<td>AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF</td>
<td>TechniStrip® MLO 07</td>
</tr>
</tbody>
</table>

### Inorganic Developers

**AZ® Developer** is based on sodium phosphate and –metasilicate, is optimized for minimal aluminum attack and is typically used diluted 1 : 1 in DI water for high contrast or undiluted for high development rates. The dark erosion of this developer is slightly higher compared to other developers.

AZ® 351B is based on buffered NaOH and typically used diluted 1 : 4 with water, for thick resists up to 1 : 3 if a lower contrast can be tolerated.

AZ® 400K is based on buffered KOH and typically used diluted 1 : 4 with water, for thick resists up to 1 : 3 if a lower contrast can be tolerated.

AZ® 303 specifically for the AZ® 111 XFS photoresist based on KOH / NaOH is typically diluted 1 : 3 - 1 : 7 with water, depending on whether a high development rate, or a high contrast is required

**Metal Ion Free Developers** (typical demand under standard conditions approx. 5 - 10 L developer concentrate per L photoresist)

AZ® 326 MIF is 2.38 % TMAH- (TetraMethylAmmoniumHydroxide) in water.
**Our Removers: Application Areas and Compatibilities**

AZ® 100 Remover is an amine solvent mixture and standard remover for AZ® and TI photoresists. To improve its performance, AZ® 100 remover can be heated to 60 - 80°C. Because the AZ® 100 Remover reacts highly alkaline with water, it is suitable for this with respect to sensitive substrate materials such as Cu, Al or ITO only if contamination with water can be ruled out.

TechniStrip® P1316 is a remover with very strong stripping power for Novolak-based positive resists (including all AZ® positive resists), epoxy-based coatings, polyimides and dry films. At typical application temperatures around 75°C, TechniStrip® P1316 may dissolve cross-linked resists with residue also, e.g. through dry etching or ion implantation. TechniStrip® P1316 can also be used in spraying processes. For alkaline sensitive materials, TechniStrip® P1331 would be an alternative to the P1316. Not compatible with Au oder GaAs.

TechniStrip® P1331 can be an alternative for TechniStrip® P1316 in case of alkaline sensitive materials. TechniStrip® P1331 is not compatible with Au or GaAs.

TechniStrip® Ni555 is a stripper with very strong dissolve power for Novolak-based negative resists such as the AZ® 15 nXT and AZ® nLOF 2000 series and very thick positive resists such as the AZ® 40 XT. TechniStrip® Ni555 was developed not only to peel cross-linked resists, but also to dissolve them without residues. This prevents contamination of the basin and filter by resist particles and skins, as can occur with standard strippers. TechniStrip® Ni555 is not compatible with GaAs.

TechniClean™ CA25 is a semi-aqueous proprietary blend formulated to address post etch residue (PER) removal for all interconnect and technology nodes. Extremely efficient at quickly and selectively removing organo-metal oxides from Al, Cu, Ti, TiN, W and Ni.

TechniStrip™ NFS2 is a highly effective remover for negative resists (liquid resists as well as dry films). The intrinsic nature of the additives and solvent make the blend totally compatible with metals used throughout the BEOL interconnects to WLP bumping applications.

TechniStrip™ Micro D2 is a versatile stripper dedicated to address resin lift-off and dissolution on negative and positive tone resist. The organic mixture blend has the particularity to offer high metal and material compatibility allowing to be used on all stacks and particularly on fragile III/V substrates for instance.

TechniStrip™ MLO 07 is a highly efficient positive and negative tone photoresist remover used for IR, III/V, MEMS, Photonic, TSV mask, solder bumping and hard disk stripping applications. Developed to address high dissolution performance and high material compatibility on Cu, Al, Sn/Ag, Alumina and common organic substrates.

**Our Wafers and their Specifications**

**Silicon-, Quartz-, Fused Silica and Glass Wafers**

Silicon wafers are either produced via the Czochralski- (CZ-) or Float zone (FZ-) method. The more expensive FZ wafers are primarily reasonable if very high-ohmic wafers (> 100 Ohm cm) are required.

Quartz wafers are made of monocrystalline SiO₂, main criterion is the crystal orientation (e. g. X-, Y-, Z-, AT- or ST-cut)

Fused silica wafers consist of amorphous SiO₂. The so-called JGS2 wafers have a high transmission in the range of ≈ 280 - 2000 nm wavelength, the more expensive JGS1 wafers at ≈ 220 - 1100 nm.

Our glass wafers, if not otherwise specified, are made of borosilicate glass.

**Specifications**

Common parameters for all wafers are diameter, thickness and surface (1- or 2-side polished). Fused silica wafers are made either of JGS1 or JGS2 material, for quartz wafers the crystal orientation (e. g. <100>, or <111>) the doping (n- or p-type) as well as the resistivity (Ohm cm) are selection criteria.

Prime-, Test-, and Dummy Wafers

Silicon wafers usually come as „Prime-grade“ or „Test-grade“, latter mainly have a slightly broader particle specification. „Dummy-Wafers“ neither fulfill Prime- nor Test-grade for different possible reasons (e. g. very broad or missing specification of one or several parameters, reclaim wafers, no particle specification) but might be a cheap alternative for e. g. resist coating tests or equipment start-up.

Our Silicon-, Quartz-, Fused Silica and Glass Wafers

Our frequently updated wafer stock list can be found here: [www.microchemicals.com/products/wafers/waferlist.html](http://www.microchemicals.com/products/wafers/waferlist.html)

**Further Products from our Portfolio**

**Plating**

Plating solutions for e. g. gold, copper, nickel, tin or palladium: [www.microchemicals.com/products/electroplating.html](http://www.microchemicals.com/products/electroplating.html)

**Solvents (MOS, VLSI, ULSI)**

Acetone, isopropyl alcohol, MEK, DMSO, cyclopentanone, butylacetate, ... [www.microchemicals.com/products/solvents.html](http://www.microchemicals.com/products/solvents.html)

**Acids and Bases (MOS, VLSI, ULSI)**

Hydrochloric acid, sulphuric acid, nitric acid, KOH, TMAH, ... [www.microchemicals.com/products/etchants.html](http://www.microchemicals.com/products/etchants.html)

**Etching Mixtures**

for e. g. chromium, gold, silicon, copper, titanium, ... [www.microchemicals.com/products/etching_mixtures.html](http://www.microchemicals.com/products/etching_mixtures.html)

**AZ® 726 MIF** is 2.38 % TMAH- (TetraMethylAmmoniumHydroxide) in water, with additional surfactants for rapid and uniform wetting of the substrate (e. g. for puddle development)

**AZ® 826 MIF** is 2.38 % TMAH- (TetraMethylAmmoniumHydroxide) in water, with additional surfactants for rapid and uniform wetting of the substrate (e. g. for puddle development) and other additives for the removal of poorly soluble resist components (residues with specific resist families), however at the expense of a slightly higher dark erosion.
Further Information


Our Photolithography Book and -Posters

We see it as our main task to make you understand all aspects of microstructuring in an application-oriented way. At present, we have implemented this claim with our book *Photolithography* on over 200 pages, as well as attractively designed DIN A0 posters for your office or laboratory. We will gladly send both of these to you free of charge as our customer (if applicable, we charge shipping costs for non-European deliveries):


Thank you for your interest!

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