SPIN-COATING

Due to the high potential homogeneity and throughput, spin-coating is by far the most common method for coating substrates with photoresists. In addition to the advantages of this technique, this chapter also discusses common technical problems together with possible solutions.

Techniques and Application Areas

Principle of Spin-coating

In this coating technique, typically a few ml of resist are placed (*dispensed*) on a substrate which is typically brought to a rotational speed of several 1000 rpm before (*dynamic* spin-coating Fig. 53) or shortly thereafter (*static* spin-coating).

Due to the centrifugal force, the dispensed resist spreads into a uniform resist film of desired film thickness, excess resist is spun off the edge of the substrate. At the same time, a part of the solvent evaporates from the resist film, so that its thinning stopped on the one hand and on the other hand, the resist film becomes sufficiently stable to suppress its elapsing during the handling of the wafers after coating.

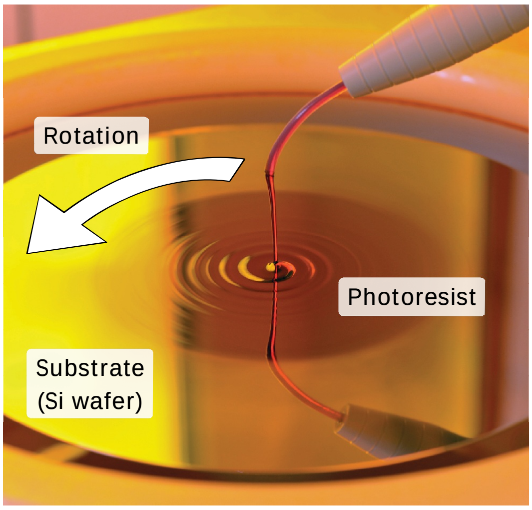

Fig. 53: A resist dispensed on a rotating substrate thins out through the spin force until the drying of the resist through the evaporation of the solvent stops a further spin off.

Advantages

The spin-coating of the resist typically takes only 10 - 20 seconds and permits the short cycle times of less than one minute required for industrial production, including dispensing and wafer handling.

The resist films attained by spin-coating are very smooth, can be adjusted in their thickness very accurately and reproducibly, and show very good thickness homogeneity, at least for circular substrates (wafers).

Disadvantages and Limitations

Especially with square or rectangular substrates, but also with circular substrates in the case of thick resist films, the air turbulences at the edges and above all the corners of the substrate causes an accelerated drying of the resist which suppresses the spin-off of the resist at the corners and edges and causes a sidewall of resist near the substrate edge.

On textured substrates, the thickness homogeneity of the resist film suffers. On the one hand, the resist can be pulled back from the edges of the textures, on the other hand spaces and holes can build up unintentional resist film thicknesses.

Because most of the dispensed resist is spun off, the yield of photoresist is very low, with typical only a few %, but this usually only plays a very minor factor in semiconductor manufacture and is only a significant cost factor for low-priced end products.

Influence Factors of the Resist Film Thickness

Influence of the Attained Spin Speed

If, as usual, the spin-coating of the resist from the substrate continues until it has been stopped by the drying process, the attainable resist film thickness decreases in a good approximation with the reciprocal square root of the spin speed (Fig. 54).

Thus a given resist allows a certain range in the attainable resist film thickness. A doubling of the spin speed thus reduces the thickness of the resist film by a factor of approximately 1.4, so that the film thickness can be adjusted with a certain resist in a certain range by varying the spin speed.

For many AZ® resists, such as the AZ® 1500, AZ® 4500, AZ® 9200 or AZ® ECI 3000 series, the last two digits of the designation (e.g. AZ® 1518) indicate the film thickness attained by spin coating at 4000 rpm (for some resists at 3000 rpm) in 100 nm units using the example of AZ® 1518, i.e. 1.8 µm.

Influence of the Spin Time

If the spin-coating is stopped during the phase in which the resist is still being spun off the substrate, the resist film thickness achieved can be adjusted over the spinning time. The more viscous a resist is and the slower the spin speed is, the larger the corresponding time window:

As Fig. 55 shows, with conventional spinning speeds of 3000 - 4000 rpm with thinner resists like the AZ® 6632, 3 µm of final resist film thickness is completed after only a few seconds, with thick resists like the AZ® 9260, 7 µm is first completed in about 20 seconds. The further thinning is based on the evaporation of the solvent during the spinning or the subsequent softbake.

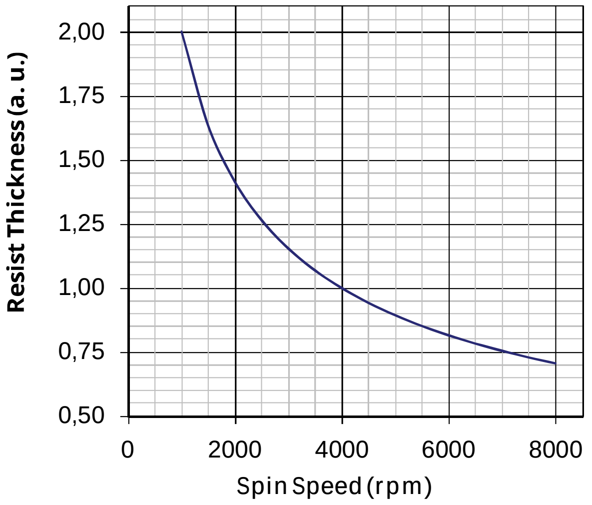

Fig. 54: The attained film thickness of an arbitrary resist (in arbitrary units, normalized to 1 at 4000 rpm) as a function of the spin speed.

Because the attained resist film thickness is very time-critical due to the interruption of the spin-coating during the spin off, however, it is advisable, for reasons of reproducibility, to use a resist which achieves the desired film thickness with conventional spin profiles (2000 - 4000 rpm for 20 - 30 seconds).

Residual Solvent Content

The residual solvent content in the resist film also influences the resist film thickness. During spin-coating, the remaining solvent concentration initially sinks rapidly and saturates to a value which usually depends on the resist film thickness and the solvent used. Typical values of the residual solvent concentration after spin-coating are between approximately 10% (thin resists) to 35% (thick resists). Only at higher temperatures (softbake) does the concentration further decrease to approx. 3 - 5%, where especially in case of thick resist films, substrate-near resist areas have significantly higher values than areas near the resist surface.

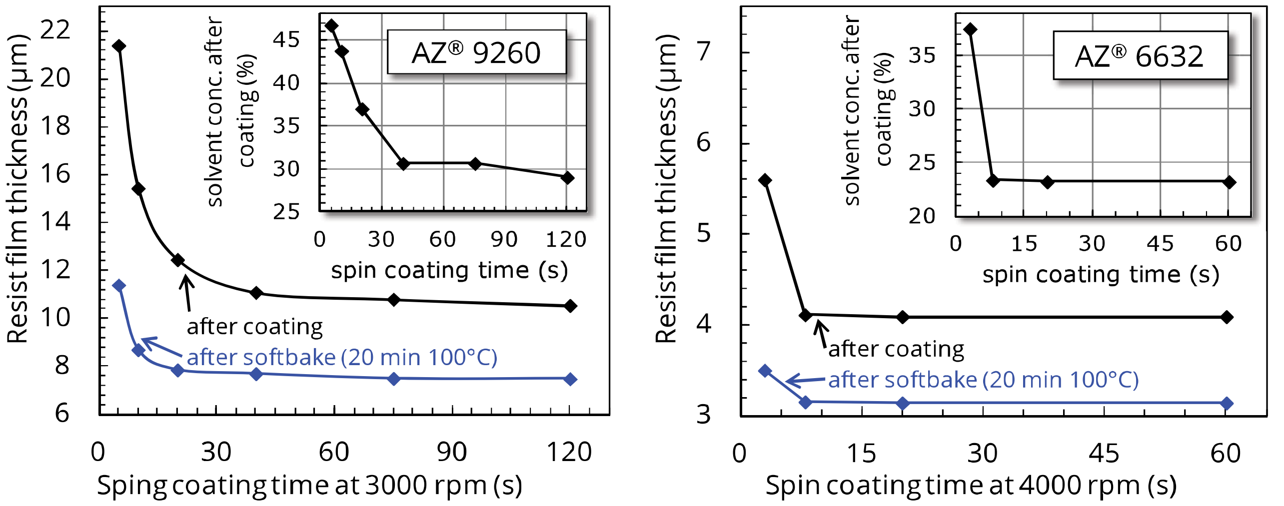

Fig. 55: With highly viscous resists such as the AZ® 9260 (left), the spin off of the resist at 3000 rpm takes approx. 20 s (external diagram), slower spin speeds hardly further reduce the resist film thickness (blue) attained after the softbake. The film thickness measured immediately after spin-coating (black) thins out further which is mainly due to residual solvent evaporating during the spin cycle (inside diagram). When a low viscous resist such as the AZ® 6632 (right), the spin off is already completed after a few seconds.

Temperature

The evaporation rate of the solvent from the resist increases towards higher temperatures and the viscosity of the resist drops. Both effects have an opposite effect on the resist film thickness attained, so that a change in the temperature by a few °C does not mean too much variation in the attained resist thickness usual tolerable for uncritical processes.

Equipment

In addition to temperature and air humidity, the solvent concentration of the atmosphere in the spin coater also influences the attained film thickness: The more saturated the air, the lower the evaporation rate of the solvent from the resist film, the longer the spinning off of the resist takes and the lower the resist film thickness finally attained. Thus after the cleaning of the coater of resist residues or after longer periods the coater has not been used, it may be useful to first coat some dummy wafers in order to obtain a constant film thickness for all subsequent wafer coatings.

The equipment itself has a great influence on the coating result: The use of a Gyr set (a cover rotating synchronously with the substrate) reduces the relative air movement over the substrate and thus the evaporation rate of the solvent from the resist film, and can thereby reduce the attained resist thickness by a factor of two or more.

The Edge Bead and Its Elimination or Reduction

Causes and Results

Especially during the coating of thick resist films as well as with square substrates, a so-called edge bead forms, that is, an edge elevation of the photoresist film which is problematical in the case of contact exposure:

Due to the high residual solvent content in the edge bead even after the softbake, the mask may stick to the resist film. The edge bead also acts as an unwanted spacer between the resist film and the mask during exposure, which is often the reason for a poor resolution, wrong dimensions or an unintentionally low sidewall angle of the developed resist pattern.

Reduction or Elimination

If an automatic edge bead removal is not possible, the following options can help reducing / eliminating the edge bead:

- For circular substrates: Dynamic edge bead removal at about 500 rpm with AZ® EBR solvent (no solvent with high vapour pressure such as acetone!) from a wash bottle with fine spray nozzle
- The use of a resist which reaches the target film thickness at sufficiently high spin speed (3000-4000 rpm)
- Towards very thick resist films: A higher spin speed for a short time
- A spin-off of the edge bead by an abrupt increase of the spin speed at the end of the coating, when the coating has sufficiently dried, but the edge bead is still liquid enough for a spin-off.
- A multiple coating of two or more resist films on top of each other with each higher spin speed
- A waiting period between the resist coating and softbake dependent on the resist film thickness and residual solvent content to prevent an increase of the existing edge bead by the sudden drop of the viscosity at the high softbake temperature (possibly multi-stage drying: Room temperature ... 50°C ... 95°C).
- A well-adjusted cavity in the substrate holder with the substrate as close inlay.
- In case of non-circular substrates: If possible, remove (break) the edge pieces of the substrate together with the edge bead, or wipe the edge bead with clean room wipers

Inhomogeneous Resist Film Thickness and Resist Defects

Textured Substrates

A two-stage spin profile can be useful in order to attain the best possible homogeneity on textured substrates: The resist can be distributed over the textures of the substrate by a short spin-coating at about 500 rpm so that it can then be thinned out to the desired film thickness at higher speeds. The spin-coating at low speeds should not take longer than a few seconds to prevent a premature drying of the resist at this stage.

If the attained coating result nevertheless is not satisfactory, an alternative coating method such as the dip coating or spray coating should be taken into consideration.

Non-circular Substrates

Here, the air swirling causes an accelerated drying of the resist at the edges and especially above the corners of the substrate which suppresses the spin off of the resist at these points and produces an edge bead of the resist (For details, see section 10.3).

Equipment

Inhomogeneous resist coatings are often caused by unsuitable equipment: Openings in the cover of the spin coater cause turbulences over the resist film during the rotation of the substrate, which result in a non-uniform drying of the same. It is generally recommended to cover these openings from the inside (e. g. with a tape) so that the inside of the cover forms a smooth, uninterrupted surface.

The inner side walls of the coater should be tilted in such a way that the spun off resist is not deflected with formation of resist droplets back onto the substrate, but downwards.

Used Resist

For spin-coating only resists with high-boiling solvents should be used. Low-boiling solvents allow the resist to dry too rapidly during spin-coating and prevent the formation of a resist film thickness which is homogeneous over the substrate. Unless otherwise denoted as dip or spray resists, our AZ® and TI resists are optimised for spin-coating.

Resist Discontinuity

Comet-shaped resist discontinuities or thinning ("comets") often start with air bubbles in the resist or particles in the resist or on the substrate.

A further reason for uncoated areas can be an excessively low resist quantity (the optimum of which depends on the substrate size, resist film thickness, resist viscosity and the spin profile) or decentrally dispensed resist on the substrate.

In the case of smooth substrates, a high acceleration (> 1000 rpm/s) towards the final spin speed suppresses the appearance of uncoated parts on the substrate: Fig. 56 shows the coating result for three differently steep ramps of the spin profile. Textured substrates may require a two-step spin profile: After distributing a comparable high resist volume at low spin speeds (e.g. 1000 rpm) for a few seconds, ramping upwards to the final spin speed adjusts the desired resist film thickness.

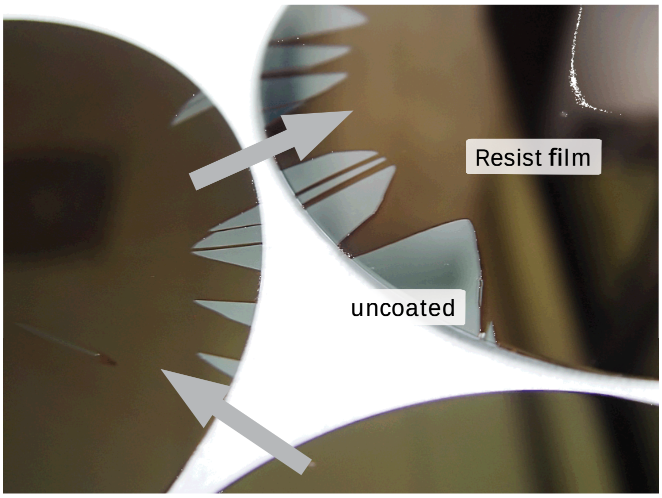

Fig. 56: A decreasing acceleration in the arrow direction on the final spin speed increases the risk of resist cracks.

Particles or Air Bubbles in the Resist Film?

Appearance

Radial, striated Inhomogeneities in the resist film often originate as particles or gas bubbles in the applied coating. Due to the usually microscopic size of the particles or bubbles, it often cannot be determined with the naked eye which is responsible both for the defective photo mask. In our experience, gas bubbles are mistaken for particles in many cases.

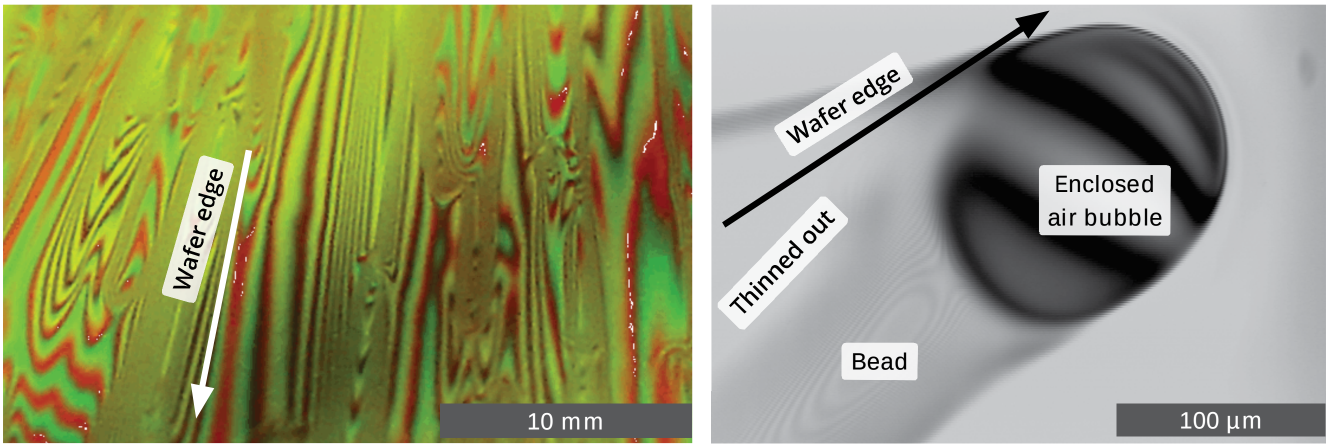

Fig. 57: Inhomogeneities of the resist film after spin-coating (left) usually supposed to stem from particles often have their origin in introduced air bubbles (right)

Particles and Clots

If particles are already on the substrate before resist coating, they can be removed with an isopropyl alcohol cleaning step. If the particles originate from the “clean”-room air and the clean-room class cannot be improved, the use of a N_2 pistol immediately before resist coating will help blow away a certain fraction of the particles from the substrate surface.

Particles can also stem from the resist itself: An expired resist, the wrong storage conditions (too hot) of the resist or a too strong resist dilution promotes the formation of particles in the resist which should no longer be used. Some resists such as the AZ® 1500 or 6600 series are much more sensitive to particle formation than typical thick resists such as AZ® 4562 or 9260.

In particular highly diluted resists may start “gelatinising” resulting in mm-sized “clots” on the coated resist film with the same colour as the resist itself.

Air Bubbles

Air bubbles in the resist film are often incorporated into the liquid resist during transportation of the resist bottle (e. g. in the clean room), refilling resist into another container or pipetting the resist for dispensing.

In this case, a delay without moving the resist in the container helps outgas the air bubbles. The time required greatly depends on the resist viscosity and ranges from approx. 20 minutes for a thin resist up to several hours for highly viscous resists.

Nitrogen Bubbles

DNQ-based positive and image reversal resists (including almost all AZ® and TI positive and image reversal resists) form nitrogen released by the gradual thermal decomposition of the photoactive compound. If – after storing for a certain time – the resist bottle is opened, the N_2 dissolved in the resist may suddenly expand and form bubbles.

Shaking the closed resist bottle, followed by leaving the screw cap slightly loosened for a period of time helps outgas the N_2 bubbles from the resist in the bottle. The time required greatly depends on the resist viscosity and ranges from approx. 20 minutes for a thin resist up to several hours for thick resists. A treatment of the open container in an ultrasonic bath can also help.

Locally Inferior Wetting

Also at points on the substrate with very poor adhesion or resist wetting, coating defects can occur. A locally reduced resist wetting can originate from previous processes or insufficient substrate cleaning, an incorrect use of adhesion promoters, prior process steps or residues from evaporated droplets of contaminated chemicals or deionized water.

Measurement of the Resist Film Thickness

The resist film thickness can be determined via optical methods such as transmission or reflection spectroscopy. Another simple way to determine the film thickness is to scratch the softbaked resist on a dummy wafer with e.g. a scalpel or tweezers and measure the depth of the scratch with a surface profilometer.

A measurement of developed resist structures is only useful for the determination of the original resist film thickness after the softbake if it can be assumed that the unexposed (or with image reversal or negative resists, exposed) resist areas are not significantly thinned by the developer.

Attaining Thick and very Thick Resist Films

Suitable Spin Profiles

For attaining a certain resist film thickness, it is recommended to use a resist which achieves this thickness at standard spin speeds of approx. 2000 - 4000 rpm. With, e.g. the positive resists AZ® 4562 or 9260 or the negative resists AZ® nLOF 2070 or AZ® 15 nXT, film thicknesses up to 10 µm can be attained and with the positive resist AZ® 40 XT or the negative resist 125 nXT film thicknesses up to approx. 50 - 100 µm are possible.

If even higher resist film thicknesses are required, there are principally two approaches: Either by reducing the spin speed or by reducing the spin time. Low spin speeds, however, cause a pronounced edge bead and sometimes even prevent the resist from tearing off the substrate with a non reproducible resist film thickness as a consequence.

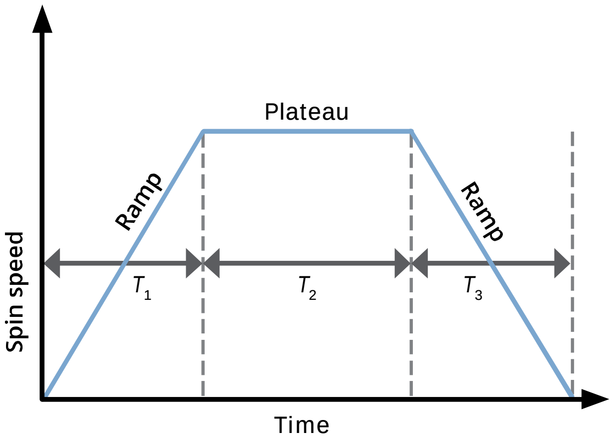

Fig. 58: A spin profile with steep ramps (short T_1 and T_3), and an adjustable short plateau (T_2) to attain thicker and at the same time, more homogeneous resist films.

Therefore, a spin profile which is much better suited for thick resist film above the standard thickness of the photoresist used is schematically shown in Fig. 58: After a short ramp (approx. 1000 rpm/s) from zero to approx. 1500 - 2000 rpm, this speed is held for a few seconds (T_2), then rapidly decelerated to 0 rpm. The attained resist film thickness can be adjusted via the time T_2 by using several trials.

Multiple Coating

For a homogeneous evaporation of the solvent from the resist film without significant loss in thickness homogeneity, we recommend a double- or multiple coating as schematically shown in Fig. 59 on the basis of the AZ® 9260: Each coating is done at a 1500 rpm spin speed for only a few seconds as described in the previous section followed by a waiting time for the smoothing and drying of the resist film. A short softbake stabilises each newly applied resist film so that the following coating does not partially dissolve the existing coating. These softbake steps can be done to improve the homogeneity of the coating result in two stages. The first step at 60°C gently dries the resist film to suppress an elapsing of the resist film

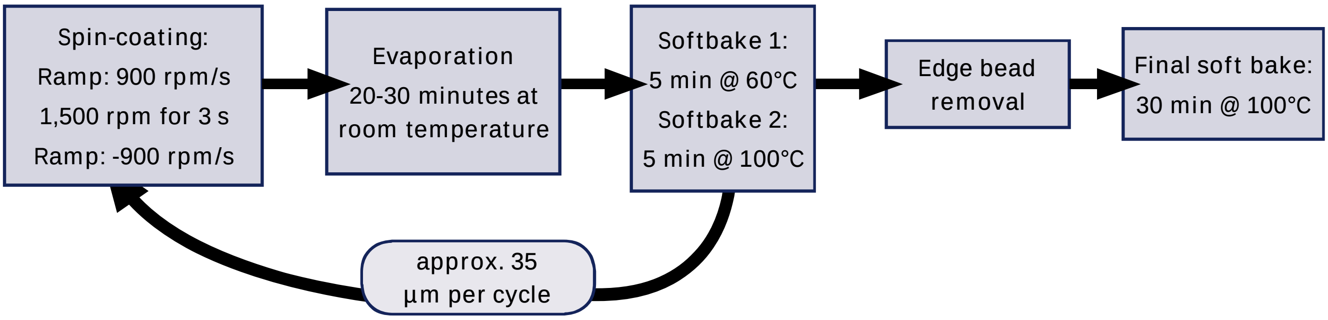

Fig. 59: Process sequence a multiple coating with the AZ 9260: The softbake after each coating cycle suppresses the dissolving of the resist film for the following coating. The actual drying of the resist film is concluded.

through the sudden decrease of the viscosity at the subsequent higher softbake temperatures.

A successful multiple coating assumes sufficiently highly viscous (low-solvent) resists such as AZ® 9260 or AZ® 4562. Otherwise, a 2nd coating step will partially or completely dissolve the resist film coated before, thus leading to strong inhomogeneities in the resist film thickness.

Suitable Ultra-thick Resists

In addition to the above spin profiles for conventional thick resists, very large resist thicknesses (approx. 30-300 µm) can be attained in the easiest way with, for example, the positive resist AZ® 40 XT, or a negative resist AZ® 125 nXT.

The innovative chemistry of these two chemically amplified resists also makes the further processing (softbake, exposure and development) much faster than with conventional resists such as the AZ® 4562 or 9260 which require long processing times for the softbake, rehydration and the development especially towards higher resist film thicknesses.

Our Photoresists: Application Areas and Compatibilities

Recommended Applications[1]		Resist Family	Photoresists	Resist Film Thickness[2]	Recommended Developers[3]	Recommended Removers[4]
Positive	Improved adhesion for wet etching, no focus on steep resist sidewalls	AZ® 1500	AZ® 1505 AZ® 1512 HS AZ® 1514 H AZ® 1518	≈ 0.5 µm ≈ 1.0 - 1.5 µm ≈ 1.2 - 2.0 µm ≈ 1.5 - 2.5 µm	AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® Developer	AZ® 100 Remover, TechniStrip® P1316 TechniStrip® P1331
		AZ® 4500	AZ® 4533 AZ® 4562	≈ 3 - 5 µm ≈ 5 - 10 µm	AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	
		AZ® P4000	AZ® P4110 AZ® P4330 AZ® P4620 AZ® P4903	≈ 1 - 2 µm ≈ 3 - 5 µm ≈ 6 - 20 µm ≈ 10 - 30 µm	AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	
		AZ® PL 177	AZ® PL 177	≈ 3 - 8 µm	AZ® 351B, AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	
	Spray coating	AZ® 4999		≈ 1 - 15 µm	AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	
	Dip coating	MC Dip Coating Resist		≈ 2 - 15 µm	AZ® 351B, AZ® 400K, AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	
	Steep resist sidewalls, high resolution and aspect ratio for e. g. dry etching or plating	AZ® ECI 3000	AZ® ECI 3007 AZ® ECI 3012 AZ® ECI 3027	≈ 0.7 µm ≈ 1.0 - 1.5 µm ≈ 2 - 4 µm	AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® Developer	
		AZ® 9200	AZ® 9245 AZ® 9260	≈ 3 - 6 µm ≈ 5 - 20 µm	AZ® 400K, AZ® 326 MIF, AZ® 726 MIF	
	Elevated thermal softening point and high resolution for e. g. dry etching	AZ® 701 MiR	AZ® 701 MiR (14 cPs) AZ® 701 MiR (29 cPs)	≈ 0.8 µm ≈ 2 - 3 µm	AZ® 351B, AZ® 326 MIF, AZ® 726 MIF, AZ® Developer	
Positive (chem. amplified)	Steep resist sidewalls, high resolution and aspect ratio for e. g. dry etching or plating	AZ® XT	AZ® 12 XT-20PL-05 AZ® 12 XT-20PL-10 AZ® 12 XT-20PL-20 AZ® 40 XT	≈ 3 - 5 µm ≈ 6 - 10 µm ≈ 10 - 30 µm ≈ 15 - 50 µm	AZ® 400K, AZ® 326 MIF, AZ® 726 MIF	AZ® 100 Remover, TechniStrip® P1316 TechniStrip® P1331
		AZ® IPS 6050		≈ 20 - 100 µm		
Image Re-versal	Elevated thermal softening point and undercut for lift-off applications	AZ® 5200	AZ® 5209 AZ® 5214	≈ 1 µm ≈ 1 - 2 µm	AZ® 351B, AZ® 326 MIF, AZ® 726 MIF	TechniStrip® Micro D2 TechniStrip® P1316 TechniStrip® P1331
		TI	TI 35ESX TI xLift-X	≈ 3 - 4 µm ≈ 4 - 8 µm		
Negative (Cross-linking)	Negative resist sidewalls in combination with no thermal softening for lift-off application	AZ® nLOF 2000	AZ® nLOF 2020 AZ® nLOF 2035 AZ® nLOF 2070	≈ 1.5 - 3 µm ≈ 3 - 5 µm ≈ 6 - 15 µm	AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	TechniStrip® NI555 TechniStrip® NF52 TechniStrip® MLO 07
		AZ® nLOF 5500	AZ® nLOF 5510	≈ 0.7 - 1.5 µm		
	Improved adhesion, steep resist side-walls and high aspect ratios for e. g. dry etching or plating	AZ® nXT	AZ® 15 nXT (115 cPs) AZ® 15 nXT (450 cPs)	≈ 2 - 3 µm ≈ 5 - 20 µm	AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	
			AZ® 125 nXT	≈ 20 - 100 µm	AZ® 326 MIF, AZ® 726 MIF, AZ® 826 MIF	TechniStrip® P1316 TechniStrip® P1331 TechniStrip® NF52 TechniStrip® MLO 07

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[1] *In general, almost all resists can be used for almost any application. However, the special properties of each resist family makes them specially suited for certain fields of application.*

[2] *Resist film thickness achievable and processable with standard equipment under standard conditions. Some resists can be diluted for lower film thicknesses; with additional effort also thicker resist films can be achieved and processed.*

[3] *Metal ion free (MIF) developers are significantly more expensive, and reasonable if metal ion free development is required.*

Our Developers: Application Areas and Compatibilities

Inorganic Developers

(typical demand under standard conditions approx. 20 L developer per L photoresist)

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 (TMAH-based) 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.

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.

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 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 without 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. Nicht kompatibel mit 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 dissolving 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™ NF52 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 SiO_2, main criterion is the crystal orientation (e. g. X-, Y-, Z-, AT- or ST-cut)

Fused silica wafers consist of amorphous SiO_2. 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 needs to be defined. For silicon wafers, beside the crystal orientation (<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: è www.microchemicals.com/products/wafers/waferlist.html

Further Products from our Portfolio

Plating

Plating solutions for e. g. gold, copper, nickel, tin or palladium: è www.microchemicals.com/products/electroplating.html

Solvents (MOS, VLSI, ULSI)

Acetone, isopropyl alcohol, MEK, DMSO, cyclopentanone, butylacetate, ... è www.microchemicals.com/products/solvents.html

Acids and Bases (MOS, VLSI, ULSI)

Hydrochloric acid, sulphuric acid, nitric acid, KOH, TMAH, … è www.microchemicals.com/products/etchants.html

Etching Mixtures

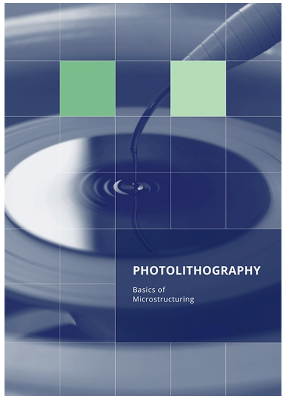
for e. g. chromium, gold, silicon, copper, titanium, ... è www.microchemicals.com/products/etching_mixtures.html

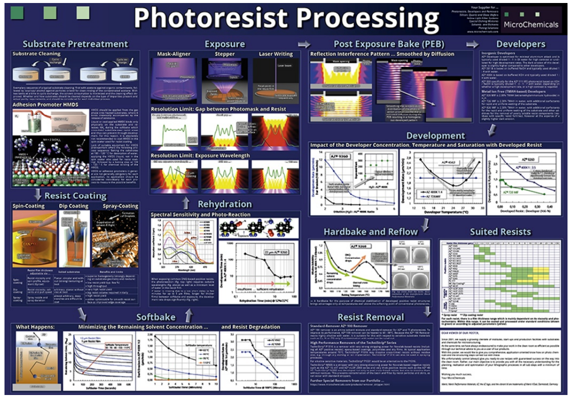
Further Information

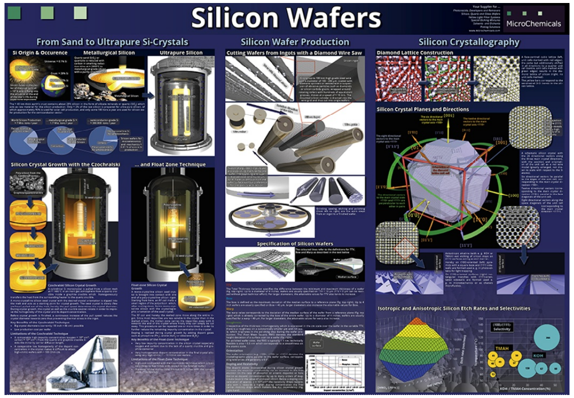
Technical Data Sheets: www.microchemicals.com/downloads/product_data_sheets/photoresists.html

Material Safety Data Sheets (MSDS): www.microchemicals.com/downloads/safety_data_sheets/msds_links.html

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):

www.microchemicals.com/downloads/brochures.html

www.microchemicals.com/downloads/posters.html

Thank you for your interest!

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