



AZ 4500 Series

Thick Film
Photoresists

GENERAL INFORMATION

This series of positive photoresists is intended for applications where coating thicknesses above 3 μm are required. When using a standard photoresist at film thicknesses above 3 μm , the necessary exposure energy drastically increases. This is due to the absorption of the photoactive compound (PAC) in the actinic range of the spectrum. So with increasing film thickness exposure dose has to be adjusted to provide sufficient energy also at the bottom of the photoresist, otherwise the pattern cannot be cleared. In extreme cases it becomes almost impossible to expose the resist properly and exposure doses above 1000 mJ/cm^2 have to be applied. Under these conditions unwanted side effects also appear: the dose at the surface of the photoresist becomes too high and induces crosslinking of the resist. This effect is similar to the well known deep-UV hardening used to preserve the resist profiles at postbake temperatures up to 200°C. Standard resist would also generate too much nitrogen during exposure which, trapped in the thick layer, cannot diffuse fast enough and may lead to lifting of the resist.

For AZ 4500-series photoresists we have chosen a special photoactive compound with low absorption and reduced nitrogen content which enables these resists to be used at thicknesses up to 50 μm . The highest viscosity product AZ 4562 allows to spin coat 10 μm in a single step (2000 rpm). For even higher thicknesses special coating techniques have to be applied:

1. The common spin time of about 30 - 40 seconds is reduced down to only 3 seconds. By this 20 μm are obtained, however the substrate has to be left on the spinner in a horizontal position for another minute to allow for drying.
2. AZ 4562 may be multiple coated with a bake cycle in-between. Due to the high solids content of this resist, which is close to the dissolution limit, the underlying coating will only be dissolved minor. The bake temperatures in-between should not exceed 90°C or the final prebake temperature.

When using high film thicknesses some special guidelines have to be observed: after coating the resist should be kept at room temperature for at least 15 minutes to allow most of the solvent to evaporate before it is put into an oven for prebake. Otherwise the resist surface will dry quite fast and trapped solvent remaining in the bulk may form bubbles and lift the resist film. Adhesion failure is the result. Using a hotplate instead of an oven is the better choice, especially when the temperature is ramped to the final value.

The development process also has to be adopted to the high film thickness: Background for this is the fact that even heavily overexposed positive photoresists only have limited dissolution rates. There is a saturation at values in the order of 100 nm/s . For this it is recommended to operate at development rates of about 2 $\mu\text{m}/\text{min}$. and adjust the exposure dose for proper clearing and feature size.

This resist series is designed for use with any common sodium and potassium based developer. AZ 351B, 1:4 diluted with water is a good choice, AZ 400K may be used as well.

PHYSICAL and CHEMICAL PROPERTIES

	AZ 4533	AZ 4562
Solids content [%]	34.5	39.5
Viscosity [cSt at 25°C]	125	440
Absorptivity [l/g*cm] at 398nm	0.86	1.01
Solvent	methoxy-propyl acetate (PGMEA)	
Max. water content [%]	0.50	
Spectral sensitivity	310 - 440 nm	
Coating characteristic	striation free	
Filtration [µm absolute]	0.2	

FILM THICKNESS [µm] as FUNCTION of SPIN SPEED (characteristically)

spin speed [rpm]	2000	3000	4000	5000	6000
AZ 4533	4.67	3.81	3.30	2.95	2.69
AZ 4562	8.77	7.16	6.20	5.55	5.06

PROCESSING GUIDELINES

Dilution and edge bead removal	AZ EBR Solvent
Prebake	100°C, 50", hotplate
Exposure	broadband and monochromatic
PEB	not required, optional with monochromatic exposure
Development	AZ 351B, 1:4, 30"/µm film thickness
Postbake	115°C, 50s hotplate or 60 min. oven
Removal	AZ 100 Remover, conc.

HANDLING ADVISES

Consult the **Material Safety Data Sheets** provided by us or your local agent!

This AZ Photoresists are made up with our patented safer solvent PGMEA. They are **flammable liquids** and should be kept away from oxidants, sparks and open flames.

Protect from light and heat and store in sealed original containers between 0°C and 25°C, exceeding this range to -5°C or +30°C for 1 week does not adversely affect the properties.

Shelf life is limited and depends on the resist series. The **expiration date** is printed on the label of every bottle below the batch number and coded as **[year/month/day]**.

AZ Photoresists are compatible with most commercially available wafer processing equipment.

Recommended materials include PTFE, stainless steel and high-density poly-ethylene and -propylene.

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