

# AZ<sup>®</sup> Developer, 400K, and 421K Inorganic Developers

## Description

AZ<sup>®</sup> inorganic developers are either sodium- or potassium-based developers. Most are buffered to maintain a uniform pH and to provide maximum developer bath life and process stability.

These developers are odorless aqueous alkaline solutions that are compatible with batch and in-line development processes.

AZ developers are defined by a product name and, as applicable, a dilution in parts of developer concentrate to parts of deionized water, e.g., AZ<sup>®</sup> 400K developer 1:4. AZ<sup>®</sup> Developer and AZ 400K developer are supplied as concentrates or prediluted. AZ<sup>®</sup> 421K developer is prediluted.

## Key Characteristics

- AZ Developer: Sodium-based buffered developer that provides optimal process control while minimizing the attack on aluminum surfaces.
- AZ 400K developer: Potassium-based buffered developer that provides optimal process control while minimizing contamination risks by using the less mobile potassium ion. Provides high throughput and contrast, particularly for thick film AZ<sup>®</sup> 9200 and P4000 series photoresists.
- AZ 421K developer: Potassium-based unbuffered developer that provides high throughput and contrast, particularly for thicker film AZ P4000 series photoresists.

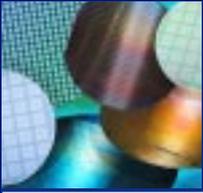
## Features

- Broad range of developers provides numerous options from which to obtain wide process latitude, high contrast, and superior production throughput.
- Excellent batch-to-batch consistency from tight product specification control.

## Processing

Developers typically have a limited range of useful dilutions. Highly concentrated dilutions have high sensitivity and allow faster photospeeds, but they are limited by high dark film losses and reduced contrast. The more dilute concentrations enable high contrast and provide greater selectivity between the exposed and unexposed resist. These require longer development times or increased exposure energy. They also have greater sensitivity to the effects of standing waves from monochromatic exposure.

- All the high contrast and high sensitivity formulations of AZ inorganic developers are suitable for a 60 to 120 second batch immersion development at 20 to 25°C. High sensitivity dilutions and/or longer development times are recommended for dyed photoresists. While inorganic developers are not as sensitive to temperature changes as metal-ion-free developers, temperature control of  $\pm 1^\circ\text{C}$  is recommended to maintain a stable process. Mild agitation is recommended to achieve uniform development.
- In-line development applications require short development times because of equipment throughput constraints. High sensitivity developer formulations are recommended. A wide variety of spray, stream, and puddle combinations can be used. Typical processes follow.



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## Typical Develop Process

### Spray-Puddle

Wet Wafer in Water Spray	0 - 5 sec, 100 - 200 rpm
Spray Developer	5 - 15 sec, 100 - 200 rpm
Stop Wafer and Continue Spray to Set up Puddle	0 - 2 sec, 0 rpm
Puddle Develop	10 - 30 sec, 0 rpm
Stream on Rinse	5 - 10 sec, 100 rpm
Spin Dry	5 - 10 sec, 4000 rpm

### Spray Only

Wet Wafer in Water Spray	0 - 5 sec, 100 - 200 rpm
Spray Developer	30 - 40 sec, 100 - 200 rpm
Overlap Rinse and Developer Sprays	0 - 5 sec, 100 - 200 rpm
Stream on Rinse	5 - 10 sec, 100 - 200 rpm
Spin Dry	5 - 10 sec, 4000 rpm

**Note:** Contaminating inorganic developer baths or lines with tetramethyl ammonium hydroxide (TMAH) based metal-ion-free developers, even at the parts-per-million level, seriously affects the photospeed of the inorganic developer process. Use caution when changing developing equipment from a metal-ion-free to an inorganic process.

Developer bath life is dependent on the amount of carbon dioxide absorbed from the air and on the amount of dissolved photoresist. Replenish the developer periodically, perhaps once a shift or when developer activity is reduced.

Typical recommendations for high sensitivity and high contrast dilutions follow.

Developer	High Sensitivity*	High Contrast*
AZ® Developer	2:1	1:1
AZ® 400K Developer	1:3	1:4

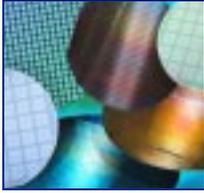
\*developer:DI water

## Specifications

Developer	Normality (R <sub>1</sub> )	Normality (R <sub>2</sub> )	Color	Chloride (ppm)	Liquid Particle Count (#/ml > 0.5 μm)
AZ <sup>®</sup> Developer	0.460 ± 0.010	0.6.00 ± 0.005	25 max.		120 max.
AZ <sup>®</sup> Developer 1:1	0.230 ± 0.005	0.3000 ± 0.0025	15 max.		120 max.
AZ <sup>®</sup> Developer 2:1	0.307 ± 0.005	0.400 ± 0.003	25 max.		120 max.
AZ <sup>®</sup> Developer 3:2	0.276 ± 0.004	0.360 ± 0.003	15 max.		120 max.
AZ <sup>®</sup> 400K Developer	0.482 ± 0.005	1.390 ± 0.005	25 max.	2.0 max.	100 max.
AZ <sup>®</sup> 400K Developer 1:3	0.120 ± 0.001	0.348 ± 0.001	15 max.	2.0 max.	100 max.
AZ <sup>®</sup> 400K Developer 1:4	0.0960 ± 0.0005	0.2780 ± 0.0005	15 max.	1.5 max.	75 max.
AZ <sup>®</sup> 400K Developer 1:5	0.080 ± 0.001	0.232 ± 0.001	15 max.	2.0 max.	100 max.
AZ <sup>®</sup> 421K Developer	0.210 ± 0.001		15 max.	2.0 max.	100 max.

Specifications are subject to revision. Contact your AZ account manager for additional information.





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## Equipment Compatibility

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AZ<sup>®</sup> inorganic developers are compatible with most commercially available wafer and photomask processing equipment. Recommended materials of construction include stainless steel, PTFE, polypropylene, and high density polyethylene.

## Storage

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Keep in sealed original containers. Protect from sunlight. Store in a cool, dry place. Empty container may contain harmful residue.

## Handling Precautions/First Aid

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Refer to the current Material Safety Data Sheet (MSDS) for detailed information prior to handling.

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