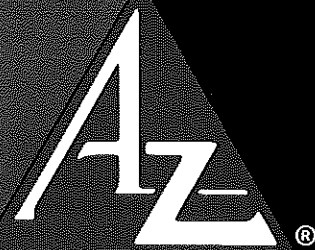


AZ® PHOTORESIST DEVELOPERS - INORGANIC

AZ Developer
AZ 400K Developer

AZ 351 Developer
AZ 421K Developer



General Discussion

The selection of developers for optical positive photoresists requires a clear understanding of their composition and the particular process conditions. The AZ inorganic developers are based on sodium or potassium hydroxide. Many of them are buffered to maintain a uniform pH and to provide maximum developer bath life and process stability.

Description

AZ Photoresist Products 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 351 1:5.

AZ Developer, AZ 351 Developer and AZ 400K Developer are supplied as concentrates or pre-diluted. AZ 421K Developer is pre-diluted.

The developers described herein are odorless, aqueous, inorganic, alkaline solutions which are compatible with batch and in-line development processes.

Key Characteristics Of These Developers Are:

AZ Developer

Sodium based, buffered developer which provides optimal process control while minimizing the attack on aluminum surfaces.

AZ 351

Sodium based, buffered developer designed for optimal process control.

AZ 400K

Potassium based, buffered developer which provides optimal process control while minimizing contamination risks through use of the less mobile potassium ion.

AZ 421K

Potassium based, unbuffered developer providing high throughput and contrast, particularly for thicker film AZ 4000 Series photoresists.

Use

Developers typically have a limited range of useful dilutions¹. The more concentrated (high sensitivity) dilutions give faster photospeeds, but the use of higher developer concentration is limited by high dark film losses and reduced contrast. The more dilute (high contrast) mixtures will provide greater selectivity between the exposed and unexposed resist but will require longer development times or increased exposure energy. The use of more dilute developers also results in greater sensitivity to the effects of standing waves from monochromatic exposure. Typical recommendations for high sensitivity and high contrast dilutions are given in Table 1 (dilutions are expressed as developer to DI water).

Table 1

Developer	High Sensitivity	High Contrast
AZ Developer	2:1	1:1
AZ 351	1:3.5	1:5
AZ 400K	1:3	1:4

Note: Contamination of inorganic developer baths or lines with TMAH based (metal-ion-free) developers, even at the part-per-million level, will have a serious impact on the photospeed of the inorganic developer process. Switching developing equipment from an MIF to an inorganic process should be done with caution.

Batch Development

All the high contrast and high sensitivity formulations of the developers are suitable for a 60-120 second batch immersion development within the range 20-25°C. High sensitivity dilutions and/or longer development times are recommended for dyed photoresists². While inorganic developers are not as sensitive to temperature changes as metal-ion-free (MIF) developers, temperature control of $\pm 1^\circ\text{C}$ is recommended for maintaining a stable process.

Mild agitation of the wafers or pumping of the developer should be used to insure uniform development.

Titration

Developers can be characterized by titration with a standard acid solution using a potentiometric titrator to monitor the reaction. A single component alkaline solution is characterized by a single inflection point (Figure 1), while a buffered developer will yield two or more inflection points (Figure 2). The second inflection point is a measure of the hydroxyl ion concentration produced by complete dissociation of the alkaline compound. This second inflection point is often referred to as the normality of the solution.

Equipment Compatibility

The AZ inorganic photoresist developers are compatible with most commercially available wafer and photomask processing equipment. Recommended compatible materials include stainless steel, PTFE, high density polyethylene and polypropylene.

Handling Precautions

AZ positive photoresist developers are alkaline solutions which will cause irritation to skin and eyes and could cause caustic burns under certain conditions. Eye contact can lead to corneal damage. May be harmful if swallowed or inhaled (mists). Avoid contact with liquid or spray mists. Wear chemical goggles, rubber gloves and protective clothing when handling developers.

First Aid

If swallowed, give two glasses of water. Never give anything by mouth to an unconscious person.

If inhaled, remove to fresh air.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Call a Physician.

Emergency

(201) 231-2244 Including Medical Emergencies.

Please consult a Material Safety Data Sheet for further information.

Materials Storage

Keep in sealed original containers.

FOR INDUSTRIAL USE ONLY.

References

¹ See also AZ Bulletin "The Selection of Process Conditions For Optimal Linewidth Control."

² See AZ Bulletins "Dyed Positive Photoresists."

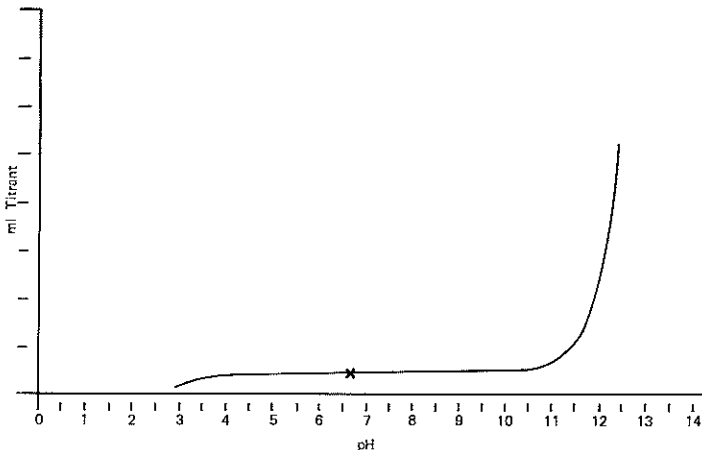


Figure 1. 421K Developer

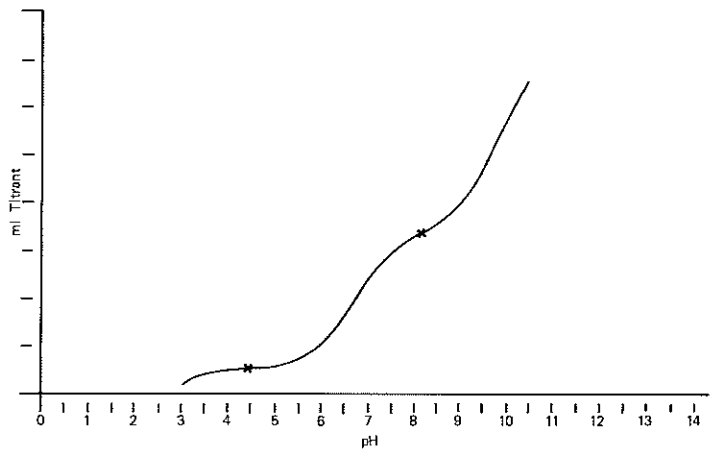


Figure 2. AZ Developer