Technical Data Sheet

Technisches Datenblatt

AZ 326, AZ 726, AZ 826 and AZ 833 MIF Developer

Ready to Use MIF Developer

General Information

AZ 326 MIF, AZ 726 MIF, AZ 826 MIF Developers are ready to use **metal ion free developers** for use with all modern AZ Photoresists. They all are aqueous solutions of 2.38% tetramethyl-ammonium-hydroxide (**AZ 833 MIF** 3,0% TMAH), which has become the standard concentration in semiconductor lithography. While **AZ 326 MIF** does not contain any additives, as requested by some users, AZ 726 MIF contains a small amount of wetting agent to provide fast and uniform build-up of the puddle. The wetting agent does not influence the lithographic performance as required for modern zero-bias photoresists. This means that the isofocal line (Bossung plot) is not shifted, independent of pattern geometries. **AZ 826 MIF** contains surfactants which also influence dissolution of photoresist. This results in faster and absolutely clean and scum-free development. Due to the higher dark erosion AZ 826 MIF introduces a slight litho bias.

All developers are manufactured to highest standards regarding trace metal level and batch to batch variation in photospeed. Typical concentrations of Na, K, Mg, Fe and Al are below 5ppb each. Photospeed - or activity of the developer - is influenced mainly by normality (concentration) and carbon dioxide. To ensure utmost consistency we apply two different tests:

1. Precise titration for normality

Whereas the normal acknowledged precision of this analytical method is considered to be 0.3%, this by far is not sufficient to control our MIF Developers with a normality specification of

$$0.2610 \pm 0.0005 \text{ moles/l.}$$

We have developed a propriety method which works with an accuracy of 0.03% which in case of these developers means a tolerance less than 0.0001 mol/l.

2. Precise determination of carbon dioxide

We are able to detect 1 - 2 ppm of carbon dioxide in the developer. To ensure a content of less than 20 ppm however, requires not only measurement, but mainly a manufacturing process which avoids any carbon dioxide absorption from the atmosphere. Like any alkaline solution the developers eagerly absorb it. This also has to be kept in mind when handling them.

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The following table gives the relationship between these three parameters and their influence on photospeed:

1% change in photospeed is caused by:

normality change	0.0010 mole/l (0.0090 wt.%)
carbon dioxide	0.0005 mole/l (22 ppm)

From this it can be easily seen that by our tight specifications the worst case variation of photospeed from batch to batch will be:

normality	± 0.0005 moles/l	=>	± 0.5% photospeed
carbon dioxide	≤ 20ppm (=10±10)	=>	± 0.5% photospeed
together (maximum)			± 1.0% photospeed

Handling the Developers

To preserve these extremely tight specifications of **AZ 326 MIF, AZ 726 MIF, AZ 826 MIF and AZ 833 MIF** Developers up to the point of use some handling precautions have to be observed.

As already mentioned above, the developers, like any alkaline solution, are sensitive to carbon-dioxide absorption. For the containers we have chosen HDPE as material. It has a low permeability for gases. A completely full and sealed 5-litre bottle with developer will lose about 0.5% in activity (photospeed) within 2 years by carbon dioxide diffusion. Partially empty containers will absorb all the carbon dioxide contained in the empty volume. Assuming 1 litre of developer, 18 litres of normal air (containing 0.03% carbon dioxide) will lower the activity by 0.5%.

For these reasons the developers must never be pressurised with air, if necessary high purity nitrogen may be used. Containers should be kept well closed and, once opened, they should be used up soon.

After cleaning the equipment and associated pressure-vessels they should be well dried to avoid any dilution of the developer. 2 ml of water added to 1 litre of developer will lower its activity by 0.5%. It is also possible to rinse the system thoroughly with developer prior to filling it again.

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The high quality of the developers can best be maintained when used in a closed supply system which is directly connected to the containers. As this calls for higher volume containers, we generally supply AZ MIF Developers in 200 litre drums. Larger and also returnable containers are available on request. The higher ratio of volume / surface also contributes to reduced particle counts and low trace metal impurities.

Physical and Chemical Properties

Chemistry aqueous solution of:
2.38% tetra methyl ammonium hydroxide
AZ 326 without, AZ 726, AZ 826 and AZ 833 with surfactant

Normality:
AZ 326, AZ 726 and AZ 826 0.2610 ± 0.0005 moles/l
AZ 833 0.3300 ± 0.0005 moles/l

Carbon dioxide (typical) ≤ 20 ppm

Trace metal content
(Na, K, Ca, Mg, Al, Fe, Ni, Cu) ≤ 5 ppb each

Filtration 0.1 µm absolute

Particle count (cumulative) > 0.5 µm max. 100/ml

(tighter specifications on request, depending on container type)

Application

AZ 326 MIF, AZ 726 and **AZ 826 MIF** Developers are ready to use. They may be used with any standard and high resolution positive photoresist. The development process itself however depends on the requirement of the photoresist. Every photoresist shows optimum performance in a certain range of development time. Typical development time are between 30 sec and 60 sec for one to three µm film thickness. These times may of course be modified to fulfil certain requirements.

Standard development process nowadays is puddle development. This method ensures good reproducibility as every wafer is processed with fresh developer. The puddle may be established by a "stream" dispense. It mainly depends on the equipment itself.

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AZ 726 MIF does contain a wetting agent for fast and uniform wetting of the wafer. This helps to ensure good uniformity even on 8 or 12-inch wafers, especially when short development times are chosen.

AZ 826 MIF contains different surfactants which also have an impact on dissolution rate of photoresist. Dark erosion is higher than with AZ 726 MIF, however this helps to avoid scumming, which mainly is observed when the photoresist is processed on steppers without applying a post-exposure-bake (PEB).
AZ 833 MIF is specially designed for improved compatibility with the AZ 8100 Series Photoresist.

The surfactant-free **AZ 326 MIF** Developer may be used with some photoresists which are designed to work with this developer type, for instance AZ MiR701 and AZ ECI3000. It mainly depends on the philosophy of the user whether this developer is chosen. In general it's easier to set up a process with AZ 726 MIF.

Average consumption for a puddle process is 20 ml/wafer. Some non-AZ photoresists perform better with a double puddle process.

Handling Advises

Consult the **Material Safety Data Sheets** provided by us or your local agent!
Store in sealed original containers between 0°C and 35°C, prevent from freezing.
Shelf life is limited, the **expiration date** is printed on the label of every bottle below the batch number and coded as **[day/month/year]**.
AZ MIF Developers are compatible with most commercially available wafer processing equipment. **Recommended materials** include PTFE, stainless steel and high-density poly-ethylene and -propylene

We advise our customers regarding technical applications to the best of our knowledge within the scope of the possibilities open to us, but without obligation. Current laws and regulations must be observed at all times. This also applies in respect of any protected rights of third parties. Our suggestions do not relieve our customers of the necessity to test our products, on their own responsibility, for suitability for the purpose envisaged. Quotations from our literature are only permitted with our written authority, and the source must be stated.

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