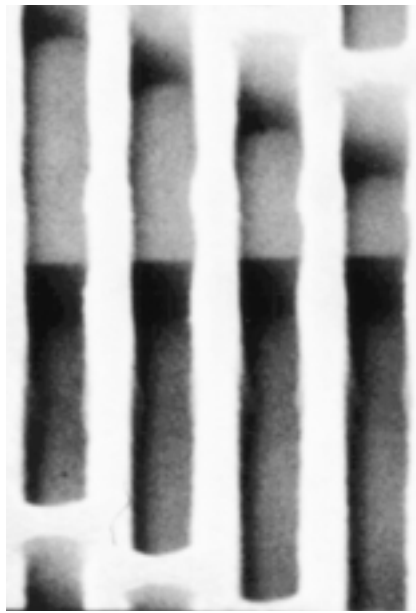


without AZ® Aquatar® at +0.6 μm focus



with AZ® Aquatar® at +0.6 μm focus



AZ® Aquatar®

## Top Anti-Reflective Coating

AZ® Aquatar® top anti-reflective coating is an aqueous material for use with positive photoresists in the semiconductor industry.

The effect of the anti-reflective coating is to dramatically reduce the amplitude of the resist swing curve. When optimized this change in swing curve amplitude can be up to a factor of three times reduction.

Optimum film thickness can be calculated using the following function:

$$\text{Film thickness} = \frac{\lambda}{4n}$$

$\lambda$  = wavelength of exposure light  
 $n$  = refractive index of AZ® Aquatar®

After exposure AZ® Aquatar® top anti-reflective coating is removed using either a water rinse or the aqueous positive resist developer itself. As soon as the anti-reflective coating is removed the resist will develop as normal.

An optimized process is confirmed when the original resist swing curve is seen to be exactly 180° out of phase with the modified swing curve derived from the use of AZ® Aquatar® top anti-reflective coating. When this is not the case there will still be a significant swing curve reduction but not to the same extent as a fully optimized process. When used with AZ® i-line photoresists, image bias, usually seen as a difference in dimension between dense and isolated lines is dramatically reduced to values close to 0%.

A top anti-reflective coating will not reduce reflective notching caused by exposing light being reflected from the substrate. For this process situation a bottom anti-reflective coating, AZ® BARLi®, is recommended.

Focus Latitude  
of 0.5  $\mu\text{m}$  Lines and Spaces

without AZ® Aquatar®

$\mu\text{m}$

with AZ® Aquatar®



- 1.2



- 0.9



- 0.6



- 0.3



0



+ 0.3



+ 0.6

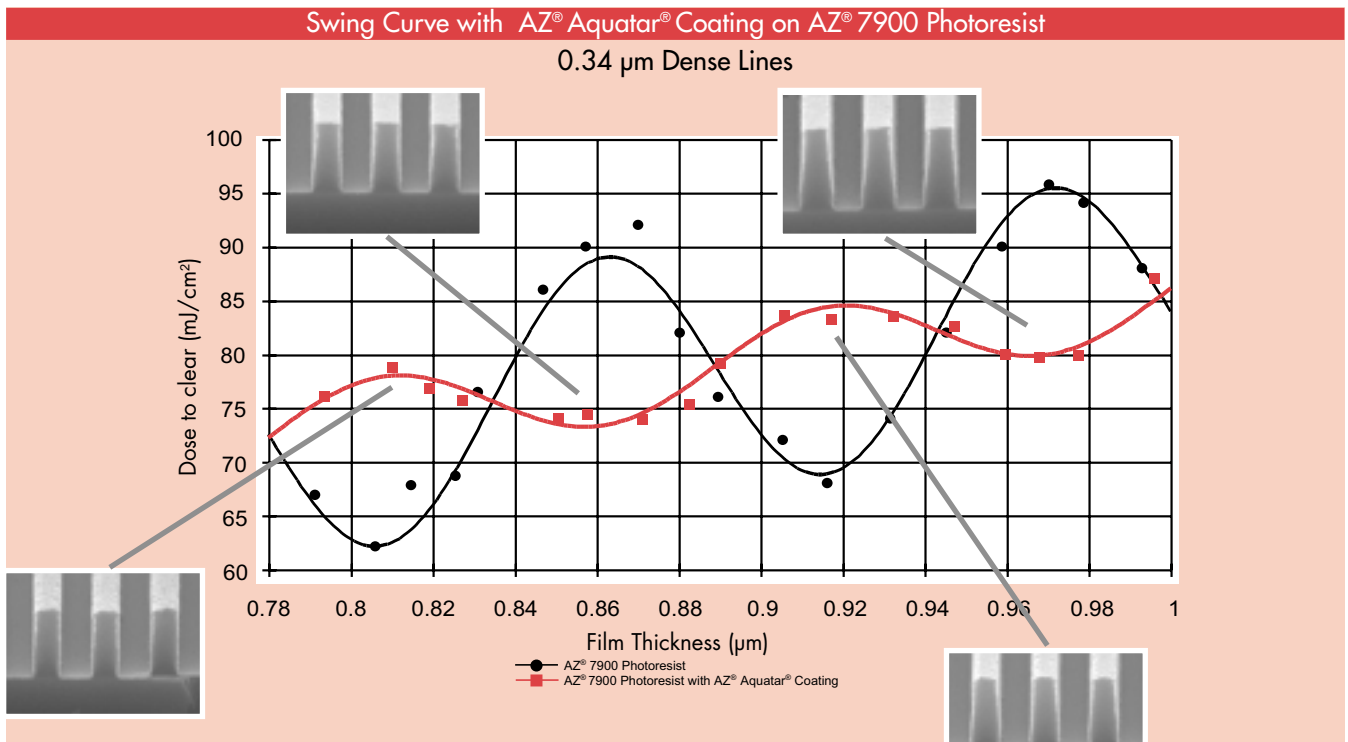


+ 0.9



+ 1.2





AZ® 7908 Photoresist  
 Softbake Hotplate 90°C, 60 sec  
 AZ® Aquatar® anti-reflective coating, 2 300 rpm spin speed  
 Exposure NIKON® 0.54 i-line stepper, 160 – 170 mJ/cm²  
 Post Exposure Bake Hotplate 110°C, 60 sec  
 AZ® 300 MIF Developer (0.261 n), 5 sec spray, 55 sec puddle at 21°C

**Typical Process Cycle**

Coat positive photoresist	AZ® 7800 or similar
Softbake resist	90°C, 60 sec
Coat AZ® Aquatar® to optimized target film thickness	i-Line: 650 Å (approx. 2 200 rpm spin speed) g-Line: 770 Å (approx. 1 500 rpm spin speed)
Exposure	g- or i-line stepper
Post Exposure Bake	110°C, 60 sec
Development	Dynamic dispense 5 sec, then puddle develop as usual, rinse and spin dry

**Note**

If the PEB temperature is higher than 110°C, we recommend that the AZ® Aquatar® top anti-reflective coating will be removed before baking with a 5 sec water rinse.

**Characteristic**

Refractive Index	633 nm	1.408
	365 nm	1.430
	248 nm	1.468
Swing Ratio	i-line exposure [AZ® 7800, 0.35 µm l/s] (29.7% without AZ® Aquatar®)	9.7% with AZ® Aquatar®
	KrF exposure [AZ® DX 1100 P (si), 0.30 µm l/s]	15.3% with AZ® Aquatar® (31.0% without AZ® Aquatar®)

## Equipment Compatibility

AZ<sup>®</sup> Aquatar<sup>®</sup> top anti-reflective coating is compatible with all commercially available wafer and photomask processing equipment. The following construction materials are preferred: stainless steel, glass, ceramic, PTFE, polypropylene and high-density polyethylene.

In-line filtration should be performed using a filter compatible to aqueous solutions. A photoresist solvent compatible filter should not be used with this material.

AZ<sup>®</sup> Aquatar<sup>®</sup> top anti-reflective coating is not compatible with photoresist solvents. For this reason scale coating operations should be carried out at an aqueous coating station so that discarded material goes directly to an aqueous drain. Often a develop station is used for initial coating trials.

## Storage

Storage temperatures between 2°C and 35°C are recommended for long term storage. This solution is not improved by long term freezing.

## Packaging

AZ<sup>®</sup> Aquatar<sup>®</sup> top anti-reflective coating is available in plastic gallon bottles, 4 litre or 10 litre NOWPAK containers as required.

---

The information contained herein is, to the best of our knowledge, true and accurate, but all recommendations or suggestions are made without guarantee because the conditions of use are beyond our control. There is no implied warranty of merchantability or fitness for purpose of the product or products described here. In submitting this information, no liability is assumed or license or other rights expressed or implied given with respect to any existing or pending patent, patent application, or trademarks. The observance of all regulations and patents is the responsibility of the user. The Hoechst name and logo are registered trademarks of Hoechst AG. AZ, the AZ logo, BARLi and Aquatar are registered trademarks of Clariant AG. NIKON is a registered trademark of NIKON Precision Inc.

© Clariant AG, February 1998

---

### Clariant GmbH

Business Unit Electronic Materials  
D-65174 Wiesbaden  
Germany  
Tel. +49 (611) 962 - 6867  
Fax +49 (611) 962 - 9207

### Clariant Corporation

Business Unit Electronic Materials  
70 Meister Avenue  
Somerville, NJ 08876-1252  
USA  
Tel. +1 (908) 429 - 3500  
Fax +1 (908) 429 - 3631

### Clariant (Japan) K.K.

Business Unit Electronic Materials  
10-16 Akasaka 8-chome,  
Minato-ku, Tokyo 107  
Japan  
Tel. +81 (3) 3479 - 5120  
Fax +81 (3) 3479 - 4770

### Clariant Industries Ltd. (Korea)

Business Unit Electronic Materials  
84-7, Chungdam-dong,  
Kangnam-ku  
Seoul, Rep. of Korea  
Tel. +82 (2) 510 - 8000/8442  
Fax +82 (2) 514 - 5918

