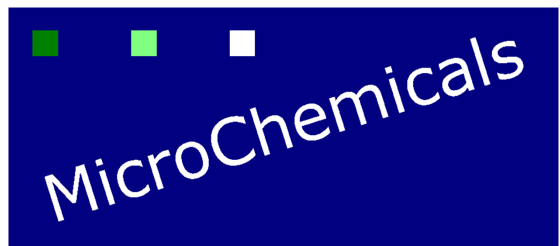
TI Plating
Spray coating resist

Technical Data Sheet
Revised 10/2002



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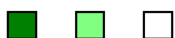
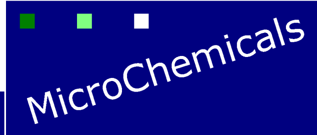
General Information

The **TI Plating** resist is optimized for spray coating of thin (2 µm) to very thick (20 µm) films. TI Plating can either be processed in **positive** mode or negative (**image reversal**) mode

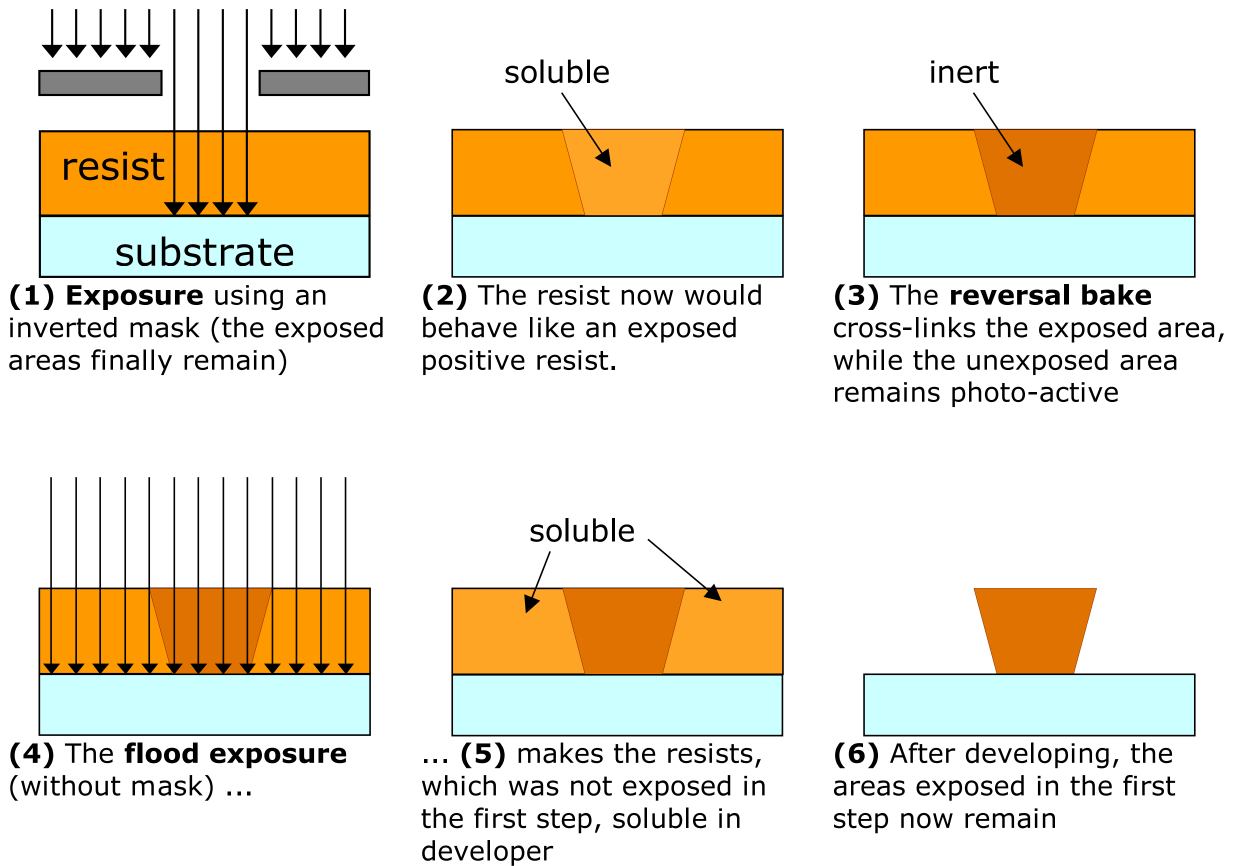
This technical data sheet intends to give you a guideline for process parameters for various applications. However, the optimum values for e.g. dilution, exposure dose, or development depend on the individual equipment and need to be adjusted on each individual demand.





'Image Reversal' – A Short Introduction

What 'image reversal' generally means



(1) Exposure using an inverted mask (the exposed areas finally remain)

(2) The resist now would behave like an exposed positive resist.

(3) The **reversal bake** cross-links the exposed area, while the unexposed area remains photo-active

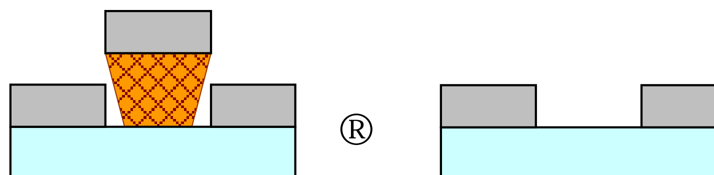
(4) The **flood exposure** (without mask) ...

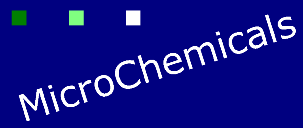
... **(5)** makes the resists, which was not exposed in the first step, soluble in developer

(6) After developing, the areas exposed in the first step now remain

... and for what image reversal is good for:

Adjustable undercut for lift-off of thin and thick sputtered, CVD, and evaporated films like metals, a-Si:H, a-SiN:H etc.





Processing the TI Plating (positive mode)

In chronological order:

- **Resist dilution**: To optimize spray coating processes for uniform film thicknesses and excellent step coverage, aliphatic or aromatic ketones or aliphatic esters could be used in certain dilutions. For detailed information please consult your spray coating equipment manufacturer.

- After **cleaning** the **substrate**, put the substrate on the hotplate at minimum 120 °C for 10 minutes to remove adsorbed water from the substrate surface. Alternatively, you can use a furnace at same temperature for 30 min. Standard HMDS procedure (only from vapor phase with an optimum substrate temperature of 125°C !) is also an adequate preparation.

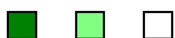
- **Soft-bake** at 95°C on a hot-plate for:

total resist thickness	5 .. 9 µm	10 .. 16 µm	17 .. 24 µm
time (min)	10	20	30

- **Exposure** (with the mask) broadband or monochromatic at a dose (calibrated on **i-line** = 365 nm) of approximately:

total resist thickness	5 .. 9 µm	10 .. 16 µm	17 .. 24 µm	25 .. 32 µm
exposure dose (mJ/cm^2)	500 .. 800	700 .. 1000	900 .. 1200	1000-1600
= exposure time (sec.) (holds for all standard mask aligners with a 350W Hg-lamp)	50 .. 80	70 .. 100	90 .. 120	100 .. 160

- **Develop** in e.g. AZ 826MIF. After development, it is **very important** to flush the wafer with **plenty of water** to remove traces of residual developer. Otherwise, even very small amounts of developer on/in the resist will concentrate when drying the wafer and cause strong local concentrations of developer, which might deteriorate the resist during subsequent processing steps in aqueous solutions.



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Processing the TI Plating (negative mode)

In chronological order:

- **Resist dilution**: To optimize spray coating processes for uniform film thicknesses and excellent step coverage, aliphatic or aromatic ketones or aliphatic esters could be used in certain dilutions. For detailed information please consult your spray coating equipment manufacturer.
- After **cleaning** the **substrate**, put the substrate on the hotplate at minimum 120 °C for 10 minutes to remove adsorbed water from the substrate surface. Alternatively, you can use a furnace at same temperature for 30 min. Standard HMDS procedure (only from vapor phase with an optimum substrate temperature of 125°C !) is also an adequate preparation.
- **Soft-bake** at 95°C on a hot-plate for:

total resist thickness	5 .. 9 µm	10 .. 16 µm	17 .. 24 µm
time (min)	10	20	30

- **Exposure** (with the mask) broadband or monochromatic at a dose (calibrated on **i-line** = 365 nm) of approximately:

total resist thickness	5 .. 9 µm	10 .. 16 µm	17 .. 24 µm	25 .. 32 µm
exposure dose (mJ/cm^2)	150 .. 250	200 .. 400	200 .. 400	200-500
= exposure time (sec.) (holds for all standard mask aligners with a 350W Hg-lamp)	15 .. 25	20 .. 40	20 .. 40	20 .. 50

- **post-exposure delay time:**

total resist thickness	5 .. 9 µm	10 .. 16 µm	17 .. 24 µm
Room temperature 20° (min) ...	120	240	480
... subsequent hot-plate 50°C (min)	60	120	120

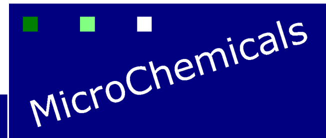
In this delay time, N_2, generated during exposure, will diffuse out the resist. If the resist foams on the hot-plate, next time increase the delay time at room temperature.

- **Reversal Bake:** After the delay bake the substrate at a temperature of 125°C on the hotplate for 2 minutes (when using furnace try 20 minutes at 120°C-130°C. Because this step is very temperature critical furnace baking is not recommended). This step is the reversal bake where the image is reversed due to cross link the exposed areas making them insoluble in the developer. If the resist foams, next time increase the delay time at 50°C (see previous point)
- **Flood Exposure:** Exposure the substrate for the second time **without a mask** (flood exposure).

total resist thickness	5 .. 9 µm	10 .. 16 µm	17 .. 24 µm
dose (mJ/cm^2)	≈ 1.200	≈ 1.800	≈ 1.800

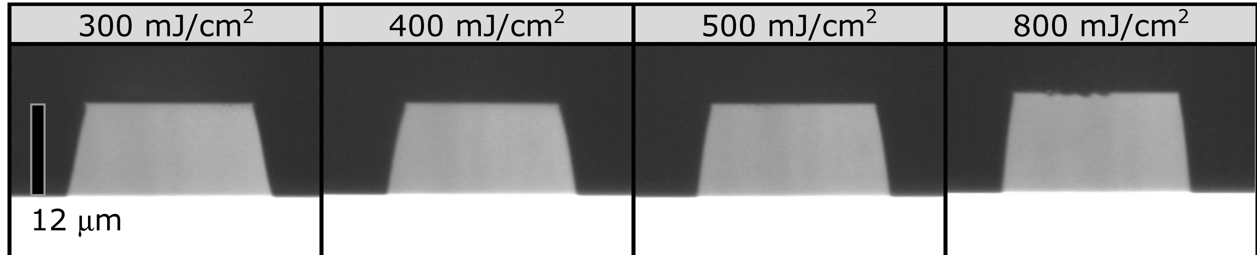
When, during a subsequent deposition, the temperature will raise over 80°C, use a high exposure dose to avoid nitrogen bubbles in the resist during the deposition.

- **Develop** in e.g. AZ 826MIF. After development, it is **very important** to flush the wafer with **plenty of water** to remove traces of residual developer. Otherwise, even very small amounts of developer on/in the resist will concentrate when drying the wafer and cause strong local concentrations of developer which might deteriorate the resist during subsequent processing steps in aqueous solutions.

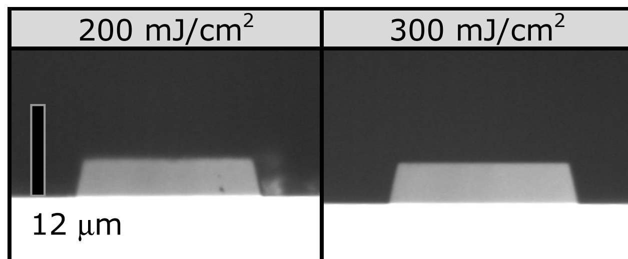


Exposure dose and resist profile

I) Positive mode: Varying the **Exposure dose**
Thickness 12 µm; Dev. AZ 826MIF



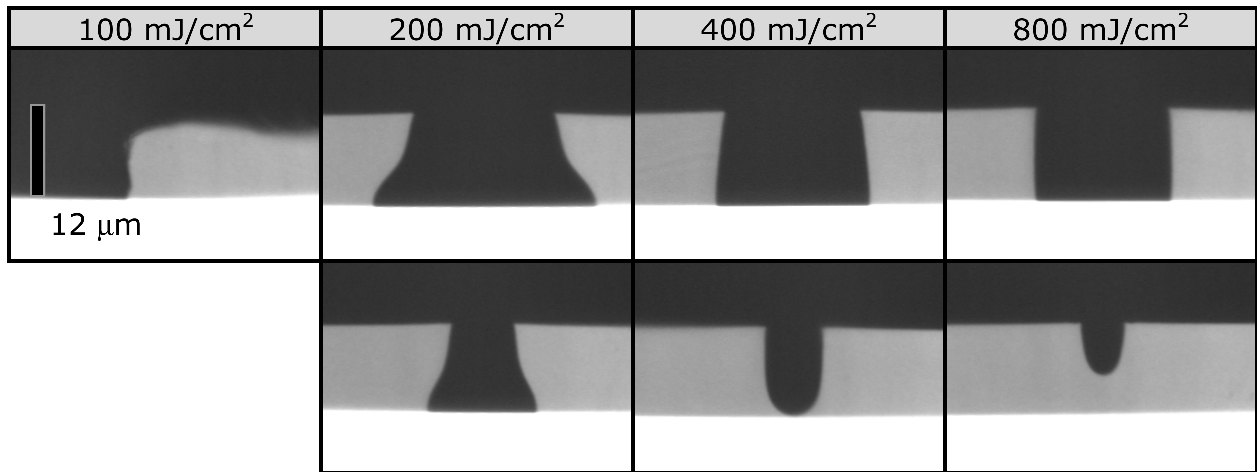
II) Positive mode: Varying the **Exposure dose**
Thickness 5 µm; Dev. AZ 826MIF



® higher 1st exposure doses: resist profile improves

III) Image reversal mode: Varying the 1st Exposure dose

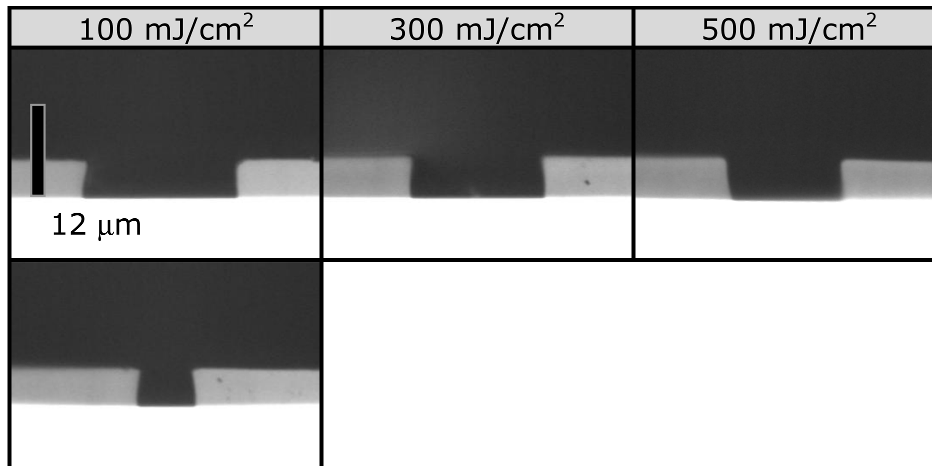
Thickness 12 µm; rev. bake 2min @ 125°C; flood exp. 1.800 mJ/cm²
Dev. AZ 826MIF 7min (5min to clear)



(top row: 24µm lines; bottom row: 4 µm lines)

IV) Image reversal mode: Varying the 1st Exposure dose

Thickness 5 µm; rev. bake 2min @ 125°C; flood exp. 1.800 mJ/cm²
Dev. AZ 826MIF 7min (5min to clear)



(top row: 24µm lines; bottom row: 4 µm lines)

® **1st exposure dose too low: dark erosion**
® **1st exposure dose too high: undercut to low (no undercut for narrow spaces)**