

# **ZEP520A**

**ZEONREX Electronic Chemicals**

**High Resolution Positive  
Electron Beam Resist**



# **ZEP520A**

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Any process conditions and data are examples.  
Those will not guarantee the same data in customers' process.

## 1. Characteristics

ZEP520A is high performance positive EB resists which show high resolution, high sensitivity and dry etch resistance.

They are suitable for various EB processes.

### (1) Resolution

Shows high resolution and rectangle pattern profile.

### (2) Resistance to dry etching

Shows high dry etch resistance and they are almost equivalent to that of positive photoresists generally used.

### (3) Sensitivity

Shows high sensitivity.

## 2. Properties

Item	Mw	Viscosity (mPa.s)	Solvent	Form
ZEP520A	57,000	11	Anisol	1QT bottle or 100ml bottle
ZEP520A-7		7		

## 3. Thinner

Item	Composition	Remarks	Form
ZEP-A	Anisol	ZEP520A	1QT bottle

## 4. Developer

Item	Composition	Remarks	Form
ZEP-RD	Xylene(o-,m-,p- mixed)	standard	1GL bottle
ZED-N50	n-Amyl acetate	high resolution	
ZED-N50 is recommended			

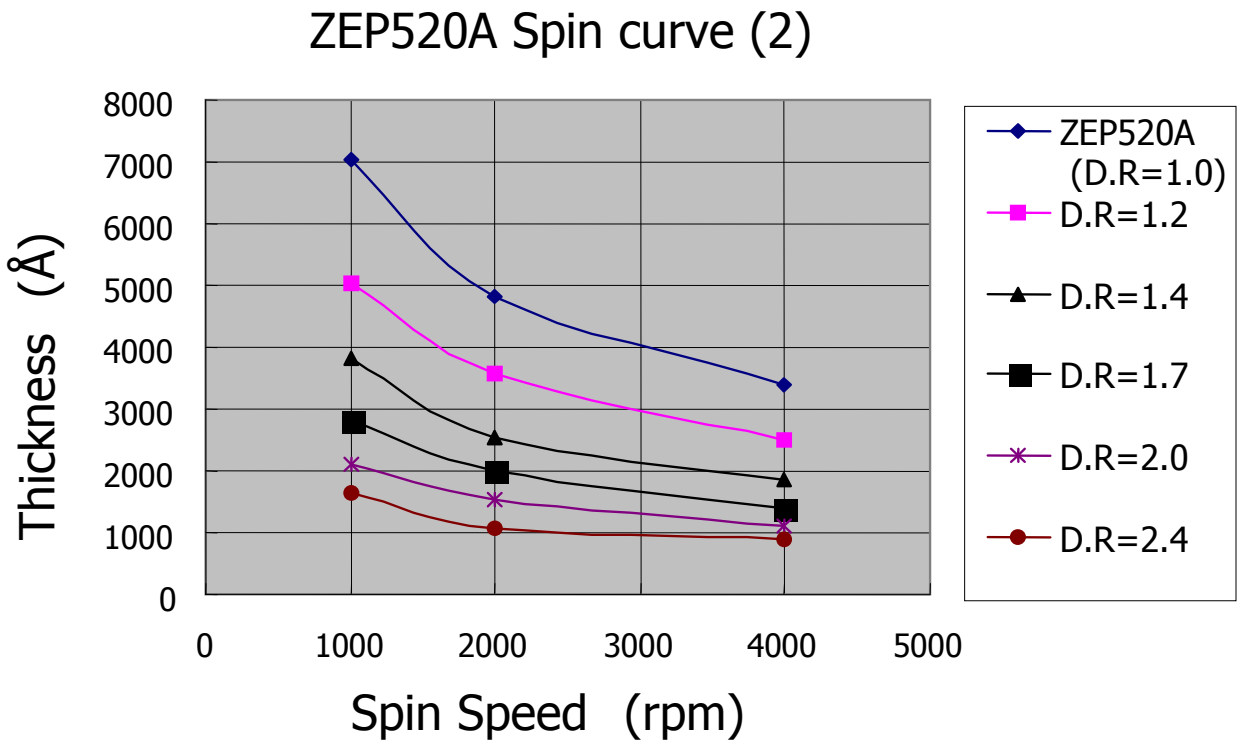
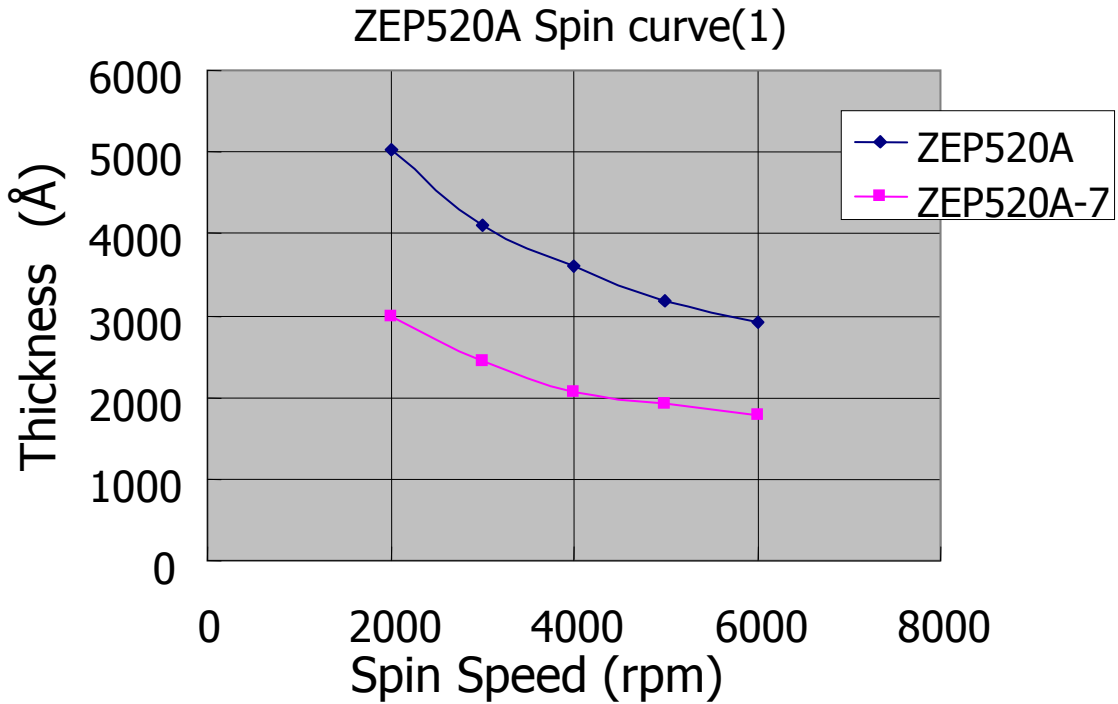
## 5. Rinse

Item	Composition	Remarks	Form
ZMD-D	Methyl isobutyl ketone 100%		1GL bottle

## 6. Remover

Item	Composition	Remarks	Form
ZDMAC	Dimethylacetamide		1GL bottle

## 7. Spin Curve



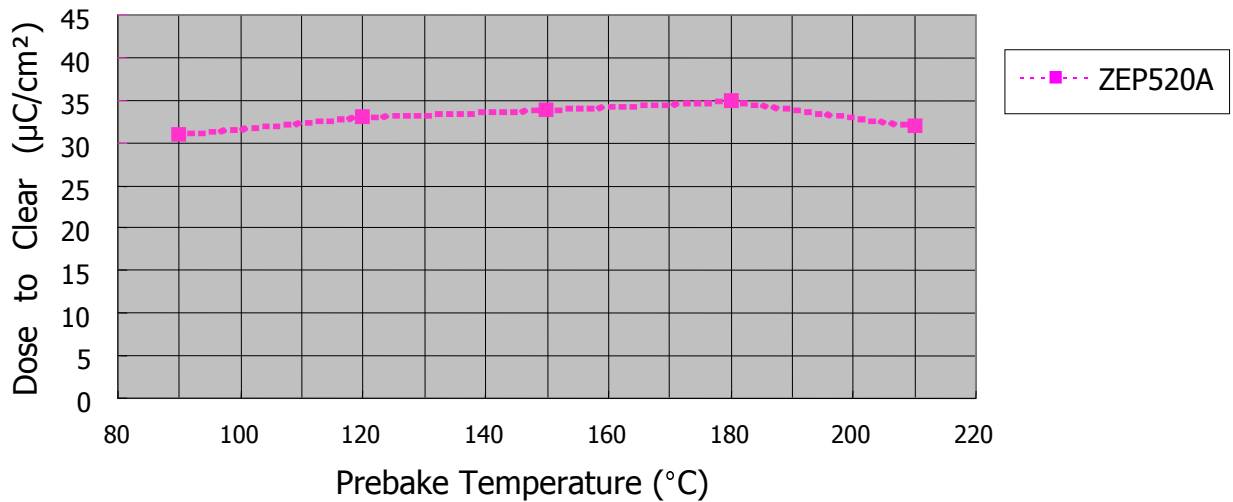
**D.R.: Dilution Rate =**  
 $\frac{\{\text{Original Resist(g)} + \text{Solvent(g)}\}}{\text{original Resist(g)}}$   
**(Weight Ratio)**

**Process Conditions**

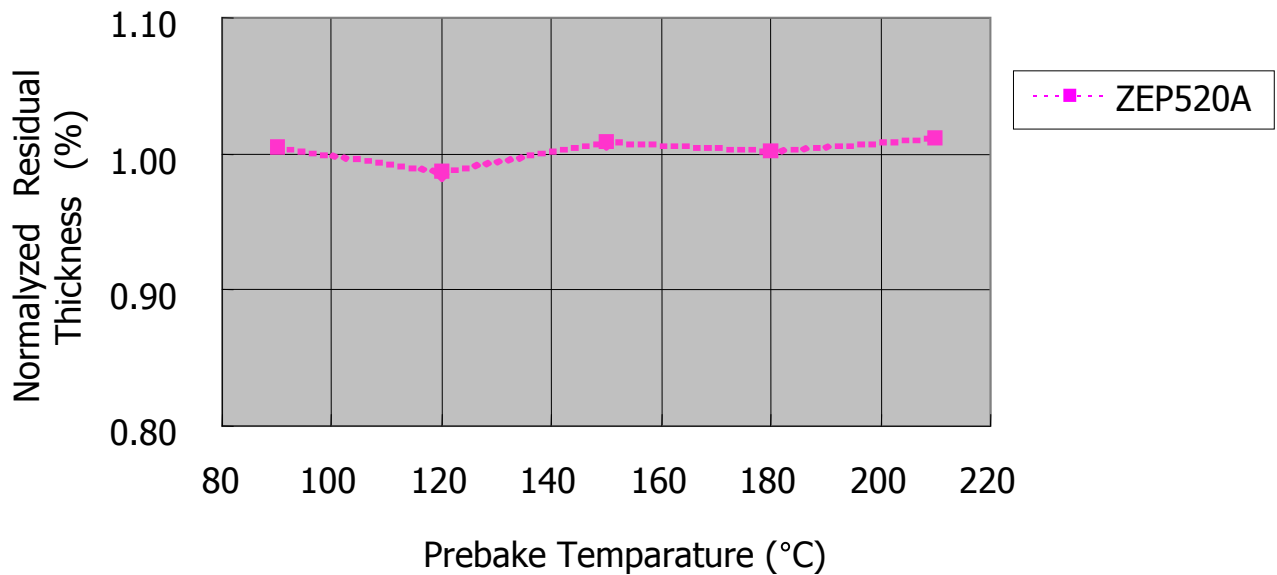
Substrate: 4inch Si wafer  
 Resist: ZEP520A  
 Spin: 300rpm,3sec.→Xrpm,120sec.  
 PB Temp.: 180°C  
 PB Time: 3 min.

## 8. Dependence on Prebake Temperature

Effect on Dose to Clear



Effect on Normalized Residual Thickness



### Process conditions

Substrate: Si wafer

Resist: ZEP520A

Film Thickness: 5000Å

PB Time: 3 min.

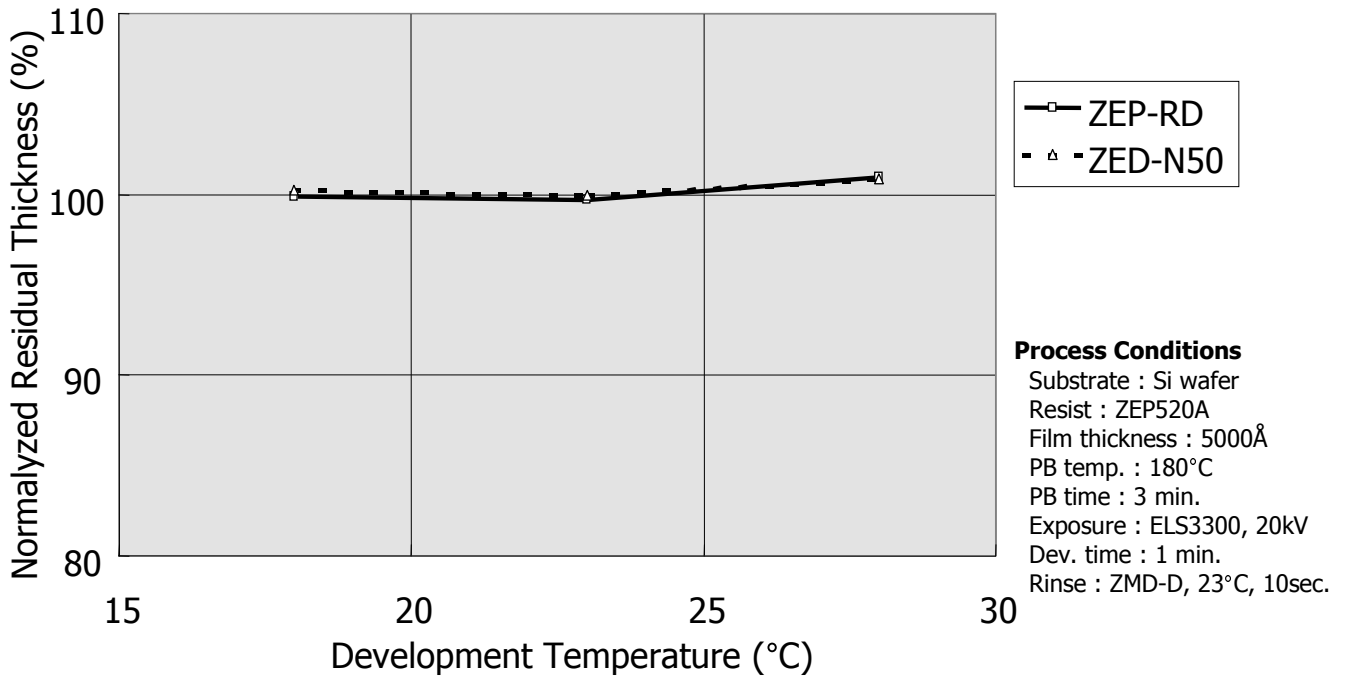
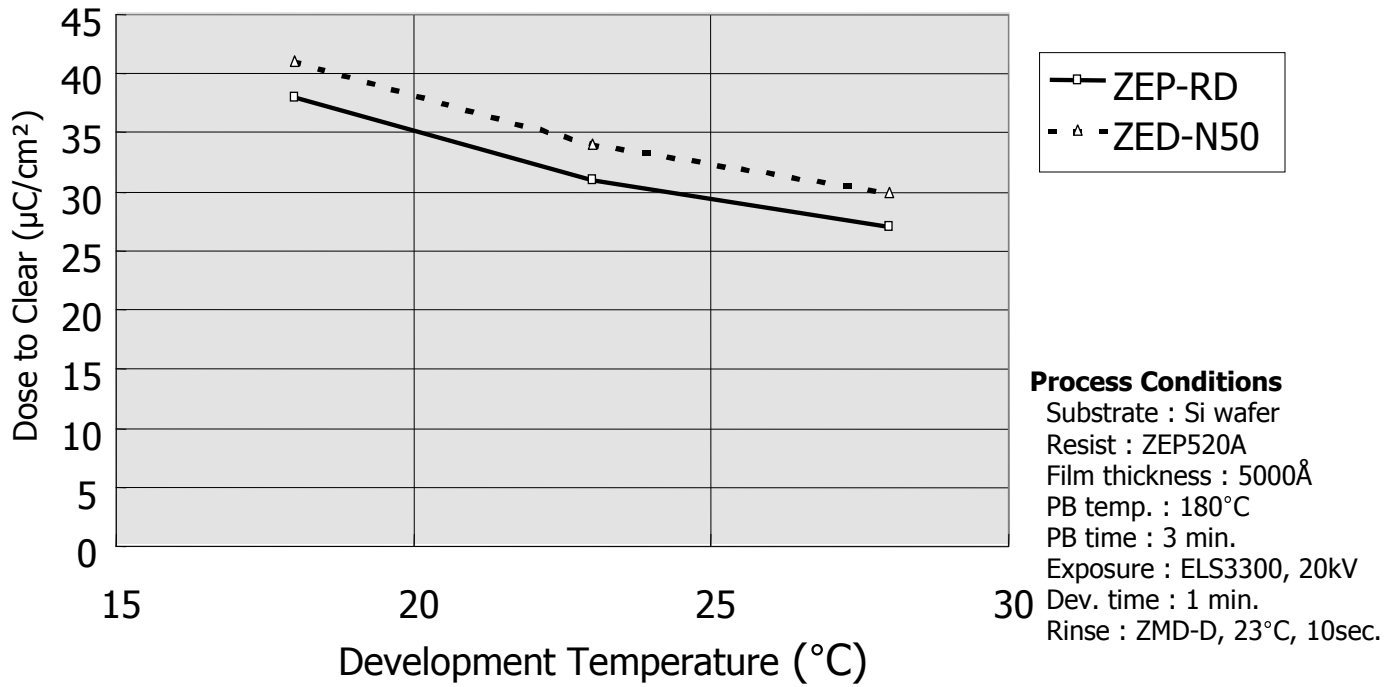
Exposure: ELS3300, 20kV

Developer: ZED-N50, 23°C

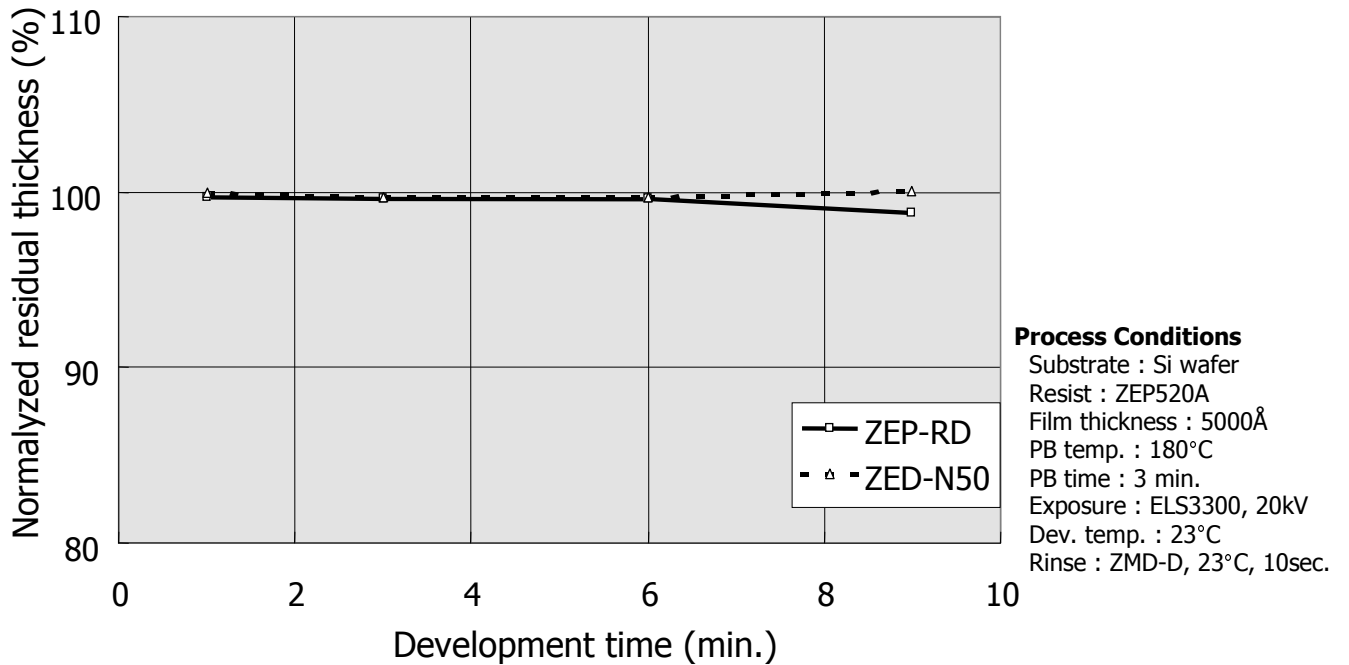
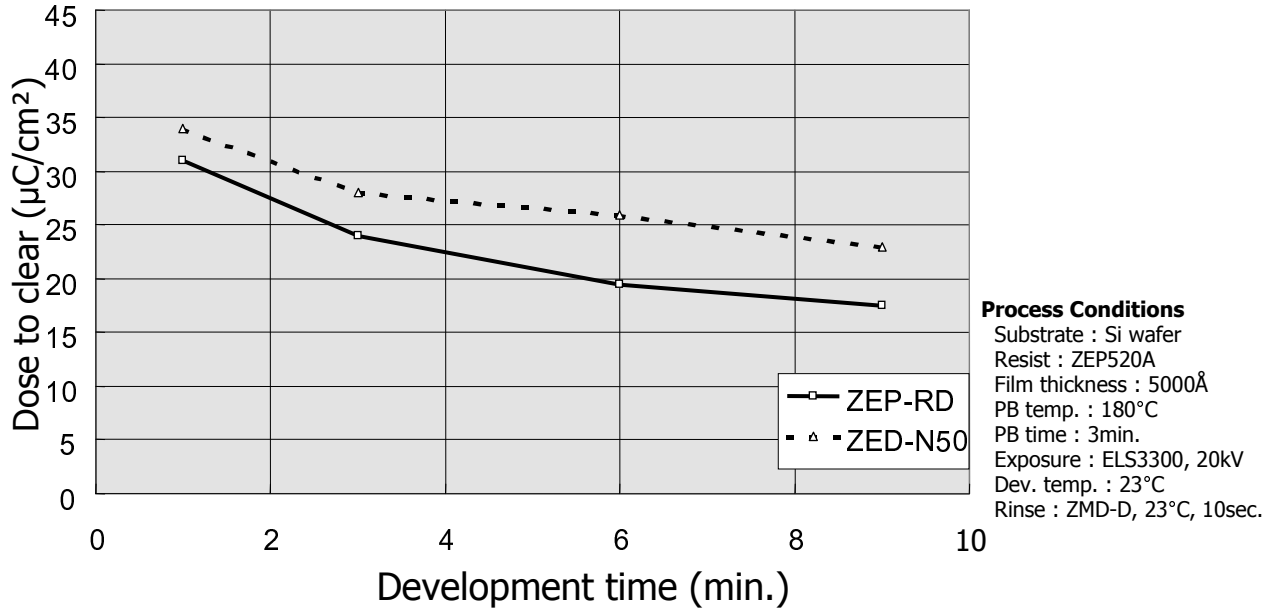
Dev. Time: 1 min.

Rinse: ZMD-D, 23°C, 10sec.

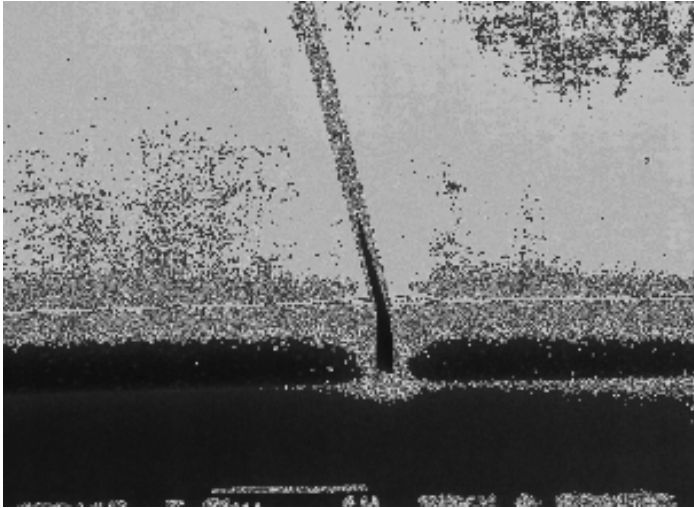
## 9. Dependence on Development Temperature



## 9. Dependence on Development Time



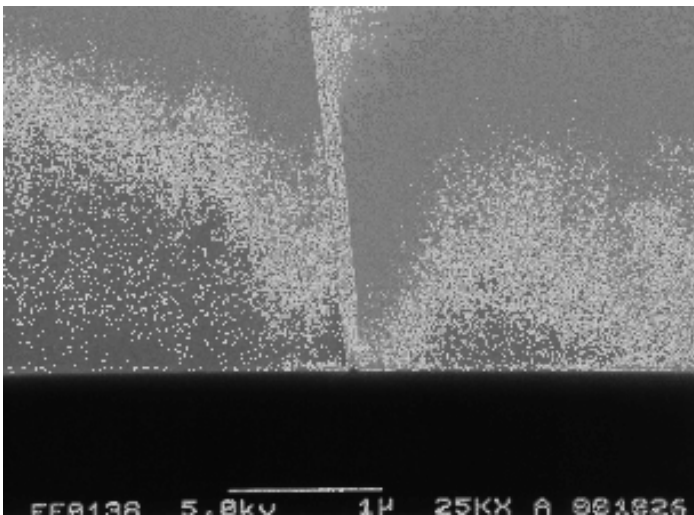
## 10. Examples of application



0.15µm Isolated space

### Process Conditions

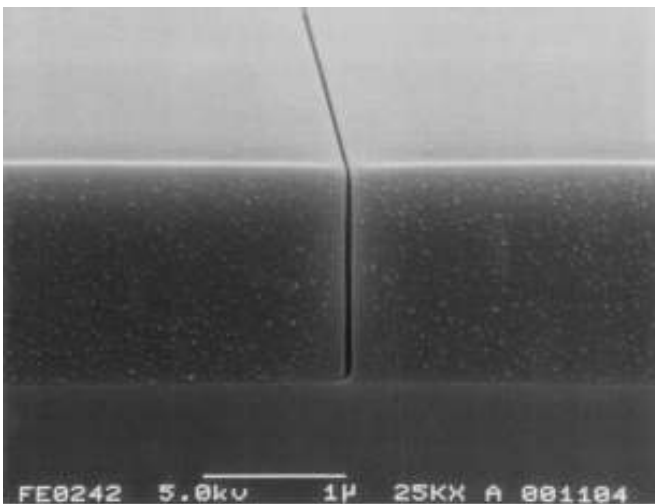
Resist : ZEP520  
Film thickness : 5000Å  
PB temp. : 180°C  
PB time : 2 min.  
Exposure : 30kV,  $5 \times 10^{-11}$ A, 1 line exp.  
 $50 \times 10^{-5} \mu\text{C}/\text{cm}$   
Dev. temp. : ZED-WN, 23°C, 30 sec.  
Rinse : IPA, 23°C, 20 sec.



0.1µm Isolated line

### Process Conditions

Resist : ZEP520  
Film thickness : 5000Å  
PB temp. : 180°C  
PB time : 2 min.  
Exposure area : 100µm (20000×20000dot)  
Exposure : 30kV,  $5 \times 10^{-11}$ A, 1 line exp.  
 $0.7 \mu\text{sec}/\text{dot}$   
Dev. temp. : ZED-WN, 23°C, 60 sec.  
Rinse : IPA, 23°C, 20 sec.



0.05µm Isolated space

### Process Conditions

Resist : ZEP520  
Film thickness : 15000Å  
Exposure : 75kV



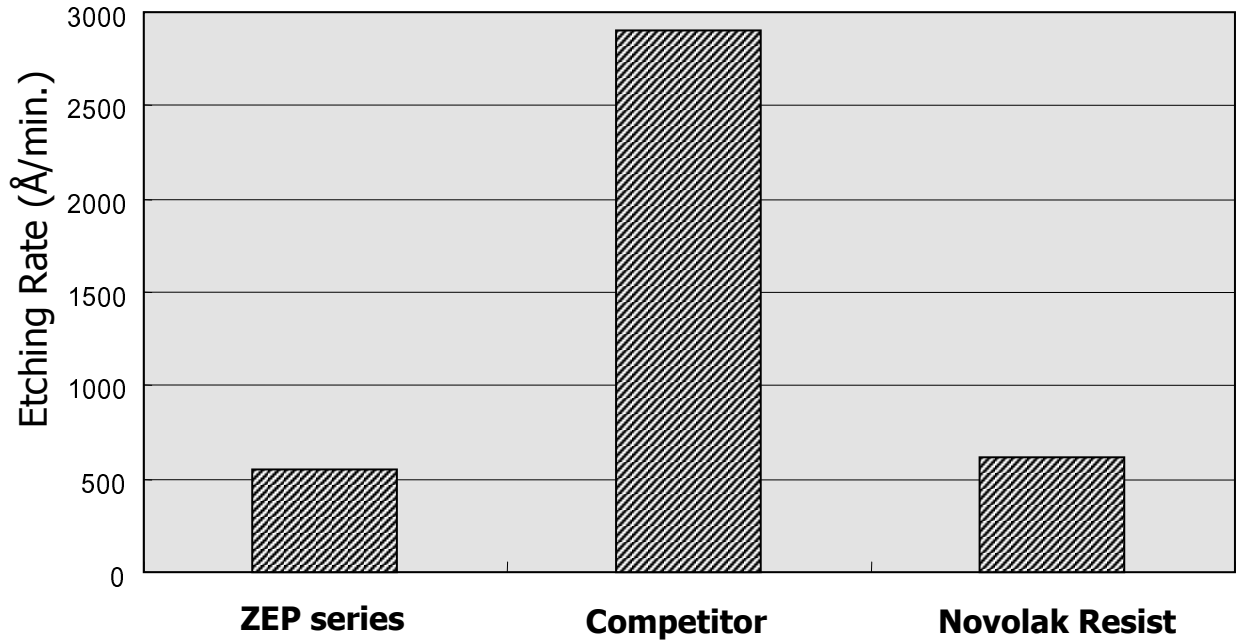
\* These SEM photographs & Data are offers of ELIONIX INC. Although ZEP520 is not sold from consideration of environment now. We think that the same pattern formations are possible also in ZEP520A.



# 11. Dry Etching Resistance

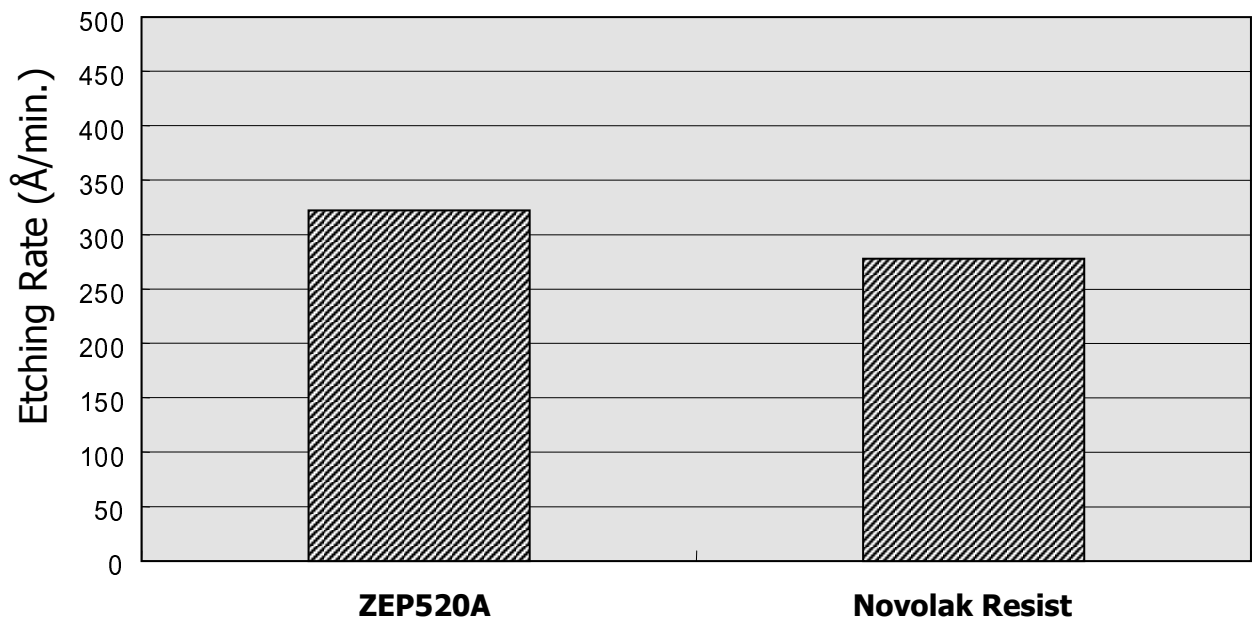
## (1) CF<sub>4</sub> Dry Etching Rate

CF<sub>4</sub> Dry Etching Condition  
0.15torr, 70sqcm, 200W



## (2) Cl<sub>2</sub>+O<sub>2</sub> Dry Etching Rate

Cl<sub>2</sub>+O<sub>2</sub> Dry Etching Condition  
Cl<sub>2</sub>/O<sub>2</sub>=4/1, 5min.



## 12. Example of Process Conditions

- |                     |  |
|---------------------|--|
| (1) Coating         | ZEP520A    2000rpmx60sec → 5000Å<br>ZEP520A-7    2000rpmx60sec → 3000Å   |
| (2) Prebake         | 170-200°Cx20-30min. (Oven)<br>170-200°Cx2-5min. (Hot Plate)  |
| (3) Exposure        | 20-50 μC/cm <sup>2</sup> at 20kV   |
| (4) Development     | 20-25°Cx60-360sec. (Dipping)<br>ZEP-RD, <u>ZED-N50</u>   |
| (5) Rinse           | 20-25°Cx10-60sec. (Dipping)<br>ZMD-D   |
| (6) Post bake       | In case of <u>wet etching</u><br>100-140°Cx20-30min. (Oven)<br>100-140°Cx2-3min. (Hot Plate)   |
| (7) De-scum         | O <sub>2</sub> -plasma    (if need be)   |
| (8) Etching         | Dry process and wet process can be used.<br><br><u>Wet Etching solution for Cr</u><br>Ammonium cerium(IV) nitrate (NH <sub>4</sub> ) <sub>2</sub> Ce(NO <sub>3</sub> ) <sub>6</sub> 13-18wt%<br>Perchloric acid HClO <sub>4</sub> 3-8wt%<br>Pure water H <sub>2</sub> O 77-84wt%   |
| (9) Resist removing | < deep-UV + organic solvent ><br>1st step: 185nm+254nm, 10mW/cm <sup>2</sup> , 3min.-irradiation<br>2nd step:<br>Dimethylacetamide(DMAC) or N-methyl-2-pyrrolidone (NMP),<br>23°Cx1min.<br>*As the polymer of ZEP520A is decomposed by deep-UV irradiation, it can be easily removed.<br><br><organic solvent ><br>Dimethylacetamide (DMAC) (30-35°C)<br>N-methyl-2-pyrrolidone(NMP) (30-35°C) |

## 13. Handling Precautions

- (1) Flammable Liquid.
- (2) Harmful by inhalation.
- (3) Avoid contact with skin and eyes.

CAUTION: Open carefully. Use in well ventilated area. In case of contact with skin and eyes, rinse immediately with plenty of water for 15 minutes and get medical attention. In case of fire use Alcohol form CO<sub>2</sub> or dry chemical, never use water.

STORAGE: Keep capped and away from oxidants, sparks and open flame. Store at cool [32°F (0°C) - 77°F (25°C)] and dark place. Use in clean room.

## 14. Appendix

### (1) Refractive index of ZEP520A film

Cauchy coefficient

$$n = n_0 + n_1/\lambda^2 + n_2/\lambda^4$$

$$n_0 = 1.541093$$

$$n_1 = 4.113002 \times 10^5$$

$$n_2 = 4.070357 \times 10^{12}$$

$$\text{absorption coefficient} = 0$$

unit of  $\lambda$  : Å

measured by UV-1250/SE (KLA Tencor)

### (2) Glass transition temperature of ZEP520A polymer

Tg : 105°C      measured by DSC

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