ZEONREX Electronic Chemicals

ZEP520A

High Resolution Positive Electron Beam Resist

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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	
ZEP-SD	2-Butanone 40% Methyl isobutyl ketone 60%	high sensitivity	

※ ZED－N50 is recommended ！

5. Rinse

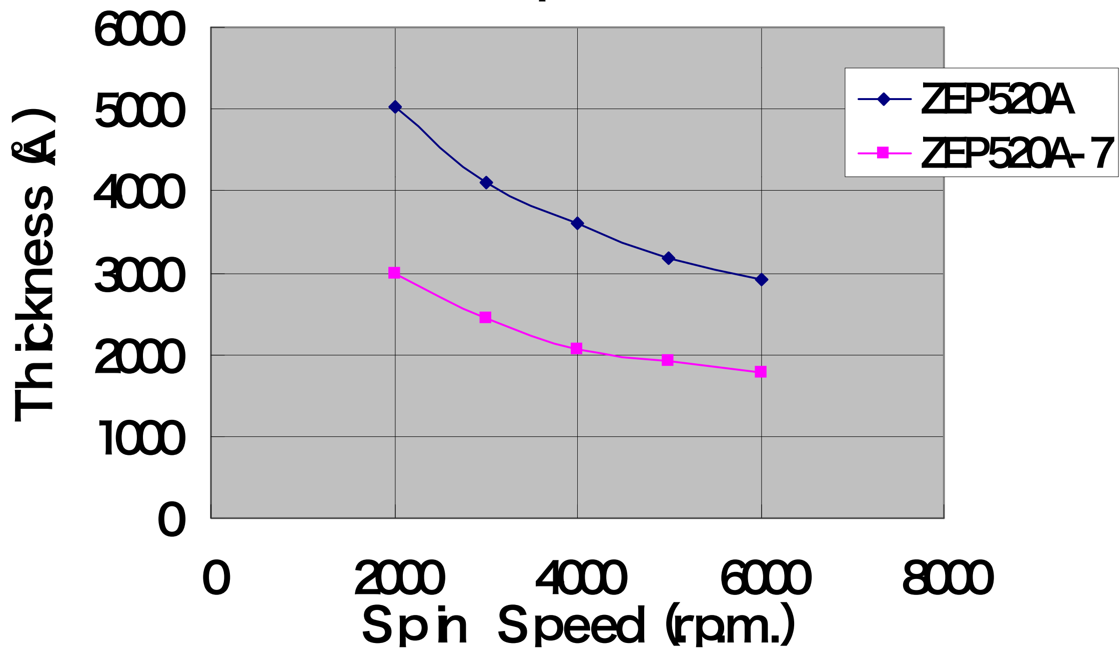
Item	Composition	Remarks	Form
ZMD-B	Methyl isobutyl ketone 89% Isopropyl alcohol 11%		1GL bottle

6. Remover

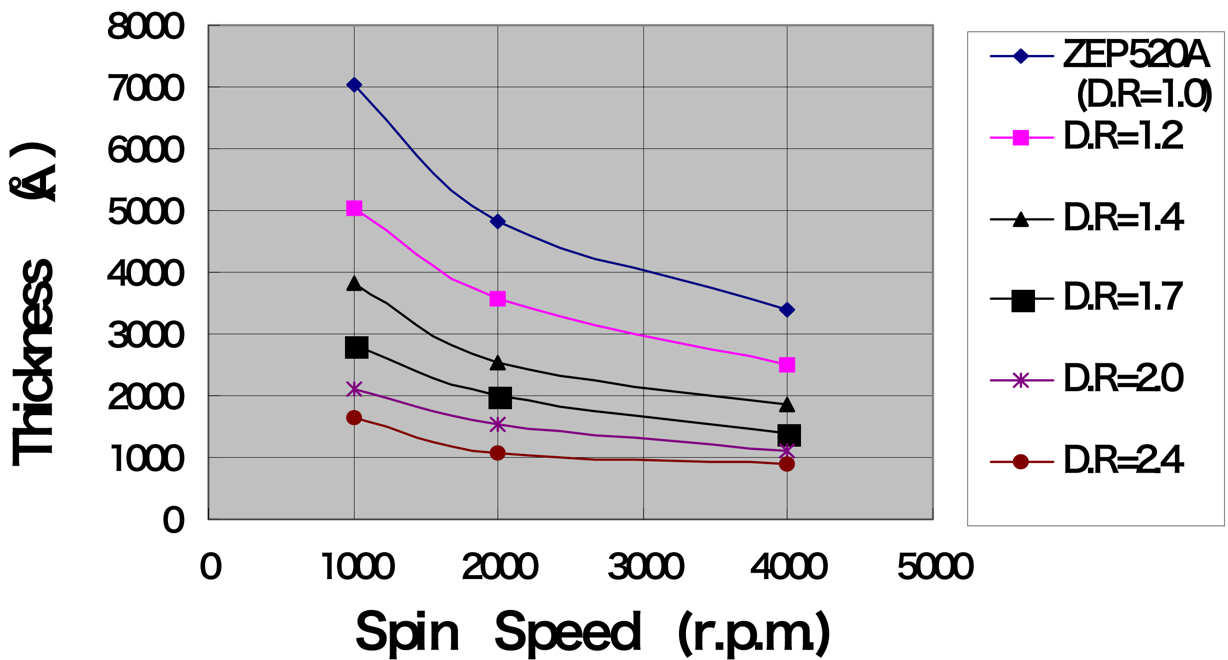
Item	Composition	Remarks	Form
ZDMAC	Dimethylacetamide		1GL bottle

7. Spin Curve

ZEP 520A Spin curve (1)



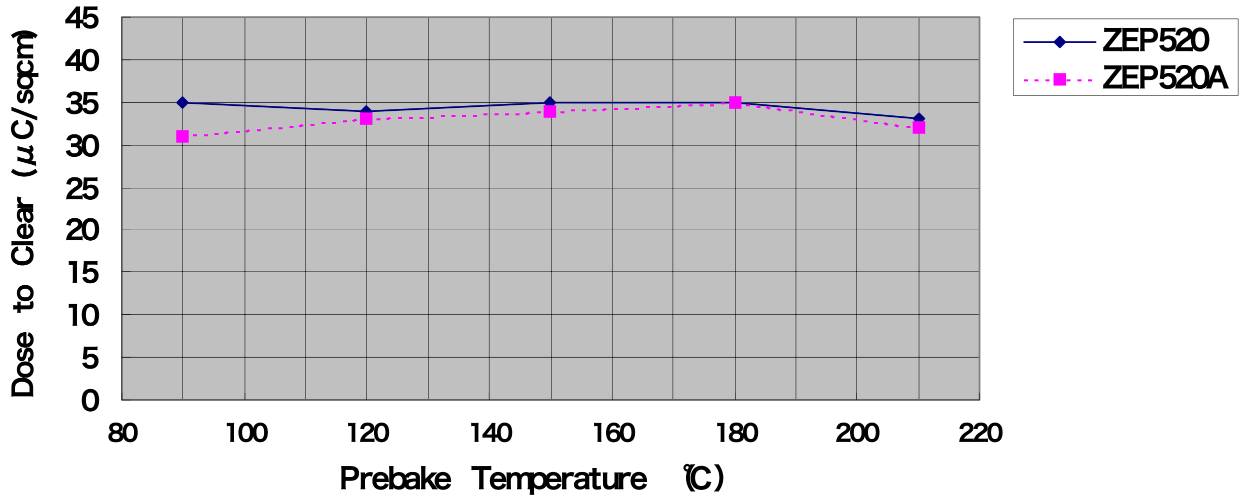
ZEP520A Spin curve (2)

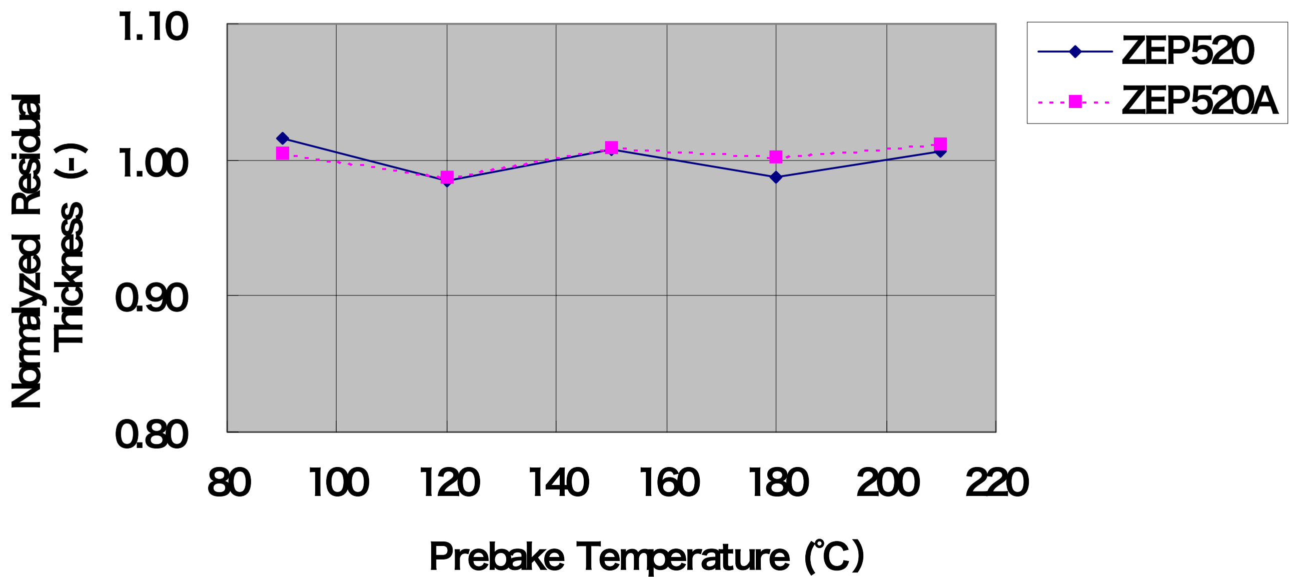


D.R=(Resist+Solvent)/Resist
(Weight Ratio)

Process Conditions
Substrate :4inch Si wafer
Resist :ZEP520A
Spin :300rpm, 3sec.→Xrpm, 120sec.
PB temp. :180°C
PB time :3 min.

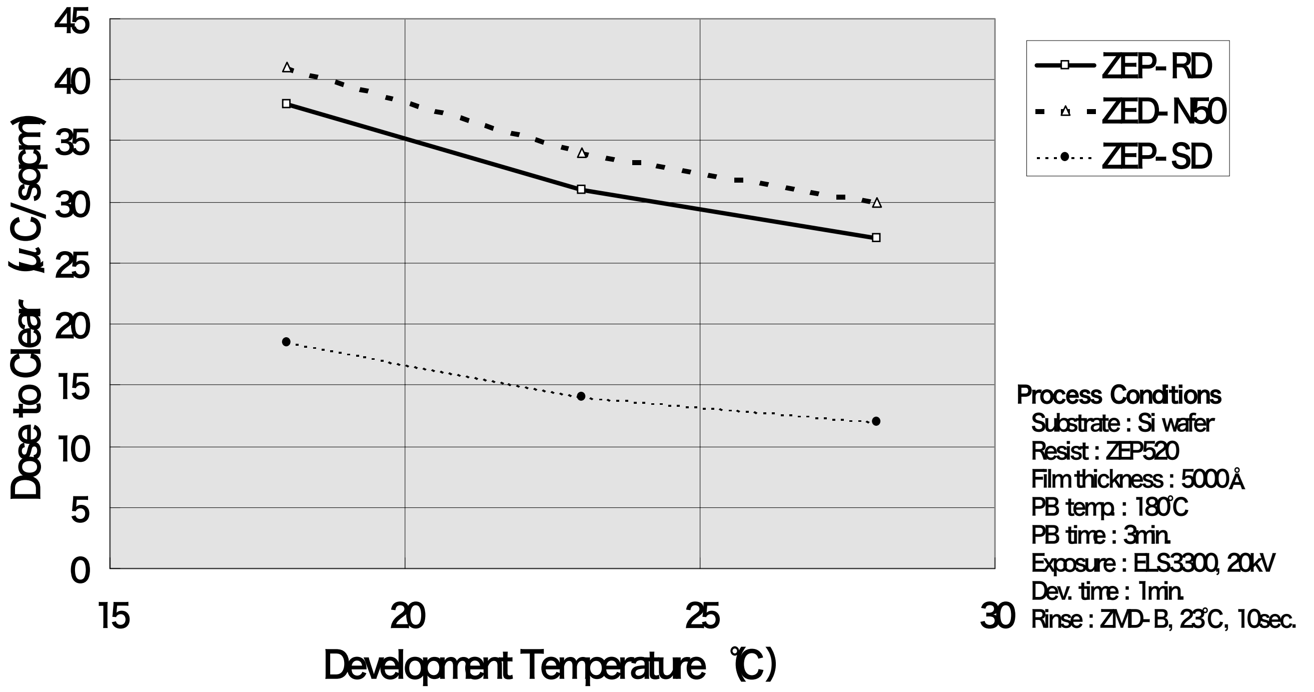
8. Dependence on Prebake Temperature

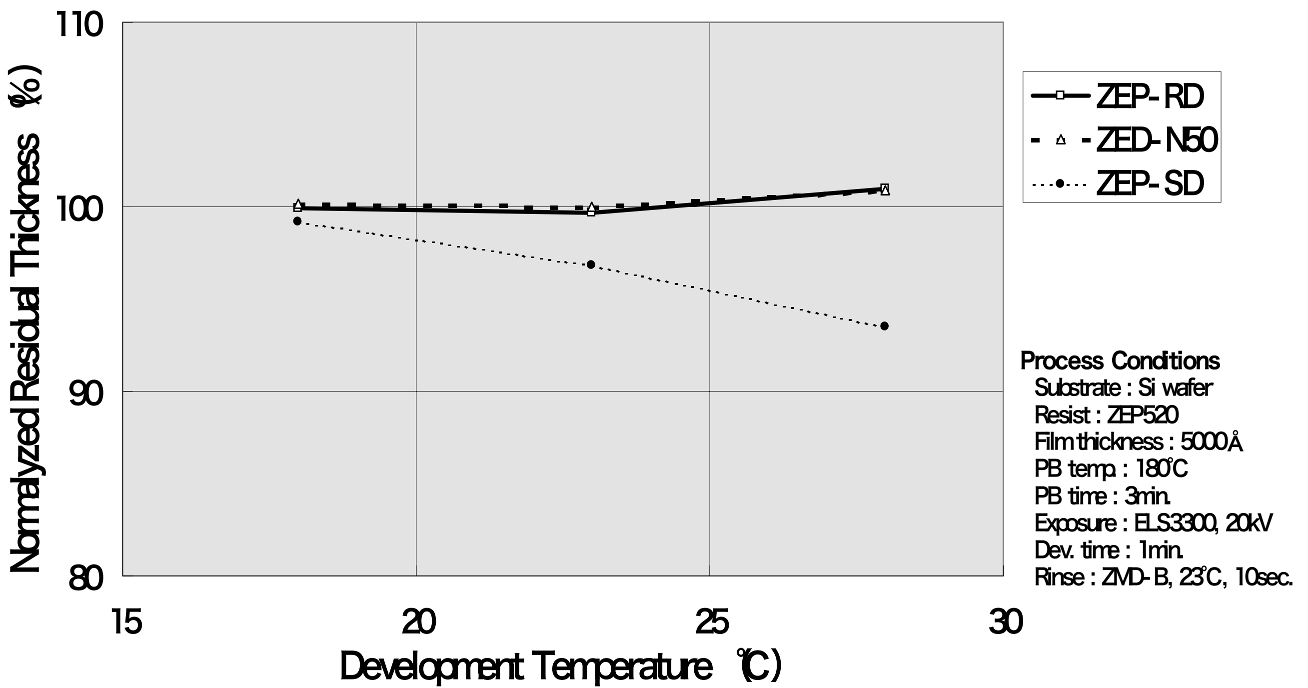




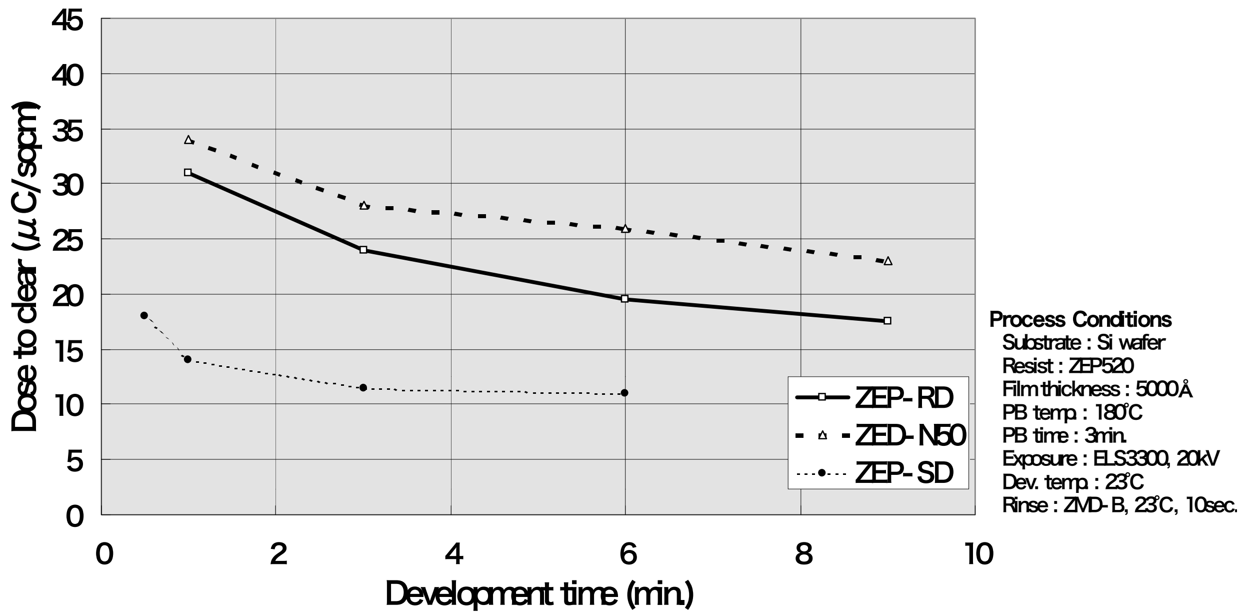
Process Conditions
Substrate :Si wafer
Resist :ZEP520,ZEP520A
Film thickness :5000Å
PB time :3 min.
Exposure :ELS3300,20kV
Developer :ZED-N50, 23℃
Dev.time :1 min.
Rinse :ZMD-B, 23℃,10sec.

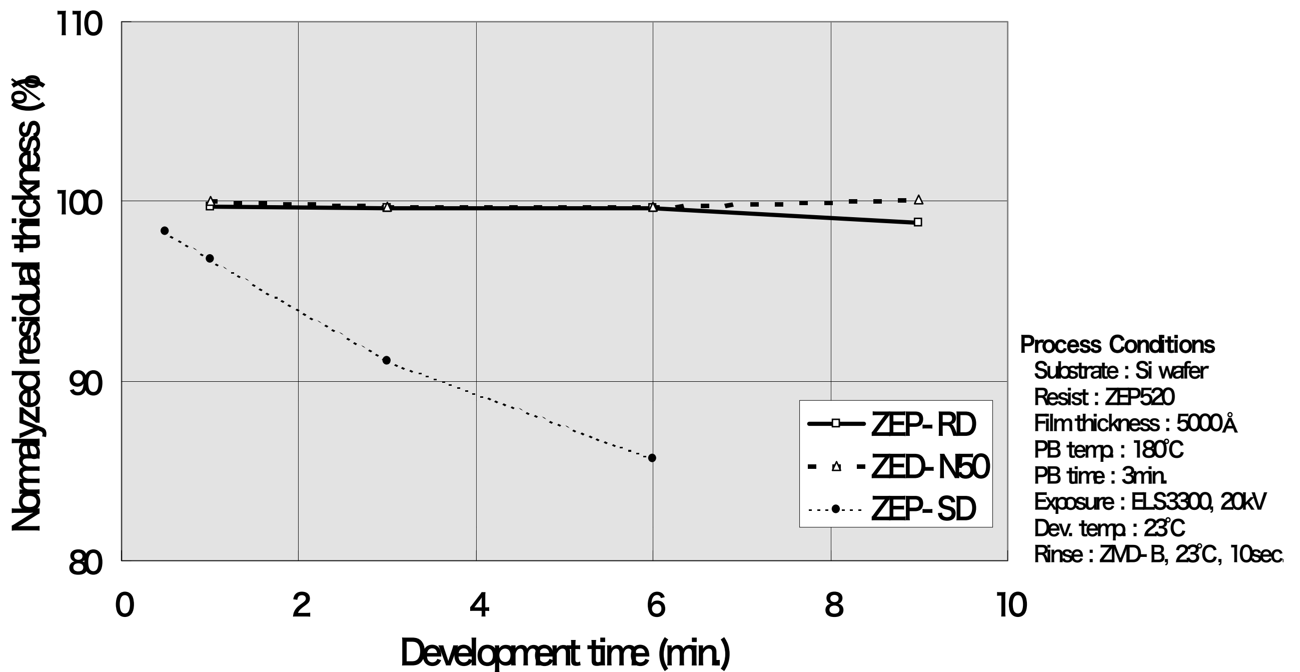
9. Dependence on Development Temperature



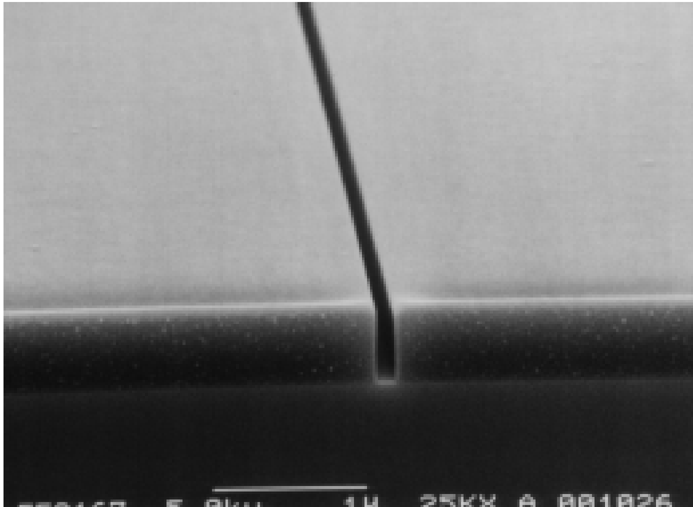


9. Dependence on Development Time





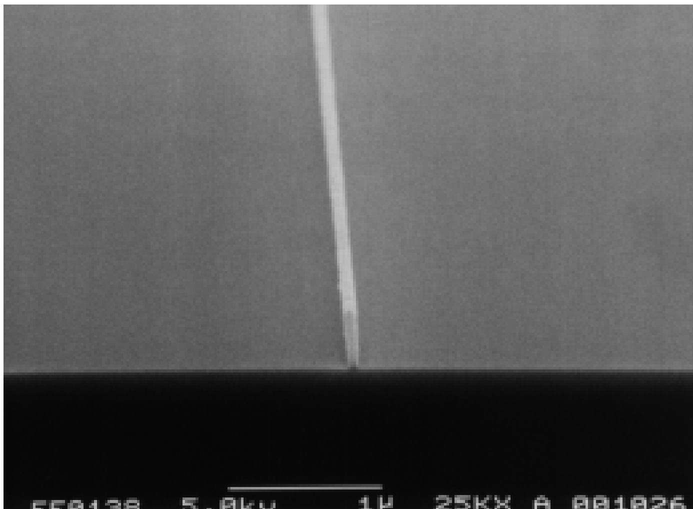
10. Examples of application



0.15 μm Isolated space

Process Conditions

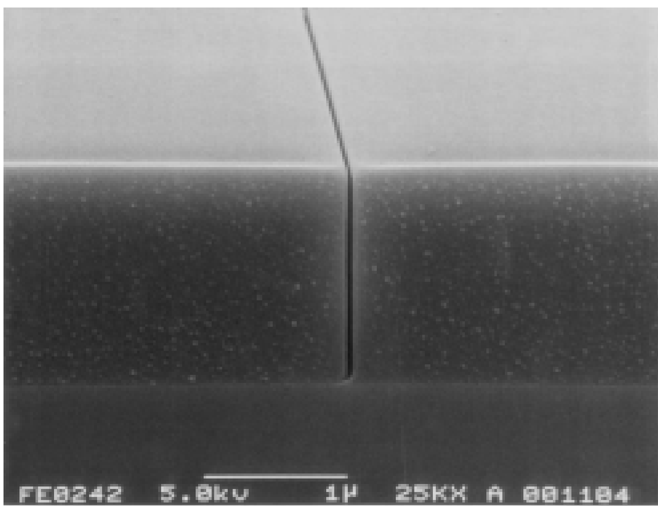
Resist : ZEP520
Film thickness : 5000 Å
PB temp. : 180℃
PB time : 2min.
Exposure : 30kV, 5×10^{-11}A, 1 line exp.
50×10^{-5} μC/cm
Dev. temp. : ZED-WN, 23℃, 30sec.
Rinse : IPA, 23℃, 20sec.



0.1 μm Isolated line

Process Conditions

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



0.05 μm Isolated space

Process Conditions

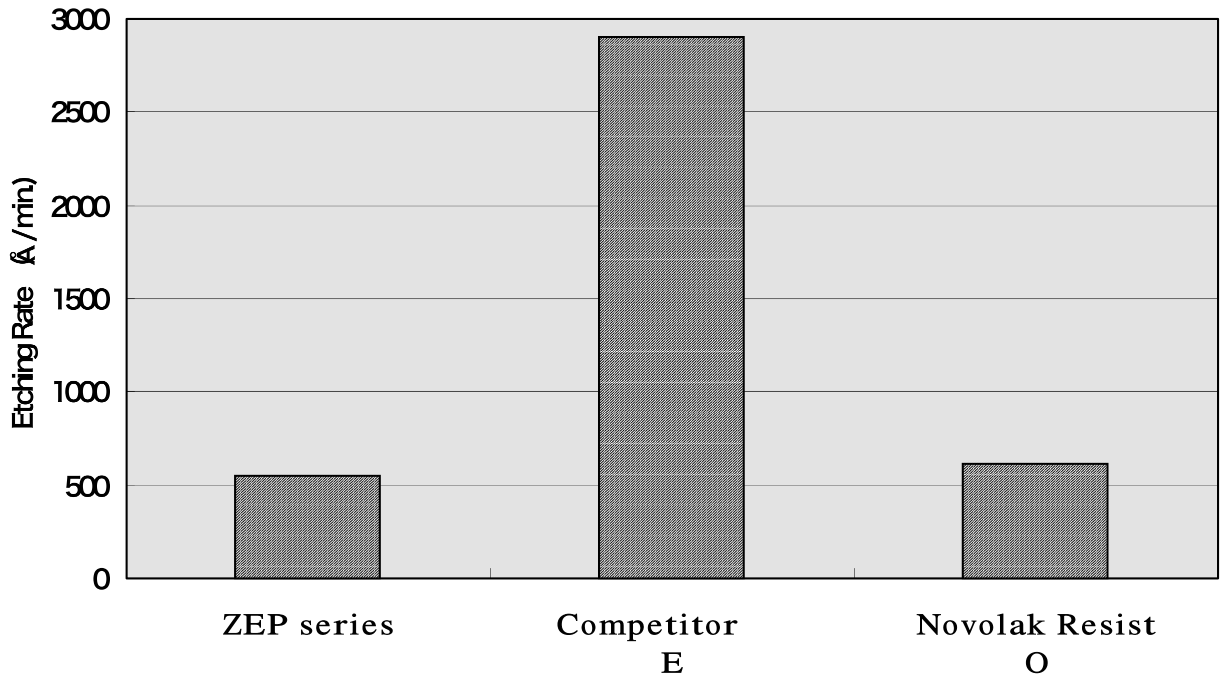
Resist : ZEP520
Film thickness : 15000 Å
Exposure : 75kV

These data were presented by ELIONIX INC.

11. Dry Etching Resistance

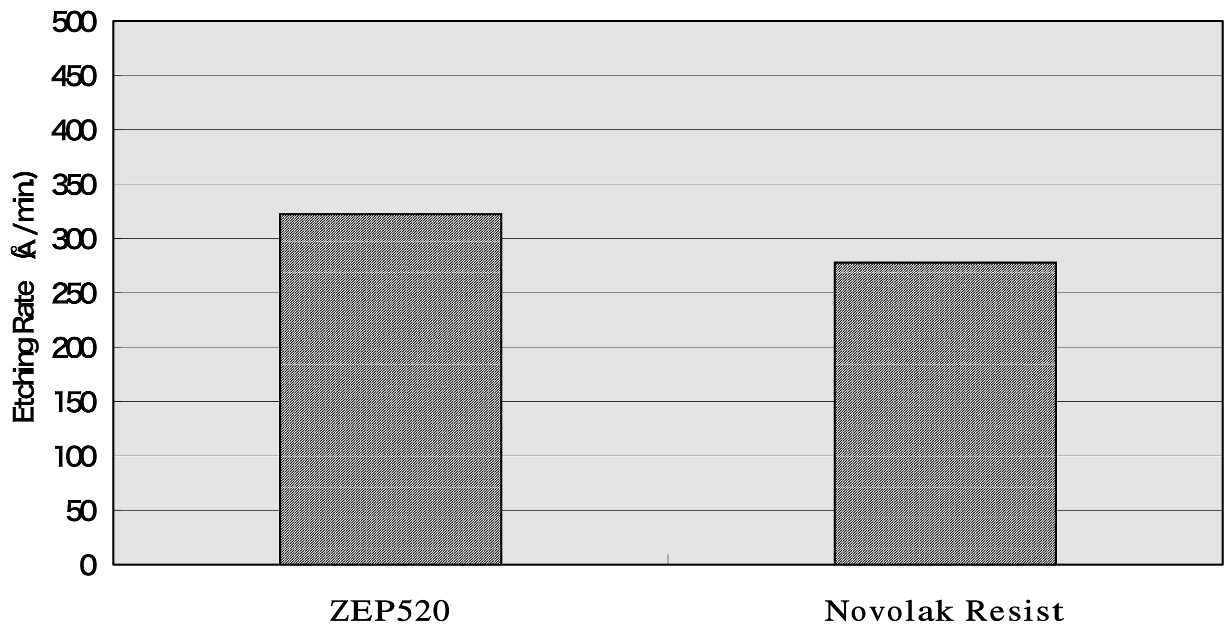
(1) CF_4 Dry Etching Rate

CF_4 Dry Etching Condition
0.15torr, 70sqcm, 200W



(2) Cl_2+O_2 Dry Etching Rate

Cl_2+O_2 Dry Etching Condition
Cl_2/O_2=4/1, 5min.



12. Example of Process Conditions

(1) Coating	ZEP520A 2000rpm×60sec → 5000Å ZEP520A-7 2000rpm×60sec → 3000Å
(2) Prebake	170～200℃×20～30min. (Oven) 170～200℃×2～5min. (Hot Plate)
(3) Exposure	20～50μC/cm2 at 20kV
(4) Development	20～25℃×60～360sec. (Dipping) ZEP-RD, <u>ZED-N50</u>
(5) Rinse	20～25℃×10～60sec. (Dipping) ZMD-B
(6) Post bake	in case of <u>wet etching</u> 100～140℃×20～30min. (Oven) 100～140℃×2～3min. (Hot Plate)
(7) De-scum	O_2-plasma （if need be）
(8) Etching	Dry process and wet process can be used. <u>Wet Etching solution for Cr</u> Ammonium cerium(Ⅳ) nitrate $(NH_4)_2Ce(NO_3)_6$ 13～18wt% Perchloric acid $HClO_4$ 3～8wt% Pure water H_2O 77～84wt%
(9) Resist removing	<organic solvent > Dimethylacetamide(DMAC) （30～35℃) N-methyl-2-pyroridone(NMP) (30～35℃) < deep-UV + organic solvent > 1st step: 185nm+254nm,10mW/cm^2,3min.-irradiation 2nd step: Dimethylacetamide(DMAC) or N-methyl-2-pyroridone (NMP), 23℃×1min. *As the polymer of ZEP520A is decomposed by deep-UV irradiation, it can be easily removed.

13. Handling Precaution

(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_2 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

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

$n_0 = 1.541093$

$n_1 = 4.113002 \times 10^5$

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

absorption coefficient = 0

unit of λ : Å

measured by UV-1250/SE (KLA Tencor)

(2) Glass transition temperature of ZEP520A polymer

Tg : 105℃ measured by DSC

< Sales Division>

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