ZEP520A Ver.2 Oct.2010

ZEONREX® Electronic Chemicals
High Resolution Positive Electron Beam Resist

ZEP520A

Technical Report

ZEON CORPORATION

Electronics Materials Division

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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 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.

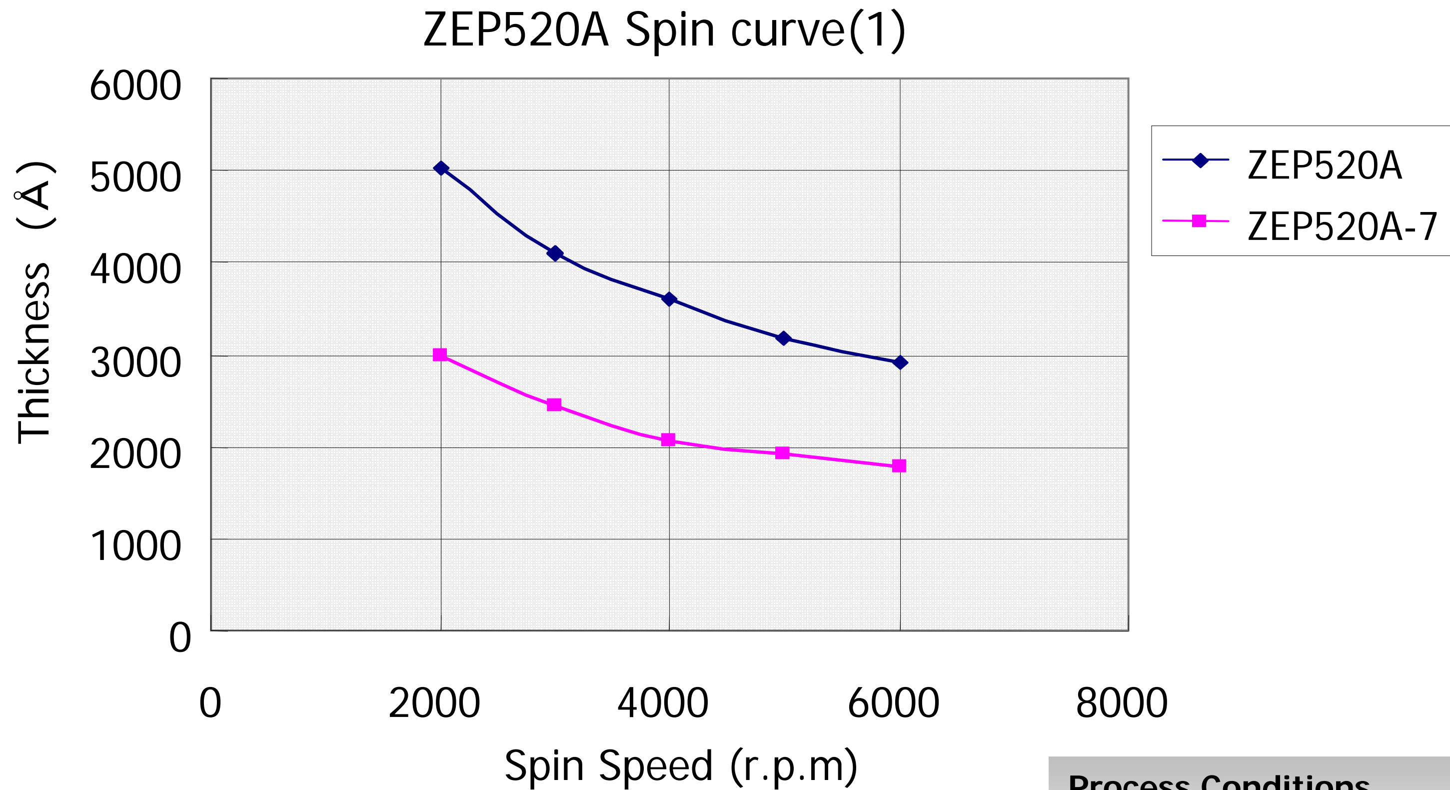
(3) Sensitivity
Shows high sensitivity.

2. Properties

Item		Mw	Viscosity (mPa・s)	Solvent	Form
EB resist	ZEP520A ZEP520A-7	57,000	11 7	Anisole	1QT bottle / 100ml bottle

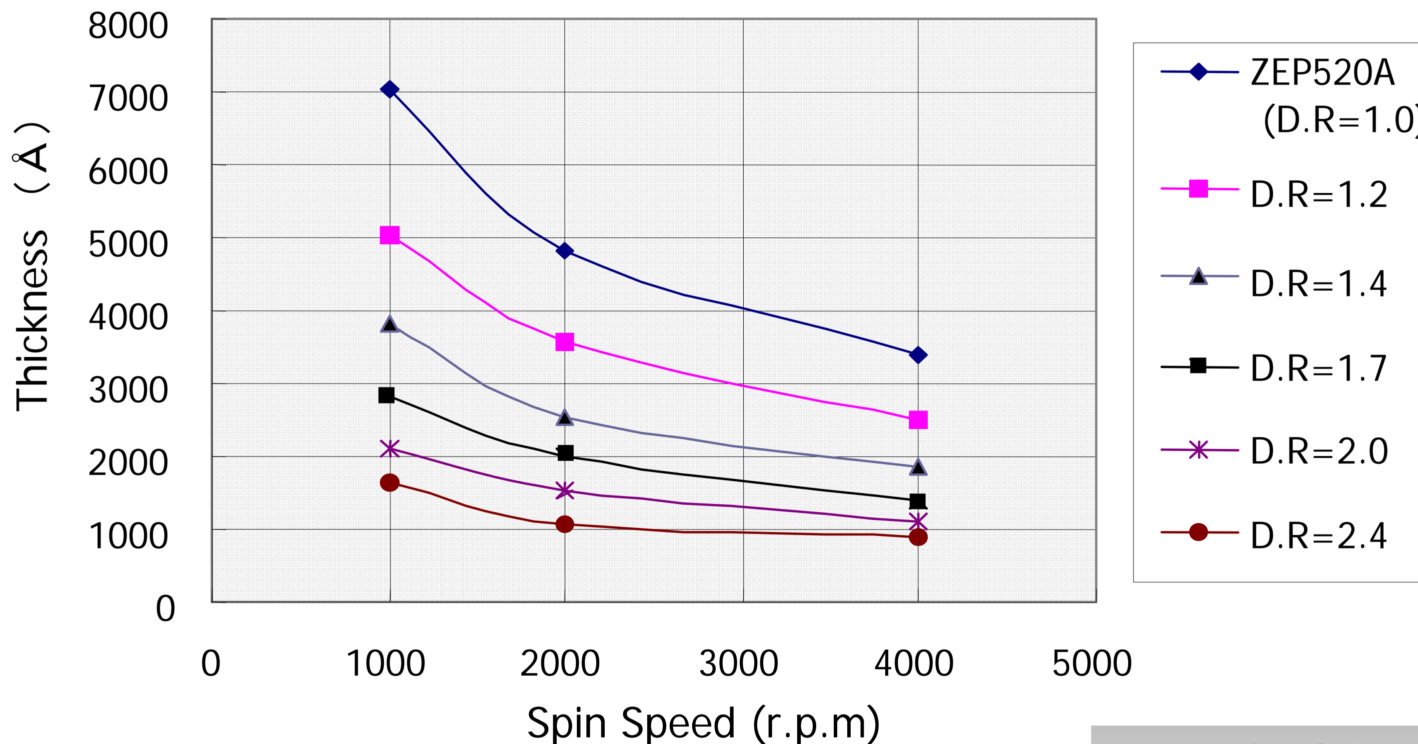
Item		Composition	Remarks	Form
Thinner	ZEP-A	Anisole	ZEP520A	1QT bottle
Developer	ZED-N50	n-Amyl acetate		1GL bottle
Rinse	ZMD-D	Methyl isobutyl ketone 100%		1GL bottle / 1QT bottle
Remover	ZDMAC	Dimethylacetamide		1GL bottle

3. Spin Curve



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

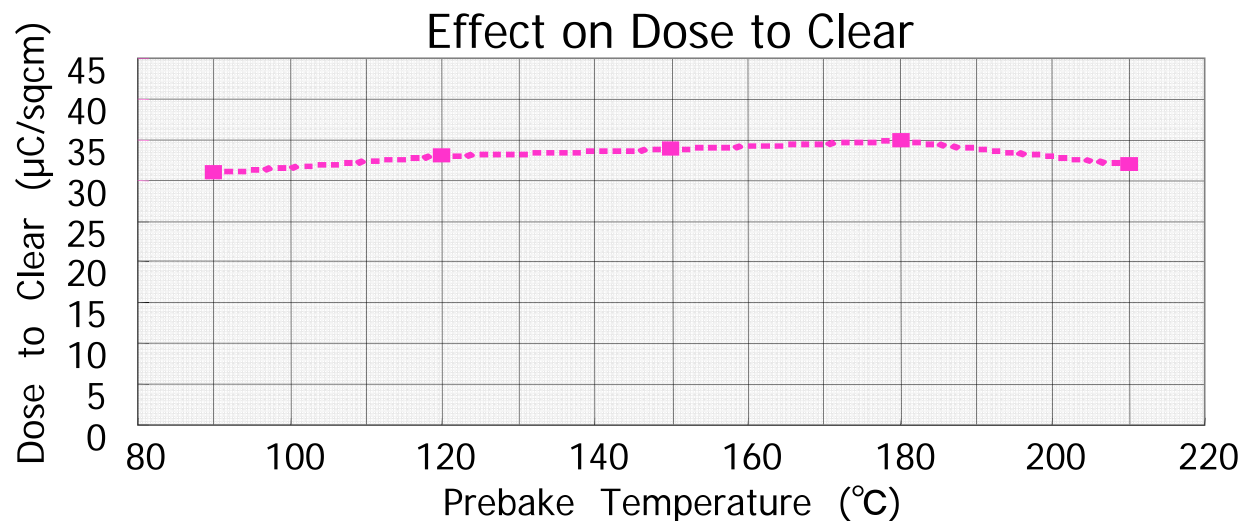
3. Spin Curve (Reference data for dilution)

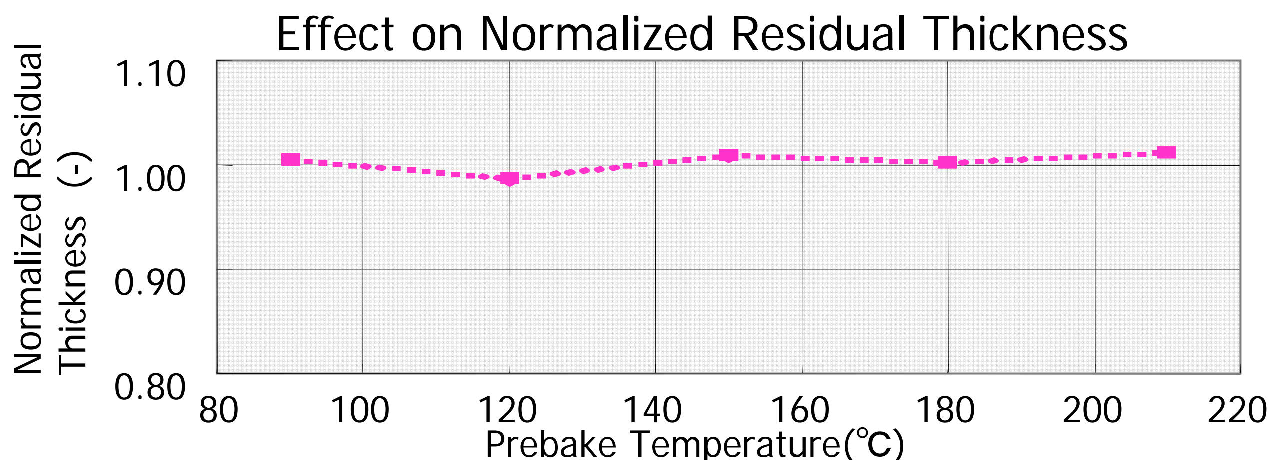


Process Conditions
Substrate : 4inch Si wafer
Resist : ZEP520A
Spin : 300rpm,3sec.→Xrpm,120sec.
PB temp. : 180℃
PB time : 3min.

D.R（Dilution Rate）
＝{Original Resist(g)＋Solvent(g)}/original Resist(g)
(Weight Ratio)

4. Dependence on Prebake Temperature

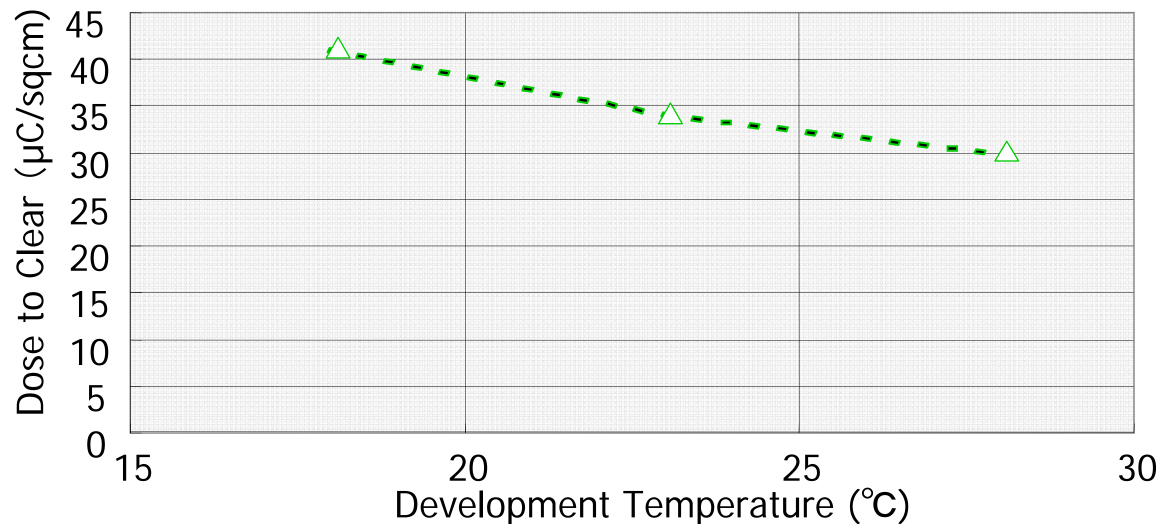


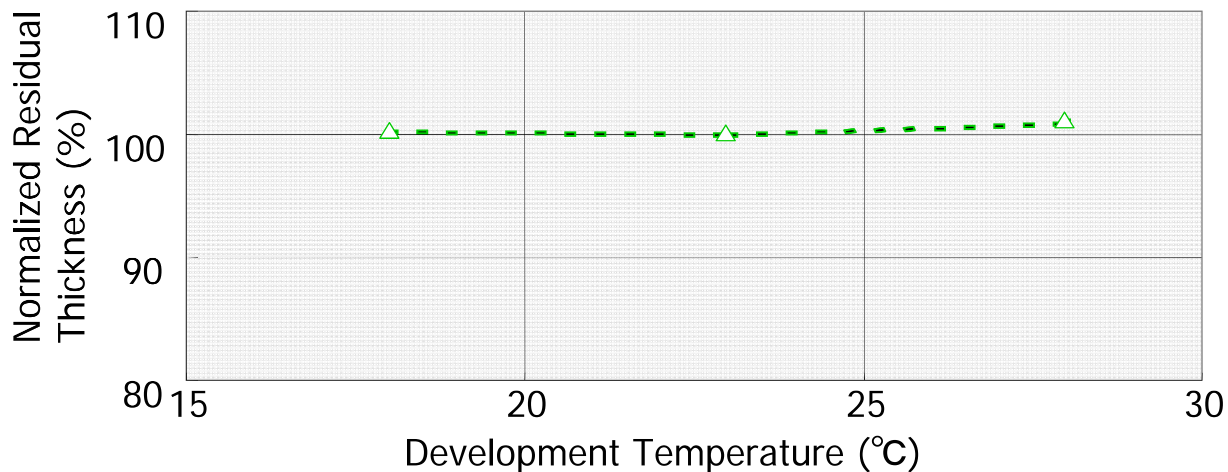


Process conditions

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

5. Dependence on Development Temperature

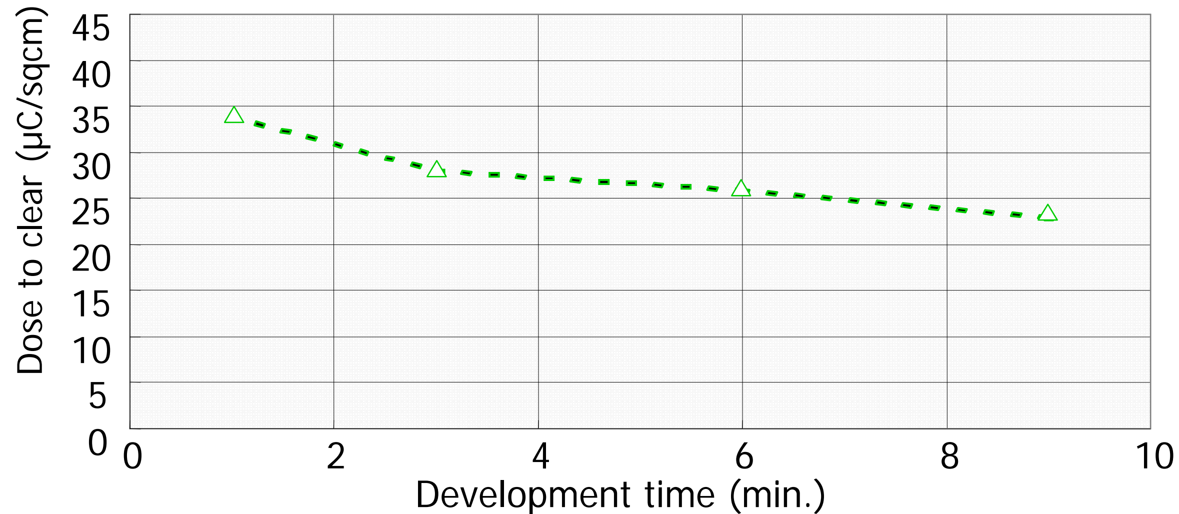


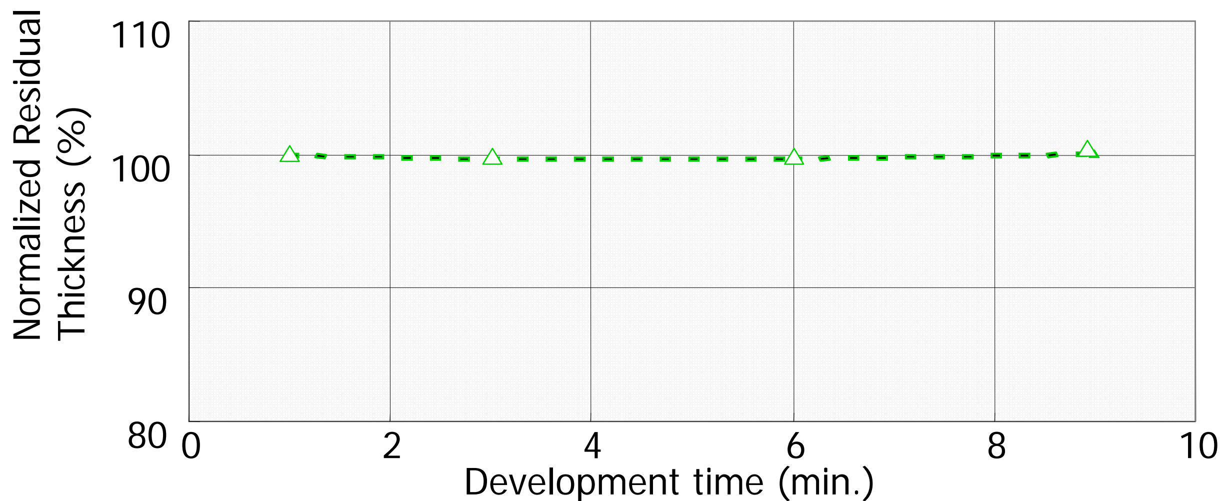


Process conditions

Substrate: Si wafer
Resist: ZEP520A
Film thickness: 5000Å
PB temp. : 180℃
PB time: 3 min.
Exposure: ELS3300,20kV
Developer: ZED-N50, 23℃
Dev.time: 1 min.
Rinse: ZMD-D, 23℃,10sec.

6. Dependence on Development Time



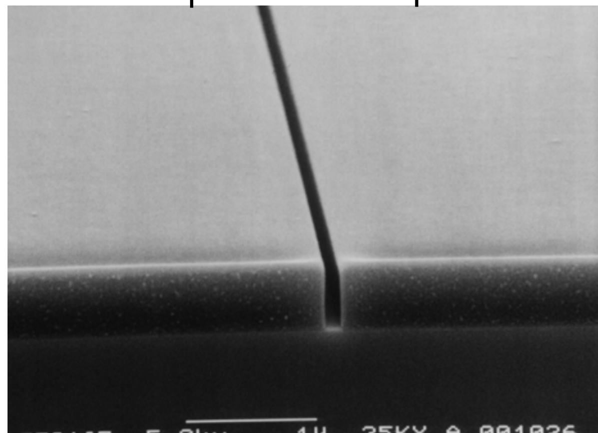


Process conditions

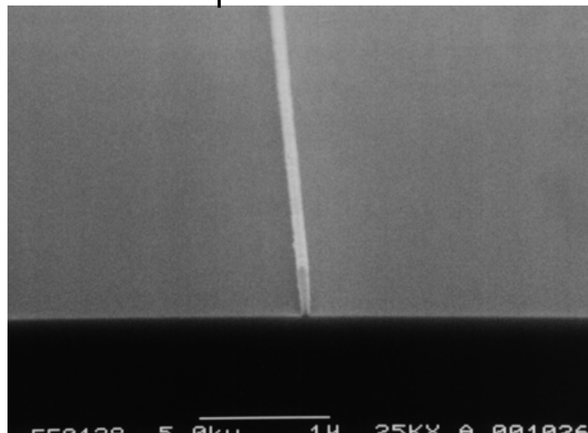
Substrate : Si wafer
Resist : ZEP520A
Film thickness : 5000 Å
PB temp. : 180℃
PB time : 3 min.
Exposure : ELS3300,20kV
Developer : ZED-N50, 23℃
Dev.time : 1 min.
Rinse : ZMD-D, 23℃,10sec.

7. Examples of application

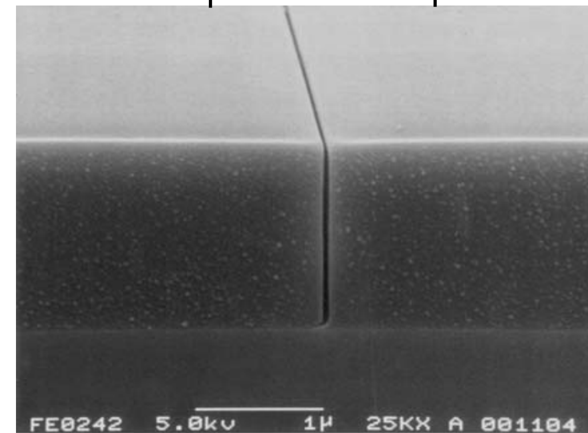
0.15μm Isolated space



0.1μm Isolated line



0.05μm Isolated space



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

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

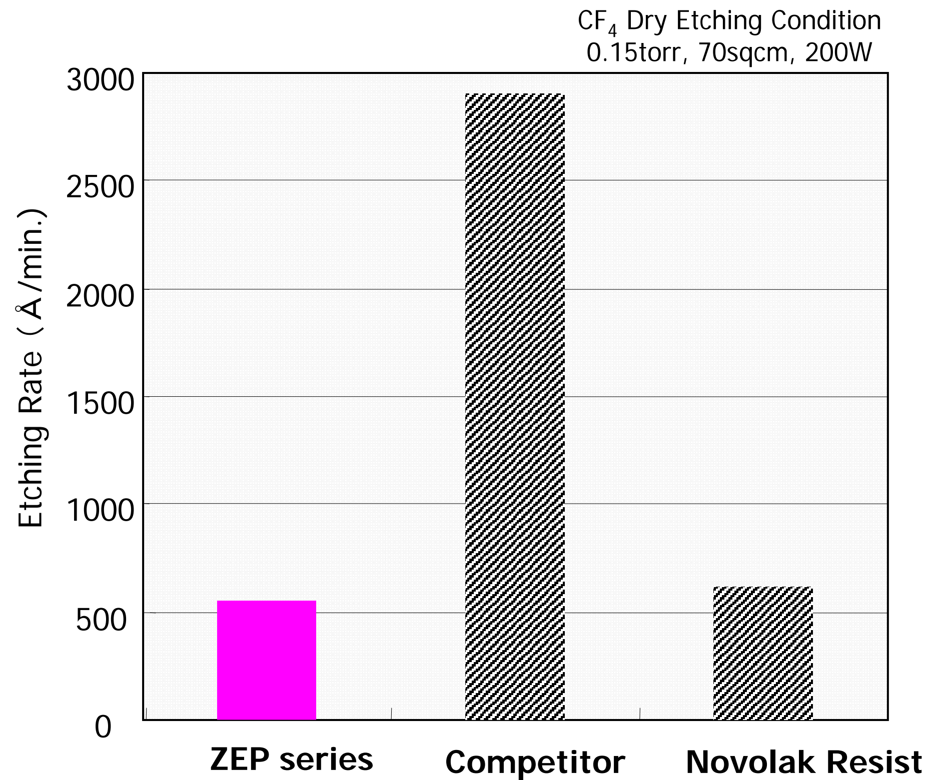
Process Conditions
Resist : ZEP520
Film thickness : 15000Å
Exposure : 75kV

These data were presented by ELIONIX INC.

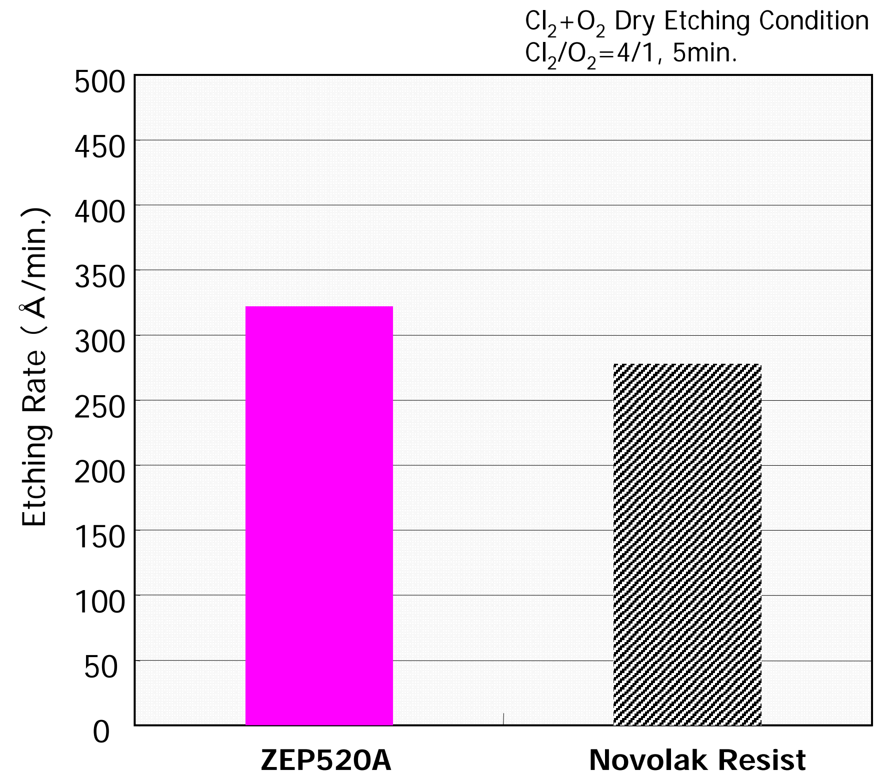
* These SEM photographs & Data are offers of ELIONIX INC. Although ZEP520 is not sold from consideration of environment now.We think that the same pattern formations are possible also in ZEP520A.

8. Dry Etching Resistance

(1) CF_4 Dry Etching Rate



(2) Cl_2+O_2 Dry Etching Rate



9. 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)
ZED-N50

(5) Rinse
20～25℃×10～60sec. (Dipping)
ZMD-D

(6) Post bake
in case of wet etching
100～140℃×20～30min. (Oven)
100～140℃×2～3min. (Hot Plate)

(7) De-scum
O2-plasma (if need be)

(8) Etching
Dry process and wet process can be used.

(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/cm2,3min.-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.

10. 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.

11. 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