ZEONREX Electronic Chemicals

ZEP7000 Ver.1.07 Apl .2009

High Resolution Positive Electron Beam Resist

ZEP7000

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

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1. Characteristics

ZEP7000 is high performance positive EB resist especialy Mask Fabrication including 50 KV process.

(1) High Resolution and High Sensitivity

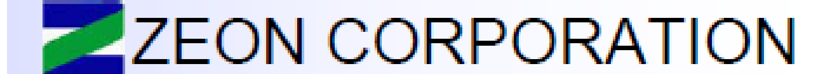
Shows High Resolution , and rectangle pattern profile.

(2) Resistance to dry etching

Shows High Dryetching Resistance and they are almost equivalent to that of positive photoresists generally used.

(3) Sensitivity

Shows very high sensitivity.



2. Line Up of ZEP7000 related Chemicals

Category	Item	Packing	Remarks
Resist	ZEP7000	1 QT	22.5 mPa.s
Developer	ZED-500	1 QT , 1 Gallon	for Spray Dev.
	ZED-750	1 Gallon	for Puddle Dev.
Rinse	ZMD-D	1 Gallon	
Remover	ZDMAC	1 Gallon	
Thinner	ZEP-D	1 QT	

3. Spin Curve (ZEP7000)

Film Thickness

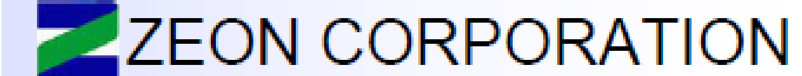
4000
3500
3000
2500
2000
1500
1000
500
0

1000 2000 3000 4000 5000

Spin Speed (rpm)

Process Conditions

Substrate: 4inch Si Wafer
Spin: 300rpmx3sec. → 1000~5000rpmx177sec.
Bake: 180°C, 180sec.(Hot plate)



3. Spin Curve (Effect of Dilution)

ZEP7000

Film Thickness (Å)

6000
5000
4000
3000
2000
1000
0

1 1.2 1.4 1.6 1.8

Dilution Rate [1)]

1) Dilution Rate
= {Original Resist(g) + Solvent(g)} / Original Resist(g)

Solvent: ZEP7000/Diethyleneglycol dimethyl ether

Process Conditions

Substrate: 4inch Si Wafer
Spin: ZEP7000 300rpmx3sec. → 490rpmx177sec.
Bake: 180ºC, 180sec. (Hot plate)

4. Sensitivity , Residual Thickness vs Pre Baking Temperature

Dose to Clear (uC/cm2)

10
9
8
7
6
5
4
3
2
1
0

100
98
96
94
92
90
88
86
84
82
80

Residual Thickness (%)

160
170
180
190
200

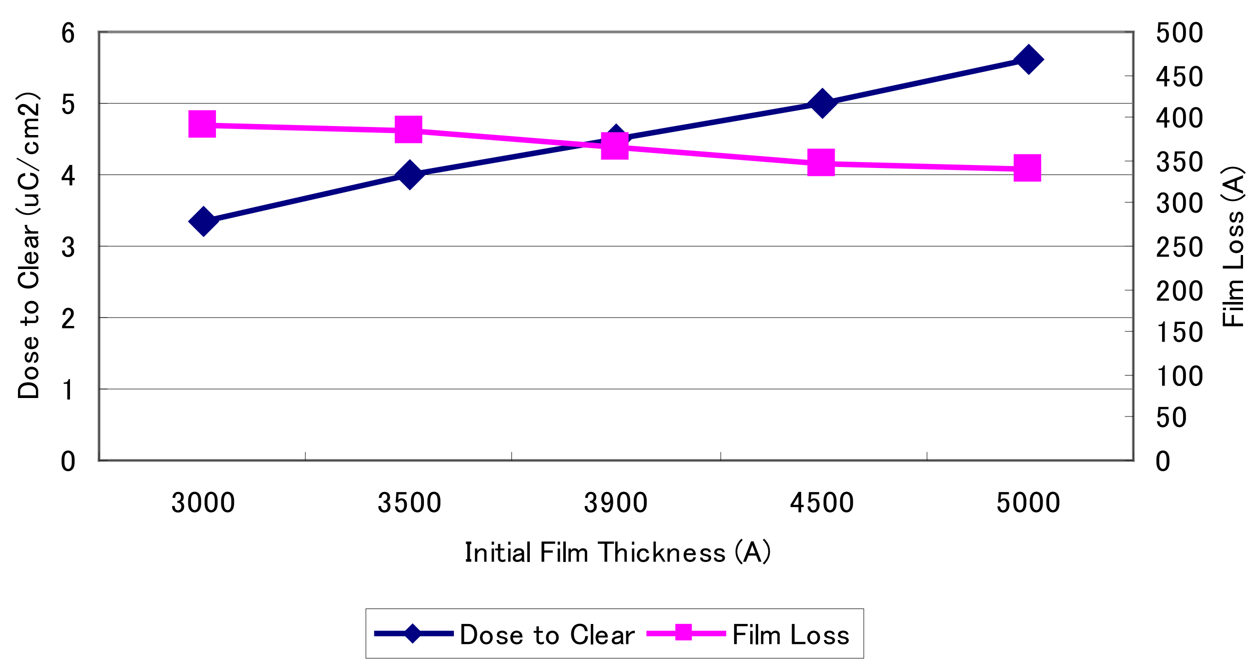
Prebake Temp. (℃)

Dose to Clear
Residual Thickness

Process Conditions

Substrate: 4inch Si Wafer
Bake: 180sec.(Hot plate)
Film thickness: 5000Å
DEV.: ZED500, 23ºC, 180sec.

5. Sensitivity , Residual Thickness vs Initial Film Thickness



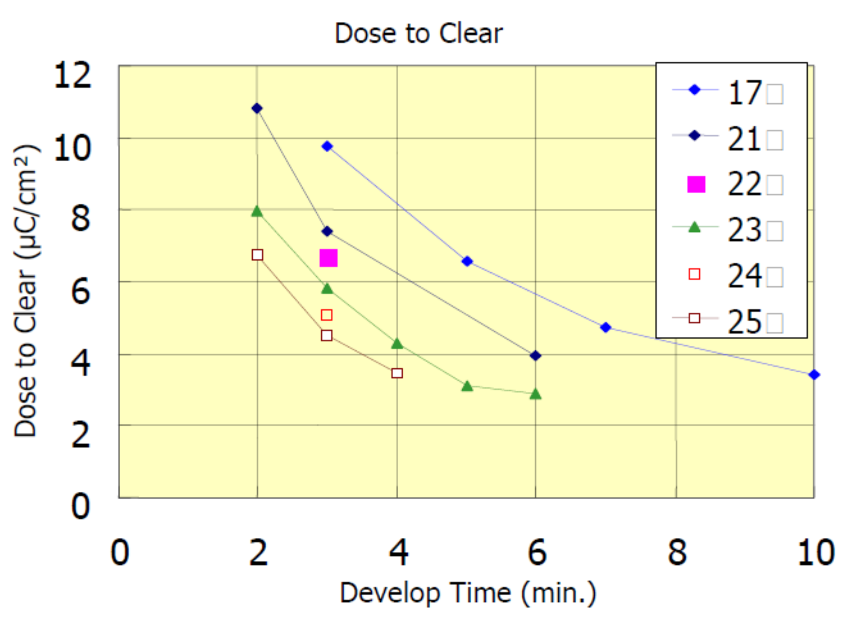
Process Conditions

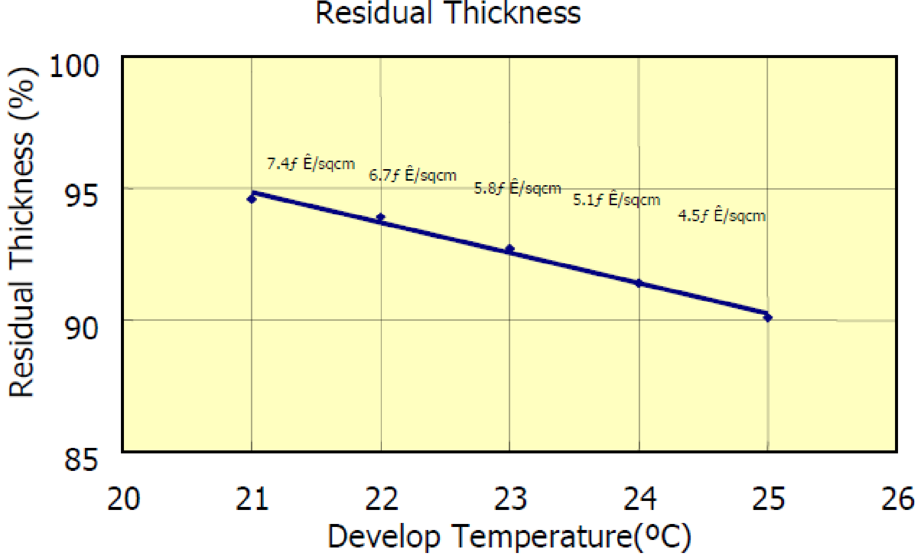
Substrate: 4inch Si Wafer

Bake: 180ºC, 180sec. (Hot plate)

DEV.: ZED500, 23ºC, 180sec.

6. Sensitivity , Residual Thickness vs Dev Temp. / Time





Process Conditions

Substrate: 4inch Si Wafer
Bake: 180ºC, 180sec. (Hot plate)
Film thickness: 5000Å
EXP.: ELS3300, 20kV
DEV.: ZED500, 180sec.

7. Dependence of developer

Residual Film Thickness (%)

100
80
60
40
20
0

0.1
1
10

Dose (uC/cm2)

◆ ZED500 ■ ZED750

Process Conditions

Substrate: 4inch Si Wafer
Film thickness: 5000Å
Bake: 180ºC,180sec. (Hot plate)
EXP.: ELS3300, 20kV

DEV.: ZED500, 23ºC, 180sec.
ZED750, 23ºC, 180sec.

8-1. Resolution (ZED-500)

	$10 \mu C/cm^2$	$11 \mu C/cm^2$	$12 \mu C/cm^2$
1.00μm L/S			
0.90μm L/S			
0.80μm L/S			
0.70μm L/S			
0.60μm L/S			
0.50μm L/S			
0.45μm L/S			
0.40μm L/S			
0.35μm L/S			
0.30μm L/S			
0.25μm L/S			
0.20μm L/S			

SUBSTRATE: 4 inch CrOx wafer
RESIST: ZEP7000
Prebake: 180°C, 180sec., Hot plate
F.T.: 5000Å
EXP.: ELS3300, 20keV
DEV.: ZED500, 23°C, 180sec., Dipping
RINSE: ZMD-D, 23°C, 10sec., Dipping

8-2. Resolution (ZED-750)

	$18\ \mu\ C/cm^2$	$19\ \mu\ C/cm^2$	$20\ \mu\ C/cm^2$
1.00 μ m L/S			
0.90 μ m L/S			
0.80 μ m L/S			
0.70 μ m L/S			
0.60 μ m L/S			
0.50 μ m L/S			
0.45 μ m L/S			
0.40 μ m L/S			
0.35 μ m L/S			
0.30 μ m L/S			
0.25 μ m L/S			
0.20 μ m L/S			

SUBSTRATE: 4 inch CrOx wafer
RESIST: ZEP7000
Prebake: 180°C, 180sec., Hot plate
F.T.: 5000Å
EXP.: ELS3300, 20keV
DEV.: ZED750, 23°C, 180sec., Dipping
RINSE: ZMD-D, 23°C, 10sec., Dipping

9 . Dryetching Resistance

CF_4 Dry Etching Rate

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

Etching Rate (A / sec.)

3000
2500
2000
1500
1000
500
0

ZEP Series
Competitor
Novolak Resist

9 . Dryetching Resistance

(2) Cl2 + O2 Dry Etching Rate

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

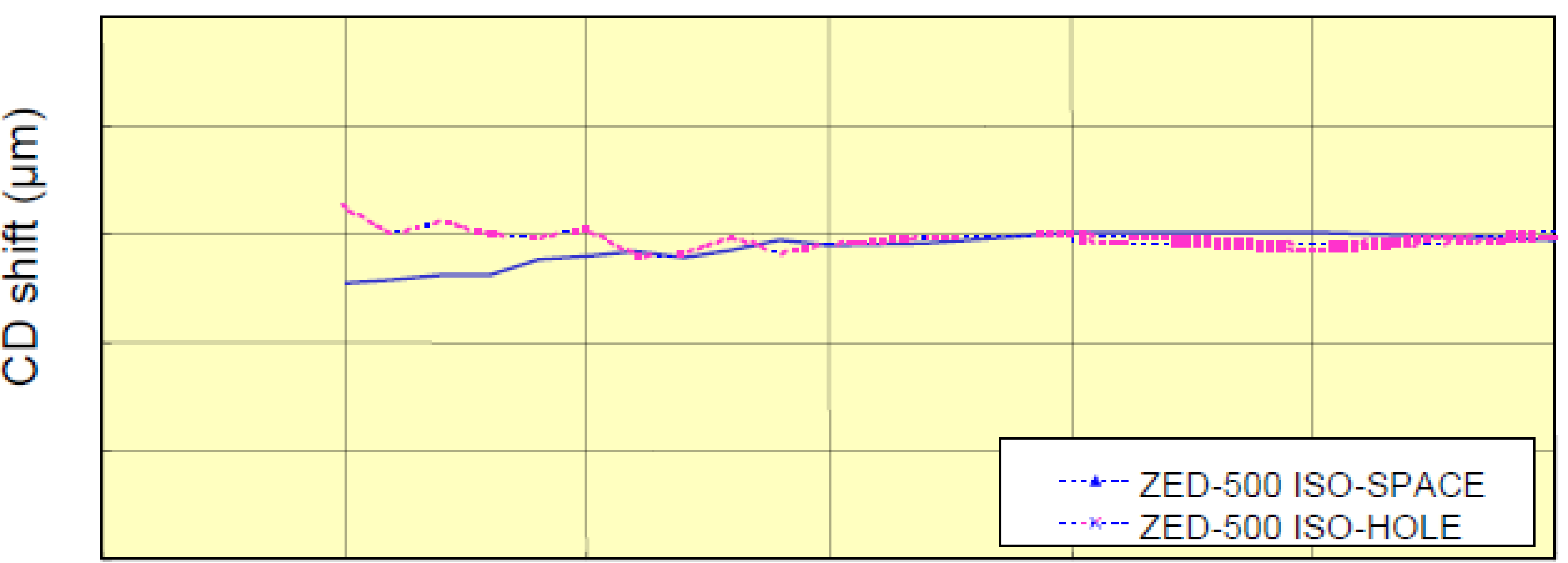
Etching Rate（A / min.）

	Etching Rate（A / min.）
ZEP7000	~320
Novolak Resist	~275

10-1 . CD Linearity (Isolated Hole)

CD linearity for isolated hole at
accelerating voltage of 20kV or 50kV (with PEC)
*PEC: Proximity effect correction

10-2 . CD Linearity (Isolated Spaces and Hole)



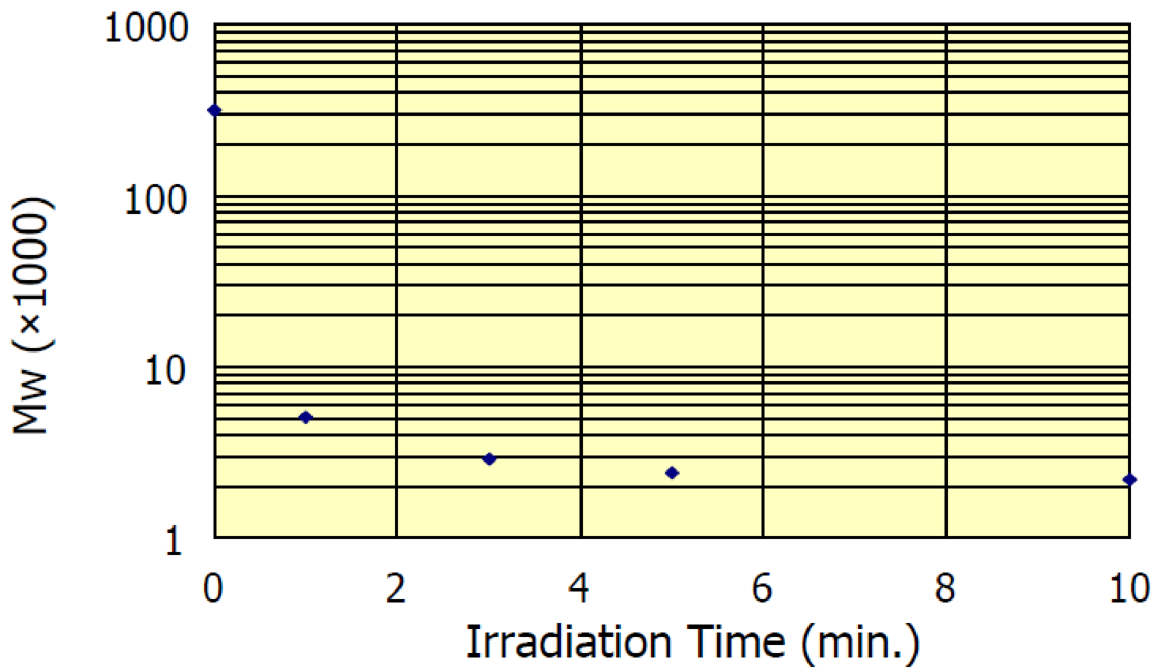
CD linearity for isolated spaces and holes at accelerating voltage of 50kV (with PEC)

11. Resist Removing

(1) Resist removing conditions

1) 1st step/ UV-O_3 → 2nd step/ organic solvent (ZDMAC)
2) 1st step/ UV-O_3 → 2nd step/ H_2SO_4-H_2O_2 (90~100°C)
3) H_2SO_4-H_2O_2 (90~100°C)

(2) Mw Change by Deep-UV Irradiation



Process conditions
Film Thickness: 5000Å
Bake: 180°C, 180sec.(Hot plate)
UV-O_3: HMW-457(ORC MANUFACTURING CO., LTD.)
Lamp: Low Pressure Mercury Vapor Lamp (185nm+254nm)
Illumination: 10mW/cm 2

12. Appendix

(1) Refractive index of ZEP7000 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 ZEP7000 polymer

Tg : 148°C measured by DSC

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.

Detail , please refer MSDS