Process guidelines for using E-beam resist ma-N 2403

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Photoresist – ma-N 2403

From Microresist technology

Negative Tone Photoresist suited for Electron Beam Lithography

Properties

- High wet and dry etch resistance
- Good thermal stability
- Excellent pattern resolution - down to 40 nm
- Aqueous alkaline development (TMAH)
- Easy to remove (soluble in Acetone)

Applications

- Mask for etching, e.g.Si, SiO_2, Si_3N_4 or metals
- Mask for ion implantation
- Stamp fabrication for NIL

http://www.microchem.com/PDFs_MRT/ma-N%202400%20overview.pdf

Processing

Sample preparation:

- Si Substrate is cleaned in Piranha solution
- Cleaned Si is dipped in dil. HF
- Dehydration bake done at 250°C for about 3 minutes

Spin speed and thickness

Spin Speed (rpm)	Time(Sec)	Measured thickness (nm)
2000	30	550
3000	30	295
4000	30	285
6000	30	200

Pre Bake : On a contact hot-plate at 110 °C for 120 sec.

Development: 35sec in AZ726MIF/ 90sec in ma-D525

Optimized Doses and patterning parameters of Area lines with different CD and resolutions are are given below

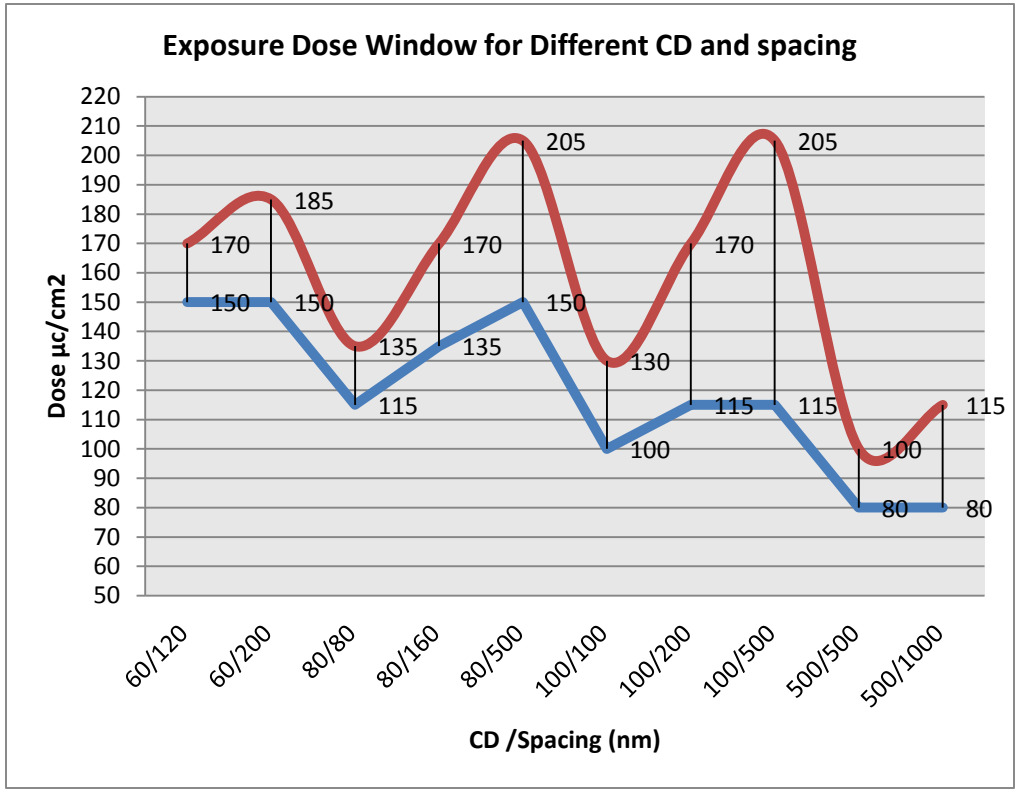
Patterning parameters

EHT	20k V
Aperture	20 µm
Working distance	9.5 mm
Write field	100 µm

Optimized Exposure dose windows for different Critical Dimensions

Spin coating: 3000rpm for 30sec and prebake: 120sec at at 110 °C on Hotplate

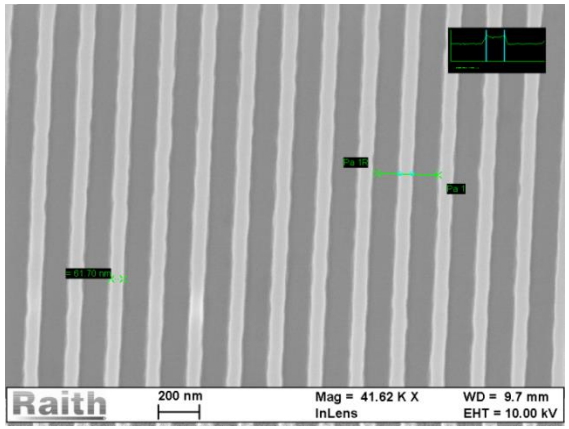
Features L/S (nm)	Exposure dose window ($\mu C/cm^2$)
60/120	150-170
60/200	150-185
80/80	115-135
80/160	135-170
80/500	150-205
100/100	100-130
100/200	115-170
100/500	115-205
500/500	80-100
500/1000	80-115



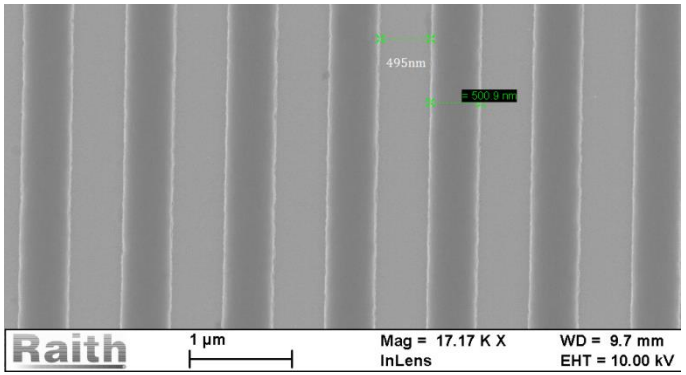
Observations:

- High resolution lines has less exposure dose window
- Low resolution lines has high exposure dose window

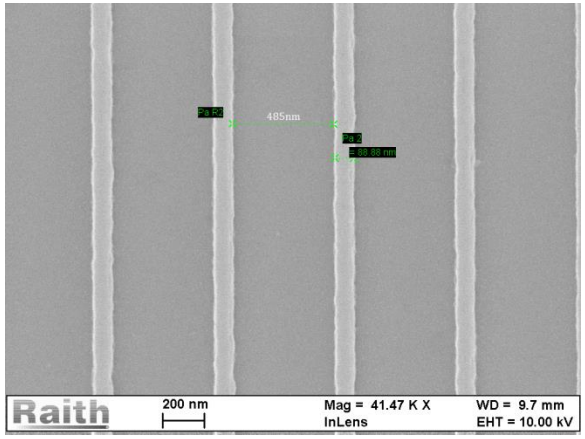
SEM Images of typical high resolution structures with maN-2403



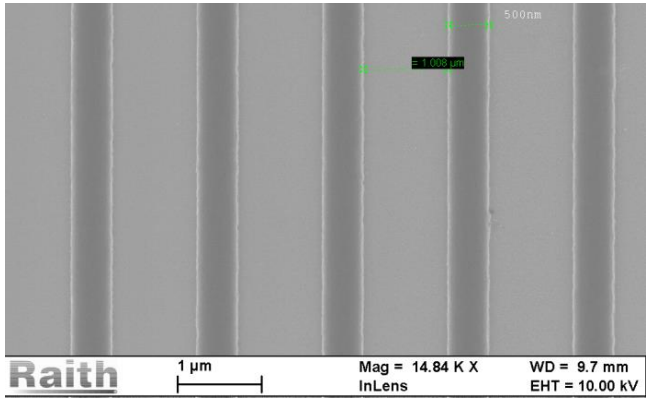
L/S: 60/120 nm



L/S: 500/500 nm



L/S: 80/500 nm



L/S: 500/1000 nm