

E-beam Process for ZEP– 520A to be used for Metal Liftoff and RIE.

Revision 2.4, September 28, 2005

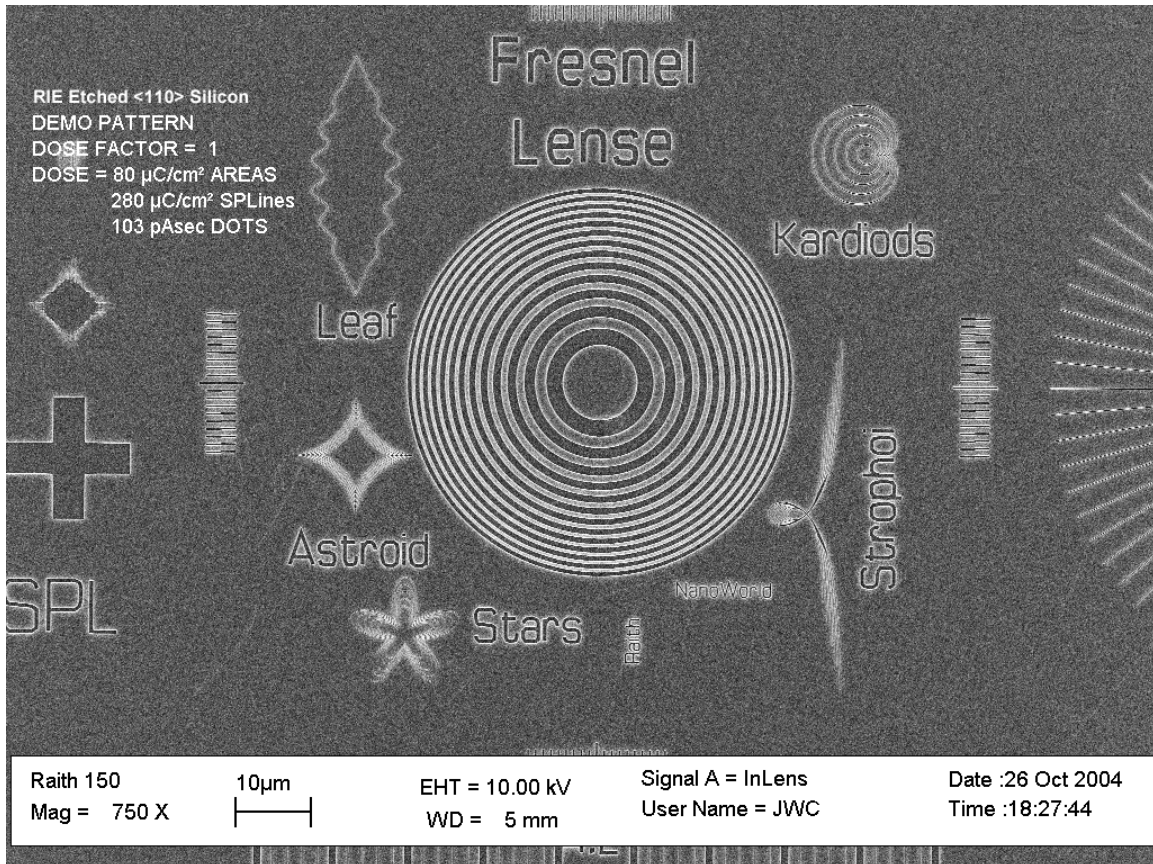
James W. Conway - Stanford Nanofabrication Facility - Stanford University

ZEP-520A is very high resolution positive tone resist, that like PMMA is simple to use and gives reproducible results. Compared to PMMA, it has an advantage of being 3 times faster and has good dry etch resistance. It has the disadvantages of poor adhesion (requires HMDS prime layer) and normal exposure doses at low acceleration voltages result in re-entrant pattern profiles. This inherent undercut is useful for metal liftoff deposition.

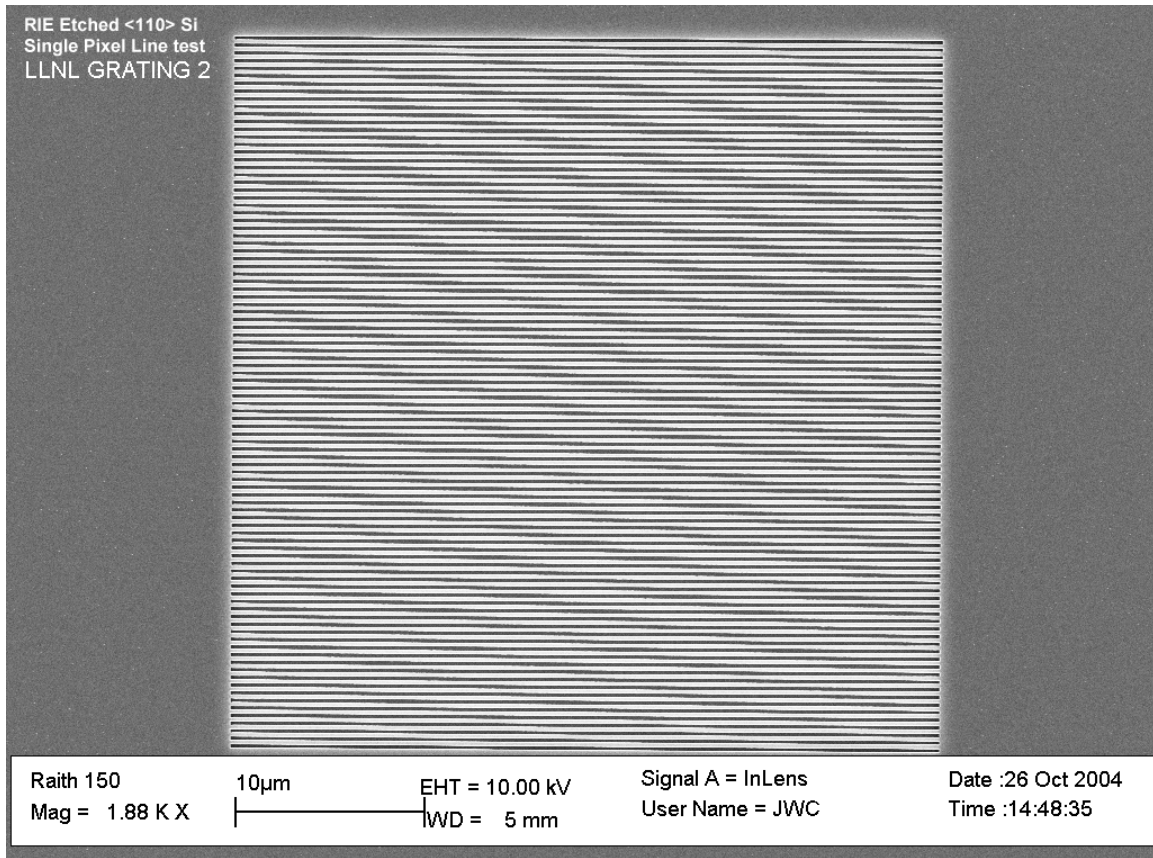
ZEP- 520A E-beam Resist Process:

1. **HMDS prime**
2. **Spin** 8000 rpm for 40 seconds Thickness = ~0.25 μm
3. **Post Application Bake:** 2 minutes at 200°C
4. **Exposure:**
Hitachi H-700 Dose: 70 - 200 μC at 30 KV 170 $\mu\text{C}/\text{cm}^2$ optimized Lines.
Raith Dose: 40 $\mu\text{C}/\text{cm}^2$ @ 10 kV for Areas, 80 – 120 for Single Pixel Lines.
65 - 70 $\mu\text{C}/\text{cm}^2$ @ 20 kV for Areas, 200 –230 for Single Pixel Lines.
5. **Develop** in Xylenes 40 second with very gentle agitation
6. **STOP1:** Rinse in 1:3 MIBK:IPA mixture for 30 seconds (optional)
7. **STOP2:** Rinse in IPA for 30 seconds
8. **Dry:** N2 Blow dry.
9. **Post Process:** Deposit Metal or RIE etching suitable to process result desired.
10. **Metal Liftoff:**
 1. 5-20 min ACETONE SOAK
 2. 3 - 5 MIN. ACETONE FLUSH WITH SQUEEZE BOTTLE.
 3. 3 MIN ACETONE SOAK W/ ULTRASONIC.
 4. 3 MIN. IPA W/ ULTRASONIC.
 5. Final Strip: NMP or PRS-1000, at 80 degrees C. or O2 ash.
11. **Optical Microscope Inspection:** 50 and 500 or 1000 X Magnification.
SEM Inspection: CD Measurements and dose determination.

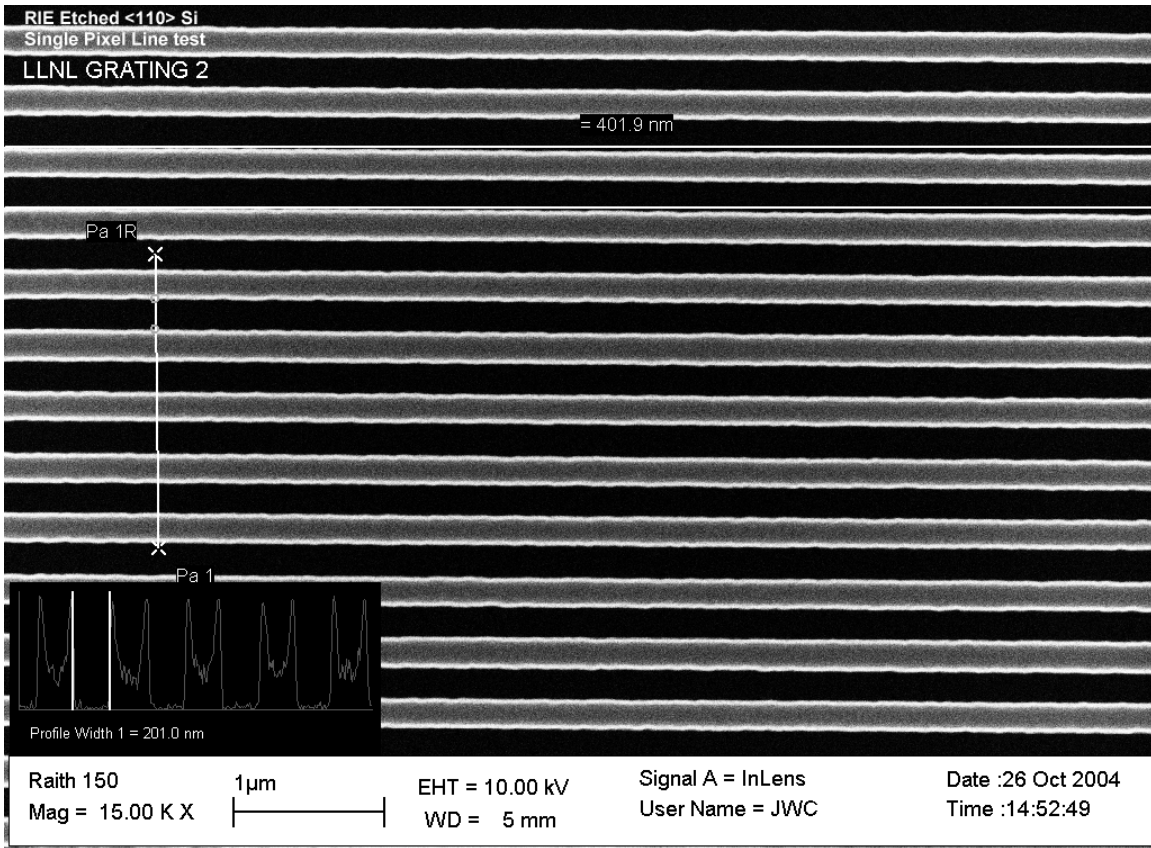
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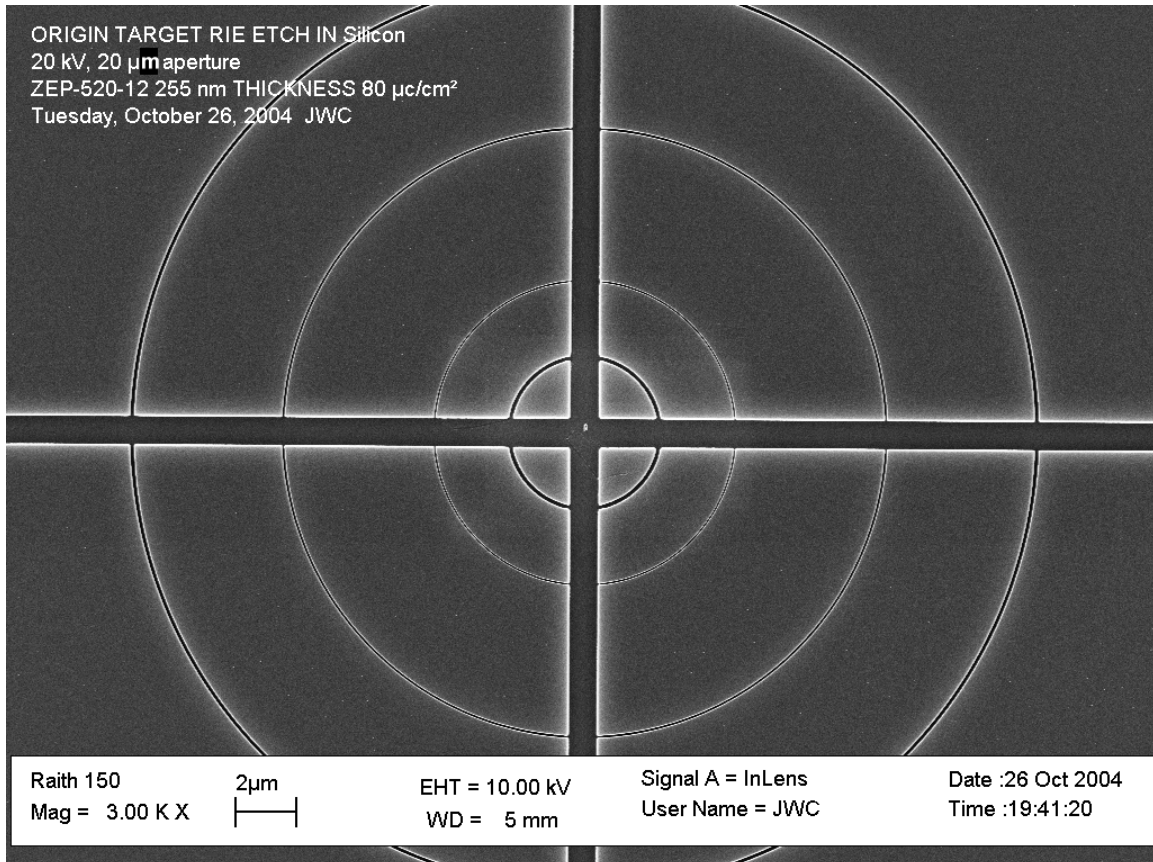
Typical etch result after RIE in P-5000: 1 minute etch time: 290 nm.
 This 'demo' pattern is employed to monitor performance of the Raith 150 system.
 Problems in the magnetic deflection section of the system will be readily observed in the exposure result using these Geometric Structures in this pattern block.



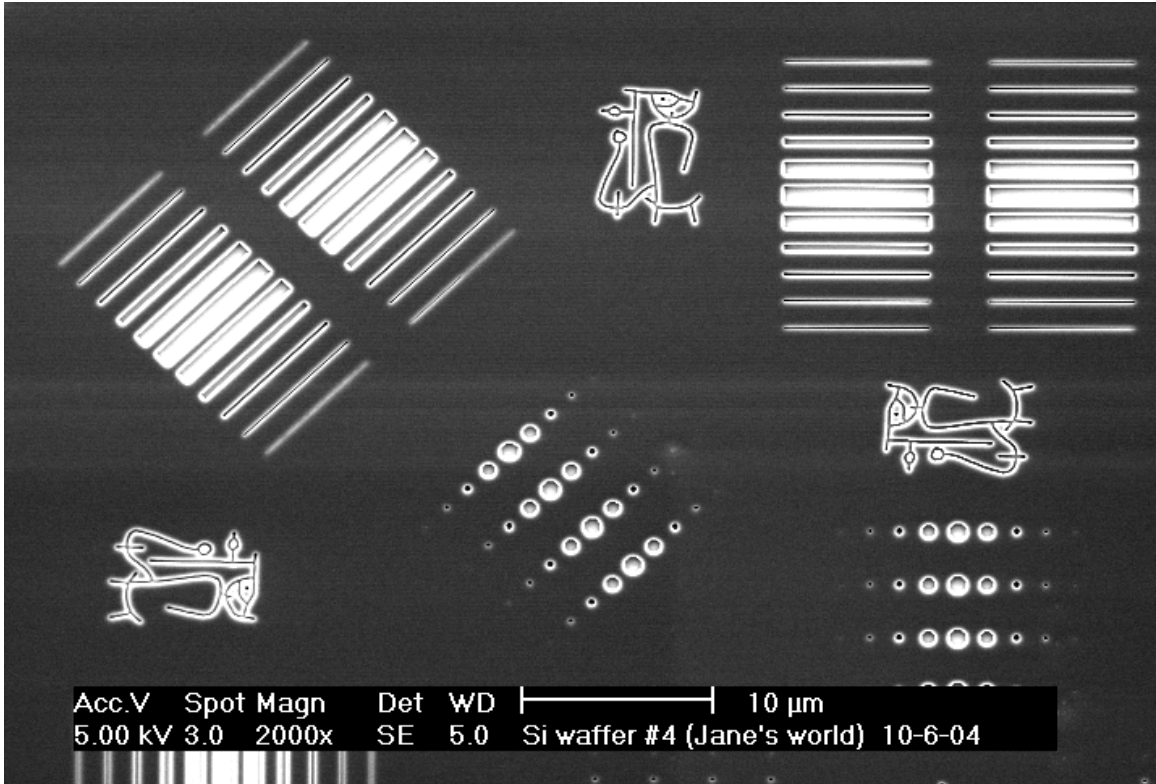
Typical etch result after RIE in P-5000: 1 minute etch time: 290 nm.
Optical Grating of 400 nm pitch with 200 nm lines used as an aid to locating nano-scale features in the final post-process Optical Microscope and SEM inspections.



Typical etch result after RIE in P-5000: 1 minute etch time: 290 nm.
Optical Grating of 400 nm pitch with 200 nm lines.



Typical etch result after RIE in P-5000: 1 minute etch time: 290 nm.
Inner and Outer Rings are 100 nm at Dose Factor 1
Second outer ring is 50 nm at Dose Factor 2
Next inner Ring is a Single Pixel Line at Dose Factor 4
Note that this sample was exposed at slightly higher than optimal exposure dose!



Typical etch result after RIE in P-5000: 1 minute etch time: 290 nm.
 Resist has been removed by stripping displaying only Silicon etch result.

