Photolithography

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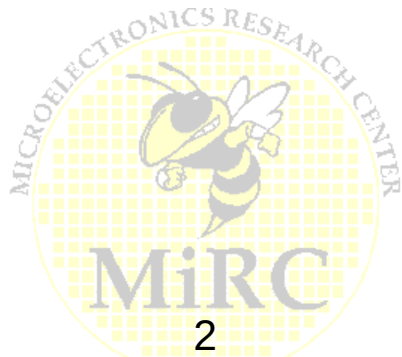
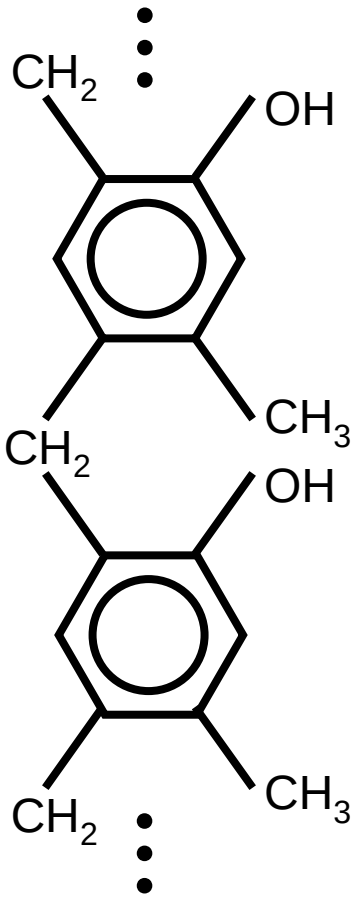
Outline

- Chemistry
- Mechanics
- Procedure
- Spinning
- Exposing
- Comments

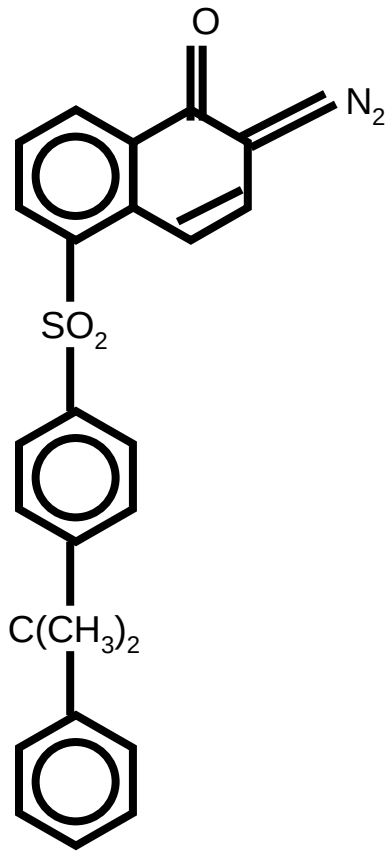


Chemistry

diazoquinone–novolac (DQN) positive photoresist

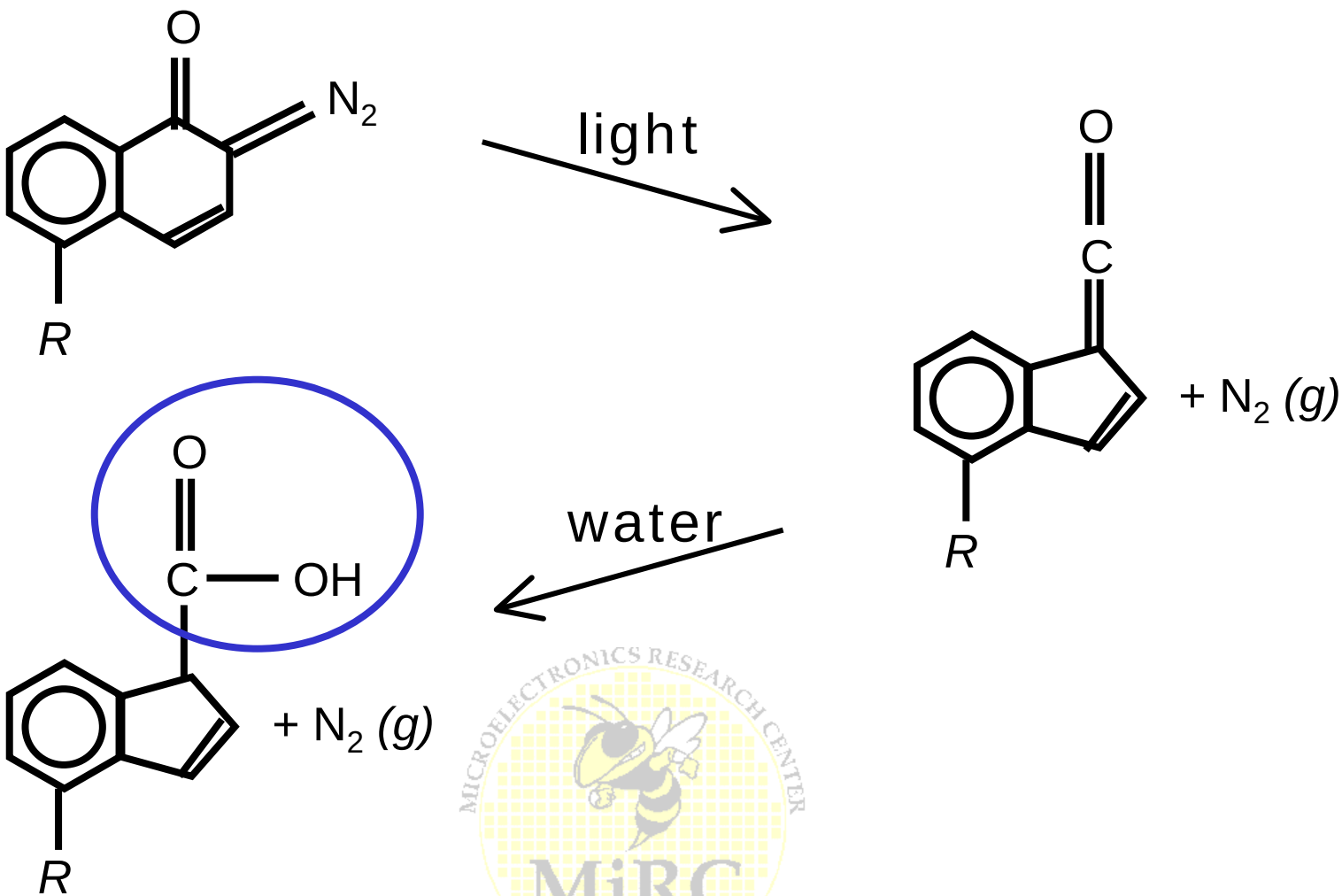


novolac (solvent)

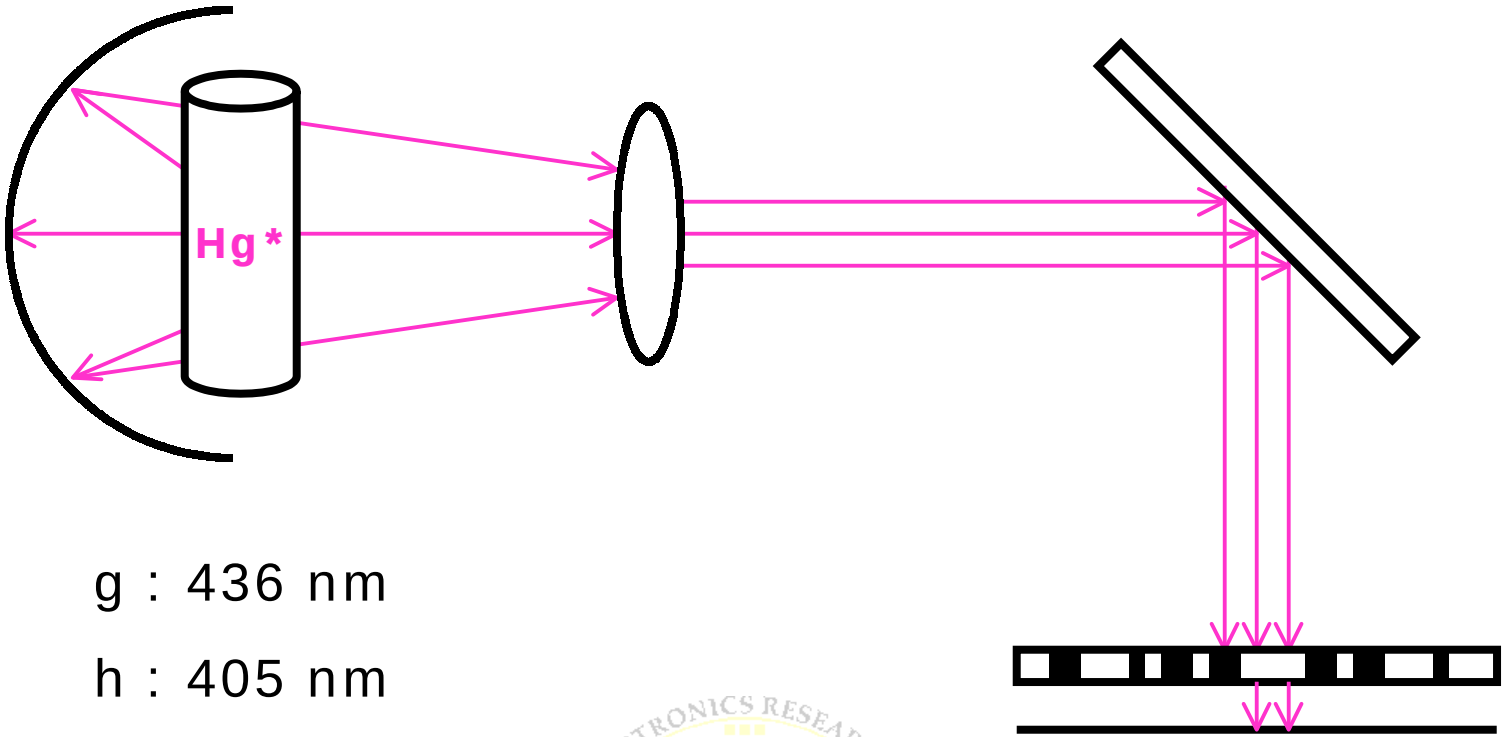


diazoquinone

Chemistry



Mechanics



g : 436 nm

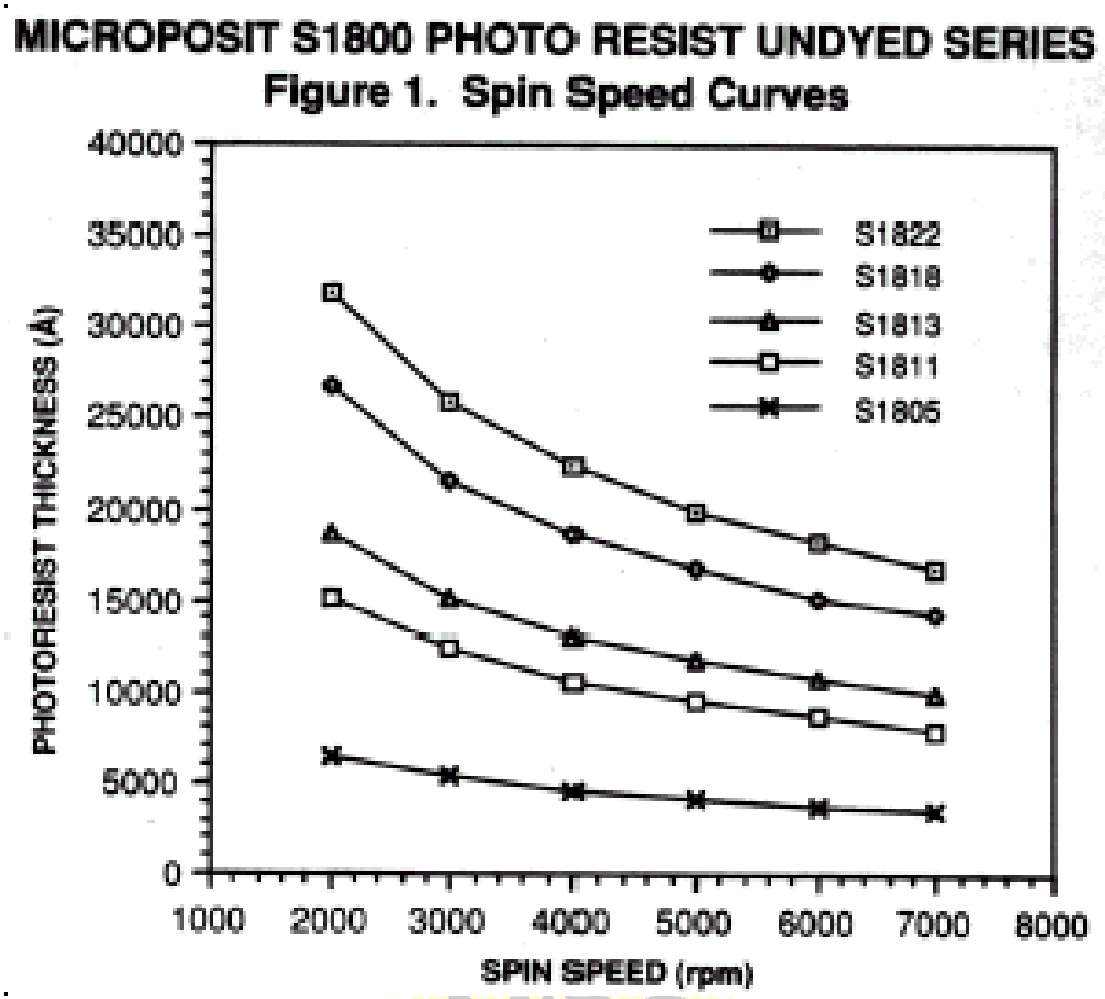
h : 405 nm

i : 365 nm

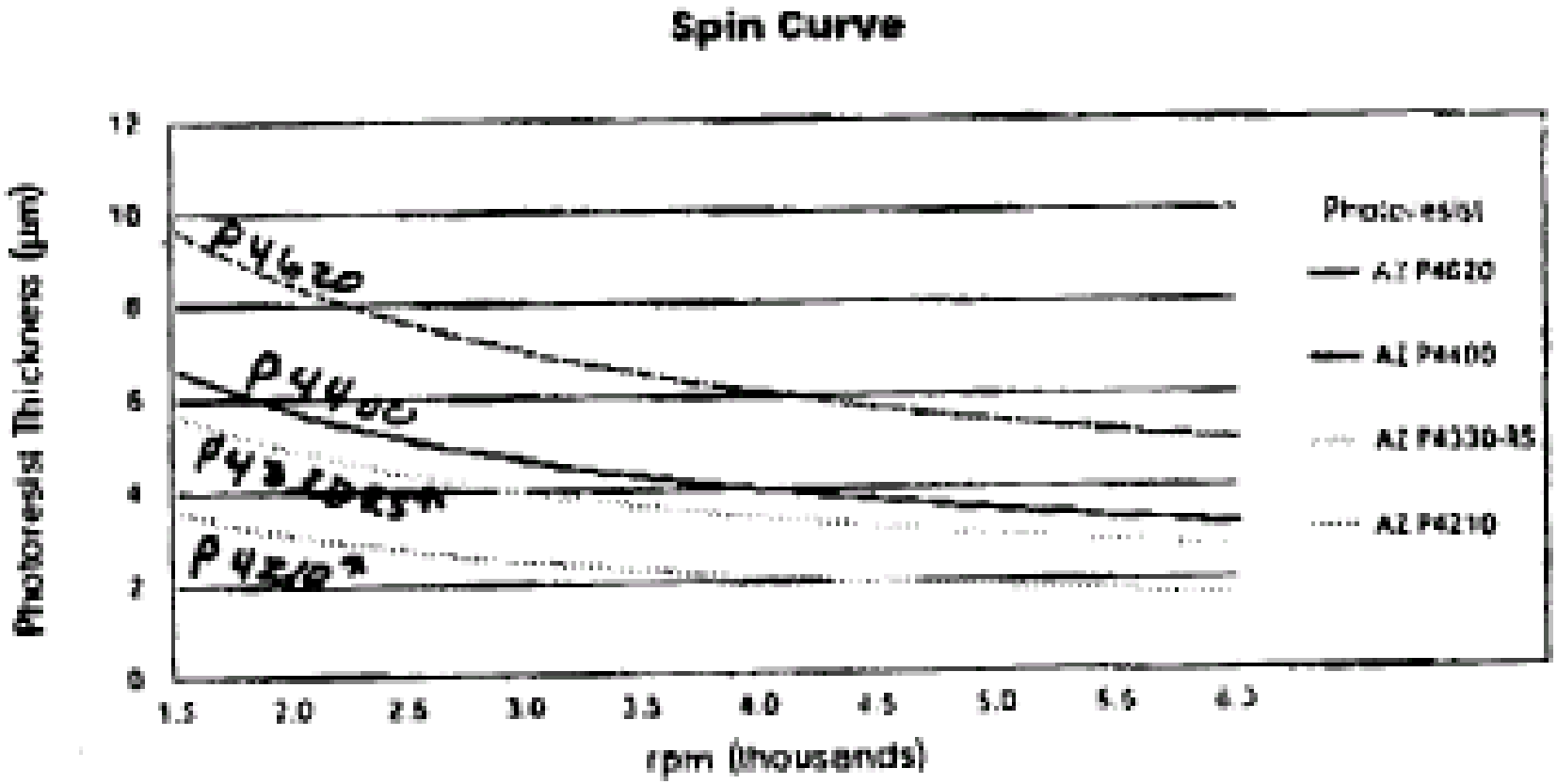
Procedure

- Clean substrate
- Primer (HMDS)
  - Spin
  - Evaporate
- Photoresist
  - Spin
  - Softbake (90 – 115 ºC, 1 – 2 min.)
  - Prebake (90 – 110 ºC, 0 – 10 min.)
- Exposure
  - Postbake (90 – 115 ºC, 0 – 2 min.)
- Develop
  - Rinse
- Hardbake (100 – 120 ºC, 10 – 60 min.)

Spinning

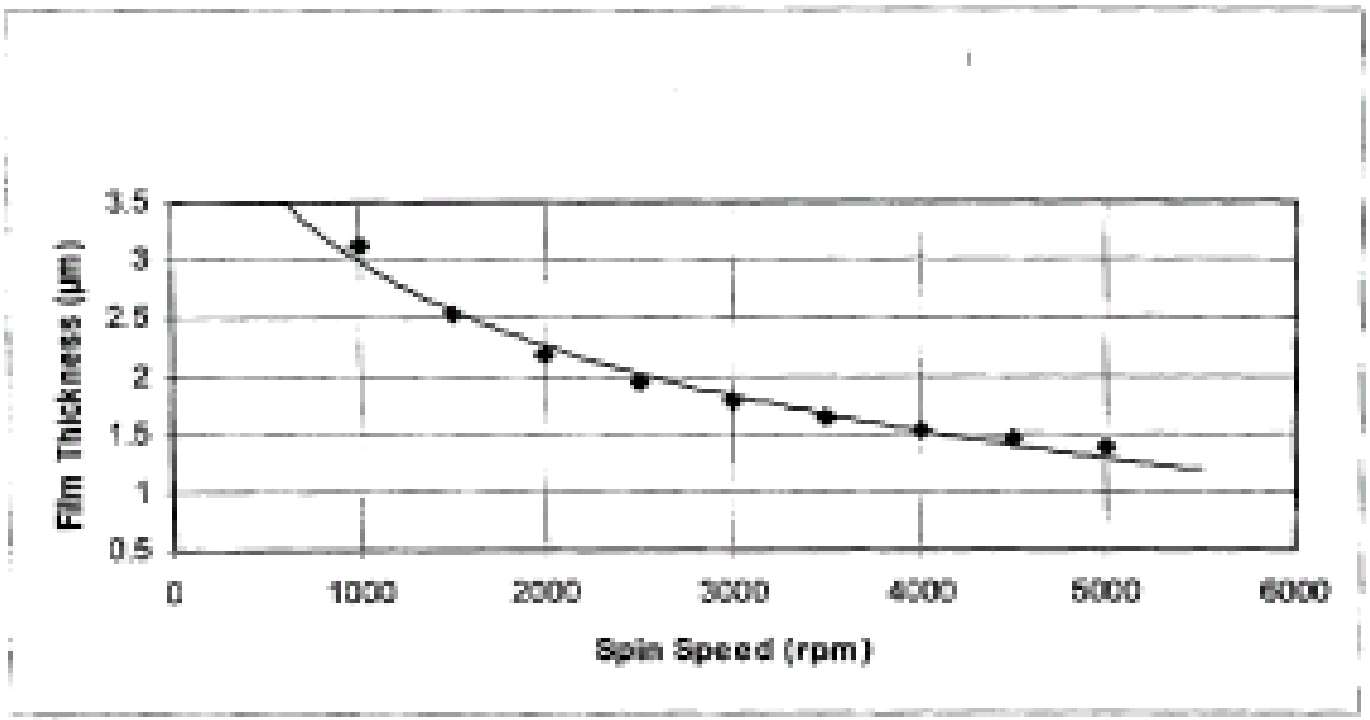


Spinning


Spin Curve
Photoresist Thickness (µm)
12
10
8
6
4
2
0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
rpm (thousands)
AZ P4620
AZ P4400
AZ P4330-RS
AZ P4210

Spinning

AZ® 5214E - Lot #D99X1
Spin Speed Curve



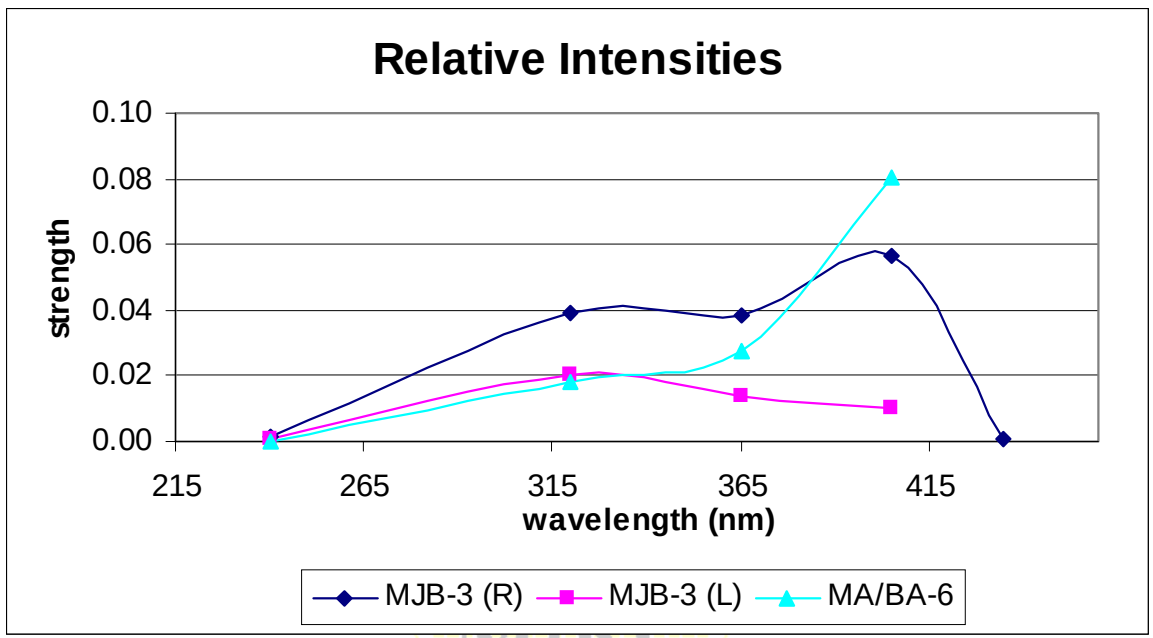
Exposing

MJB-3 (right): 155 W (“CP”); 195 W (“CI”)

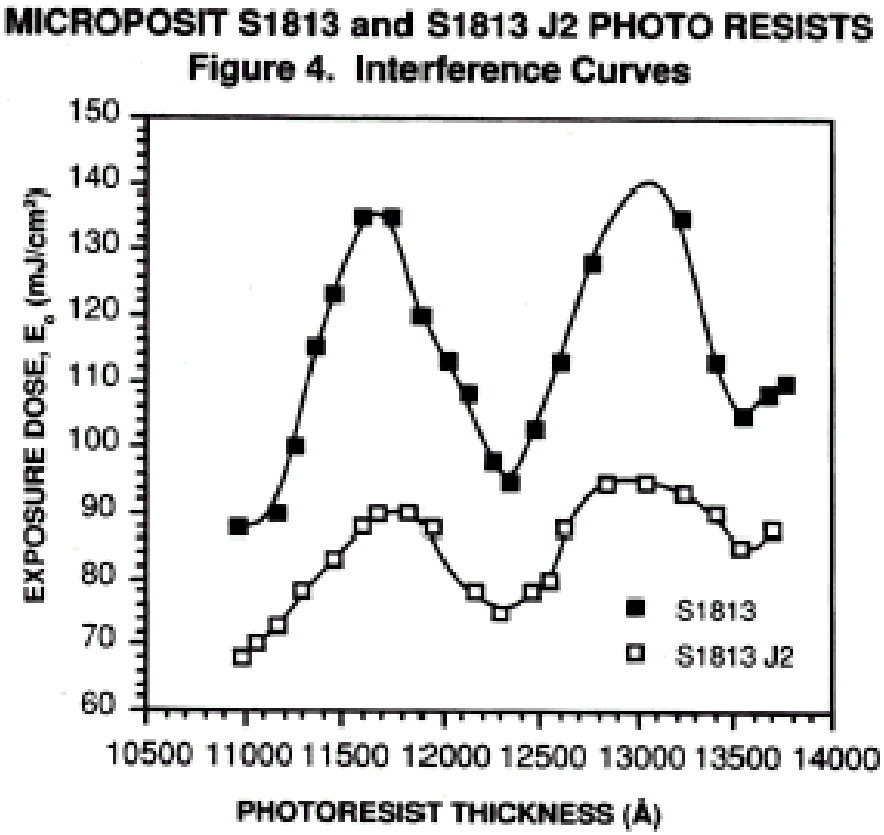
MJB-3 (left): 455 W (“CP”); 475 W (“CI”)

MA/BA-6: 275 W

OAI: 7.45 mW/cm^2 @ 365 nm (5 mW/cm^2)



Exposing

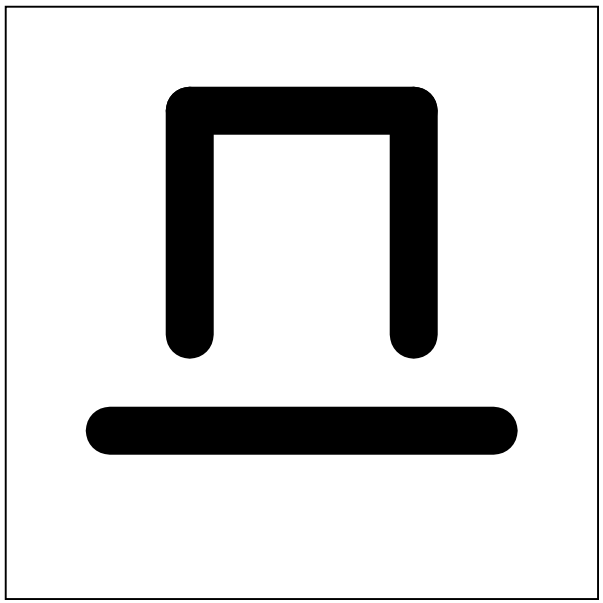


(@ 436 nm)

AZ Resists:

~120 mJ/cm² @ 365 nm

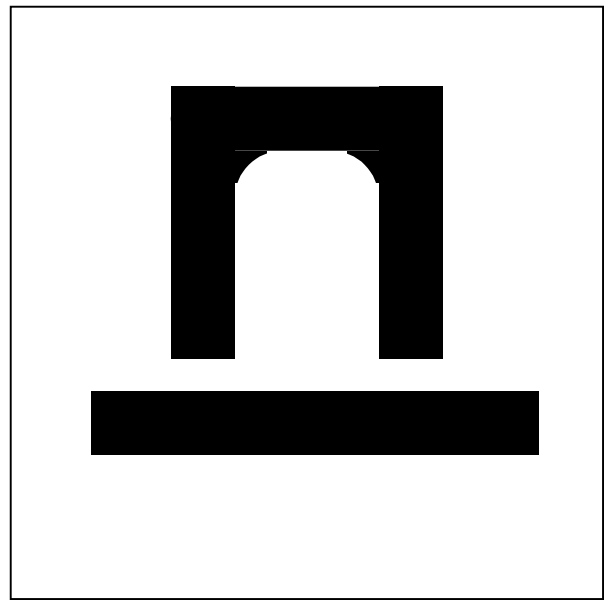
Exposing



over-exposed,

over-developed

rounded corners, thin lines



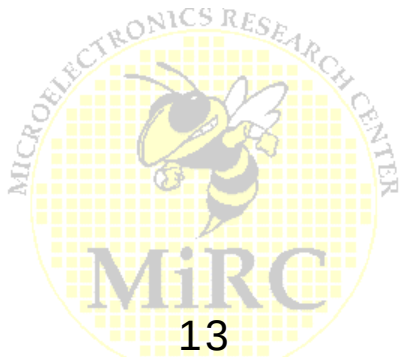
under-exposed,

under-developed

wide corners, thin spaces

Warnings

- Photoresists are suspected carcinogens and are toxic in large doses
- Prolonged exposure to UV light can cause retinal damage
- Negative developers are also carcinogenic and highly toxic
- Hotplates and ovens are hot



Recommendations

- Photoresist thickness should be less than the critical dimension
- Only spin resists on clean, planar surfaces
- Check lamp intensity often
- Examine features after developing
- Avoid dark-field masks
- Use good alignment marks

Bibliography

Campbell, Stephen A. *The Science and Engineering of Microelectronic Fabrication.* 1996.

Dr. B. Frazier (ECE 6450)

Shipley, Inc.

Clariant Corporation (AZ Electronic Materials)