

Quattrone Nanofabrication Facility

Meredith Metzler, Manager Thin Films



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Key QNF Personnel



Noah Clay

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Manager Lithography



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Singh Center for Nanotechnology



Electron Microscopy



Scanning Probe Microscopy



Micro/Nano Devices



Supporting Research





Supporting the Mid-Atlantic





NSF Grant - NNCI





Kicked-off in 2015



Floor Plan





Inside the Lab





Oxford 80 Plus RIE



- CF4, CHF3, SF6, O2, Ar
- Graphite Platen Cover

Sample Oxide Etch CHF3/O2 : 100/4 sccm 50 mT 150 W Selectivity to SPR220 = ~2:1



Oxford 80 Plus RIE



CF4 based silicon etch for SCIL Master fabrication

CF₄ 20 sccm 65 mTorr 150 W

Si etch rate: 38 nm/min Sel. To Zep 520A: ~0.65 : 1



SPTS Rapier DRIE



100 mm wafer Electrostatic chuck

Si Etch Rate ~ 6 micron/minute Selectivity to SPR220 = ~ 60:1 Selectivity to SiO2 = ~ 120:1

Optical cross section of 5 micron diameter blind hole 20:1 in Aspect Ratio with PR Mask



Trion Phantom



Sputter deposited ITO, patterned with NIL, dry etched with BCl_3/Ar

- Cl₂, BCl₃, CF₄, SF₆, Ar, O₂
- Materials: ITO, Al, Al2O3, Kapton, Polyimide, Silicon,
- Diamond, III-V's, AlN, Silicon Dioxide, Silicon Nitride, ...



Barrel and Plasma Etch

- Technics Plasma Etch
 - 02, SF6
 - Rough pump only
 - Flow rates set with needle valves
 - 1000 W power supply
- 2 Anatech Barrel Ashers
 - O2, N2, CF4
 - O2 in Soft lithography for surface activation



Laser Micromachining

- 2 systems from IPG: green laser (355 nm) and excimer (193 nm)
- Green laser: 3-5 micron spot, raster scan, opaque materials
- Excimer: high and low fluence, projected through aperture or up to 90 micron spot raster scan, both transparent and opaque materials





Etch Summary

- Oxford 80 Plus: CF₄, CHF₃, SF₆, O₂, Ar
 - Graphite platen 225 mm diameter
 - Allowed materials: silicon, silicon dioxide, silicon nitride, fused silica, quartz, standard resists, titanium, molybdenum, tantalum, tungsten, aluminum, chrome
- SPTS Rapier DRIE with 100 mm wafer ESC (electrostatic chuck)
 - Allowed mask materials: standard resists, silicon dioxide, aluminum oxide
 - Etch silicon and germanium
 - No metals exposed
- Trion: CF₄, Cl₂, BCl₃, SF₆, O₂, Ar
 - No material restrictions
- Anatech Barrel Asher 1: CF₄, O₂, Ar, N₂
 - Resist ashing and surface activation
 - Up to 25 150 mm wafers
 - No material restrictions



Etch Summary Continued

- Anatech Barrel Asher 2 (soft lithography): O₂
 - Resist ashing and surface activation
 - Up to (25) 150 mm wafers
 - No material restrictions
- Technics Plasma Etcher: SF₆, O₂
 - No material restrictions
 - Up to 200 mm substrate
- Xactix XeF₂
 - No material restrictions
 - Table top model, source not heated
 - Up to 150 mm substrate