ASU NanoFab

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ASU NanoFab Etch Tools

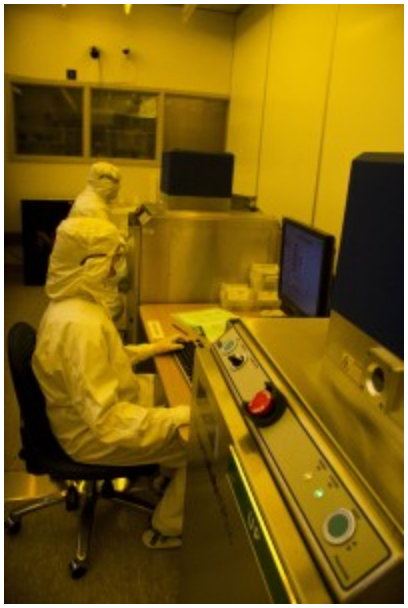
- PlasmaLab 80+ RIE (C) - Chlorine Based Etch
- PlasmaLab 80+ RIE (F) – Fluorine Based Etch
- PlasmaLab RIE#2 – General Purpose Fluorine Based Etch
- STS ICP Advanced Silicon Etch – Deep Silicon Etching
- STS ICP All General Etch – Compound Semiconductors
- Tegal Asher #1 – Plasma Cleaning
- Tegal Asher #2 – Plasma Cleaning
- Tegal Asher #3 – Plasma Activation (Bonding Process)
- Xactix e-1 XeF2 Etcher – Fast Isotropic Etching of Silicon

PlasmaLab 80+(F) – Fluorine Based Etch

Installed Oct 2004
up to 200mm substrates
Flexible Processes for dielectric materials
Gases: CHF3/CF4/SF6/Ar/O2
SiO2 Etch rate – 35nm/min (CHF3 & Ar)
Si3N4 Etch Rate – 60nm/min (CHF3 & O2)
Si Etch Rate – 1um/min (SF6 & O2)
Additional etches Fused Silica/Quartz non-documented
Quartz & Graphite base plates available
* Of note Si3N4 to PR selectivity (3:1) improved when using Graphite plate.
Base Line updated 2/12
Restrictions: Silicon etching only; No Metal, III-V or Parylene coated material

PlasmaLab 80+ (C) - Chlorine Based Etch

Installed Nov 2004
up to 200mm substrates
Flexible Processes including III-V, & metals
Gases: BCL3/CL2/Ar/O2/N2
Aluminum Etch rate – 120nm/min (BCL3 & Cl2)
Additional recipes for GaN, InP, GaAs & GeSn non-documented
Quartz base plate
Base Line updated 4/13
Restrictions: No Parylene



PlasmaLab uP (RIE#2) – General Purpose Fluorine Based Etcher

Computer/PLC Upgraded Apr 2009
up to 200mm substrates
Flexible Processes including III-V, metals & dielectric materials
Gases: CHF3/CF4/SF6/Ar/O2
SiO2 Etch rate – 30nm/min (CHF3 & Ar)
Si3N4 Etch Rate – 55nm/min (CHF3 & O2)
Si Etch Rate – 500nm/min (SF6 & O2)
Base Line updated 2/12
Aluminum base plate w/600watt ENI RF Power Supply
Additional recipes available
Restrictions: None

STS ICP Advanced Silicon Etch – DRIE

Installed 2002

Standard 100mm Si & SOI Processes

Gases: SF6/C4F8/Ar/O2

Si Etch Rate – 1-4um/min (SF6, C4F8 & O2)

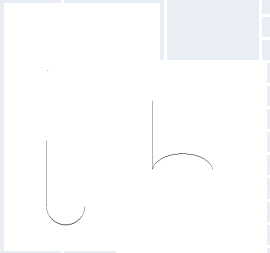
Mechanical Clamping

Baselined - 4 main recipes 8/12

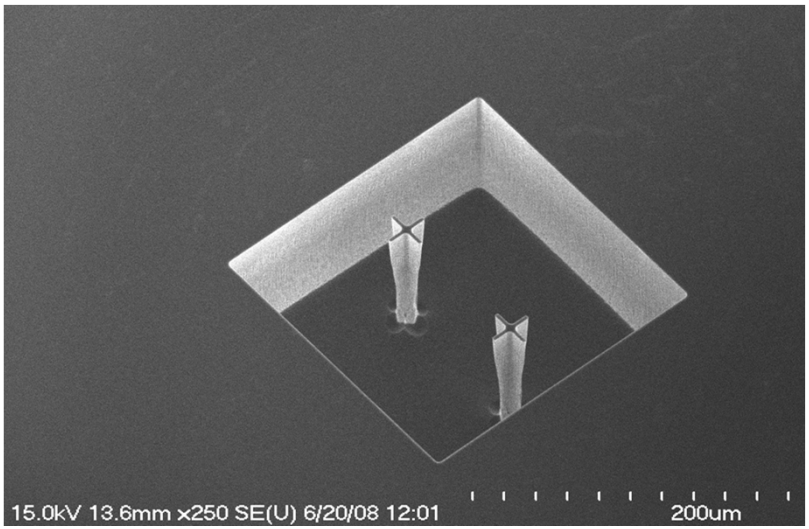
Restrictions: No Metal allowed unless coated w/PR

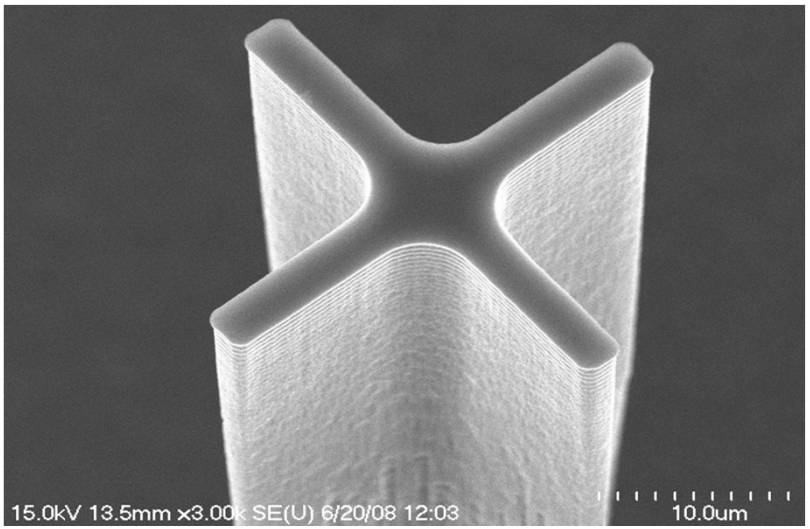
Basic Deep silicon recipes

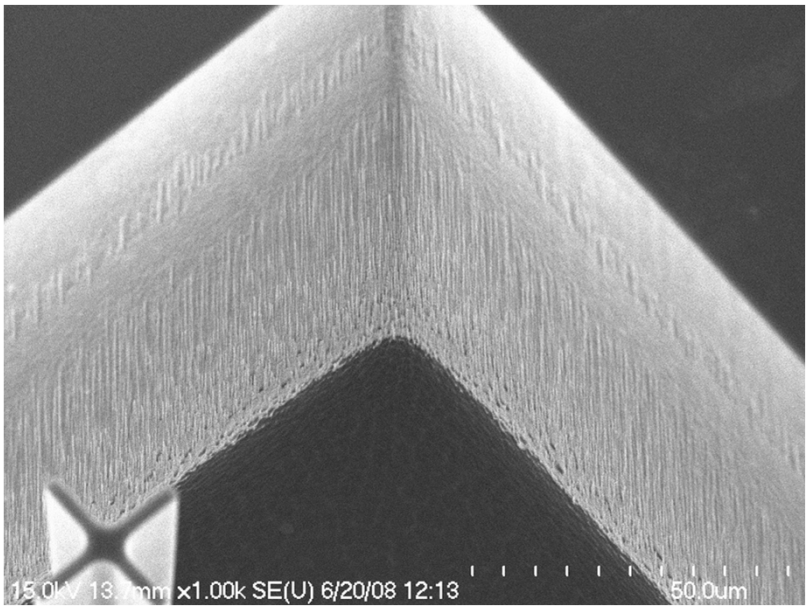
Recipes	NP	Deep	MITFast	Deepfast
Parameters	3/26/2008		6/15/2010	
Cycles/Time	62/13:26min	57/17:06min.	10/3:30min.	
Parameter Ramp	Ramp	No Ramp	No Ramp	No Ramp
Etch (sec)	8	12	14.8 +0.7ovr	13.5 +0.5ovr
Passivate(sec)	5	6	7	7.5
Pressure/Valve Position	10mtorr	82.60%	78.00%	80%
Gases Etch				
C4F8 (sccm)	35	0	0	0
SF6 (sccm)	65	130	136	130
O2 (sccm)	0	13	0	10
Gases Pass				
C4F8 (sccm)	70	85	90	85
RF Coil				
Etch (watts)	600	600	600	600
Passivate (watts)	600	600	600	600
RF Platen				
Etch (watts)	10@0.5w/min	12	12	12
Passivate (watts)	0	0	2	0
Etch rates (PR)				

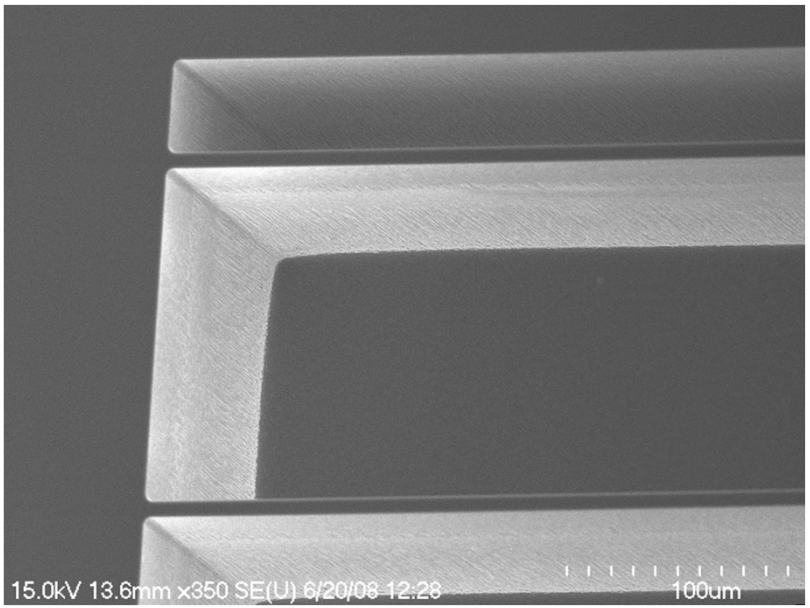


DeepFast Recipe etch test



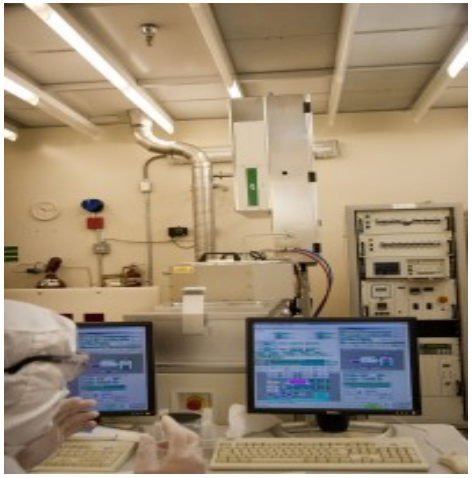






STS ICP All General Etch – III-V and Silicon

Installed 2002
Standard 100mm III-V, Si & SOI Processes
Gases: BCL3/CL2/H2/CH4/Ar/O2
GaAs Etch (BCL3 & CL2)
InP Etch (H2 & CH4)
GaN (CL2 & Ar)
Mechanical Clamping
Restrictions: No Metal allowed unless coated w/PR



Tegal Asher 1,2 & 3 – Plasma Cleaning, Surface Activation

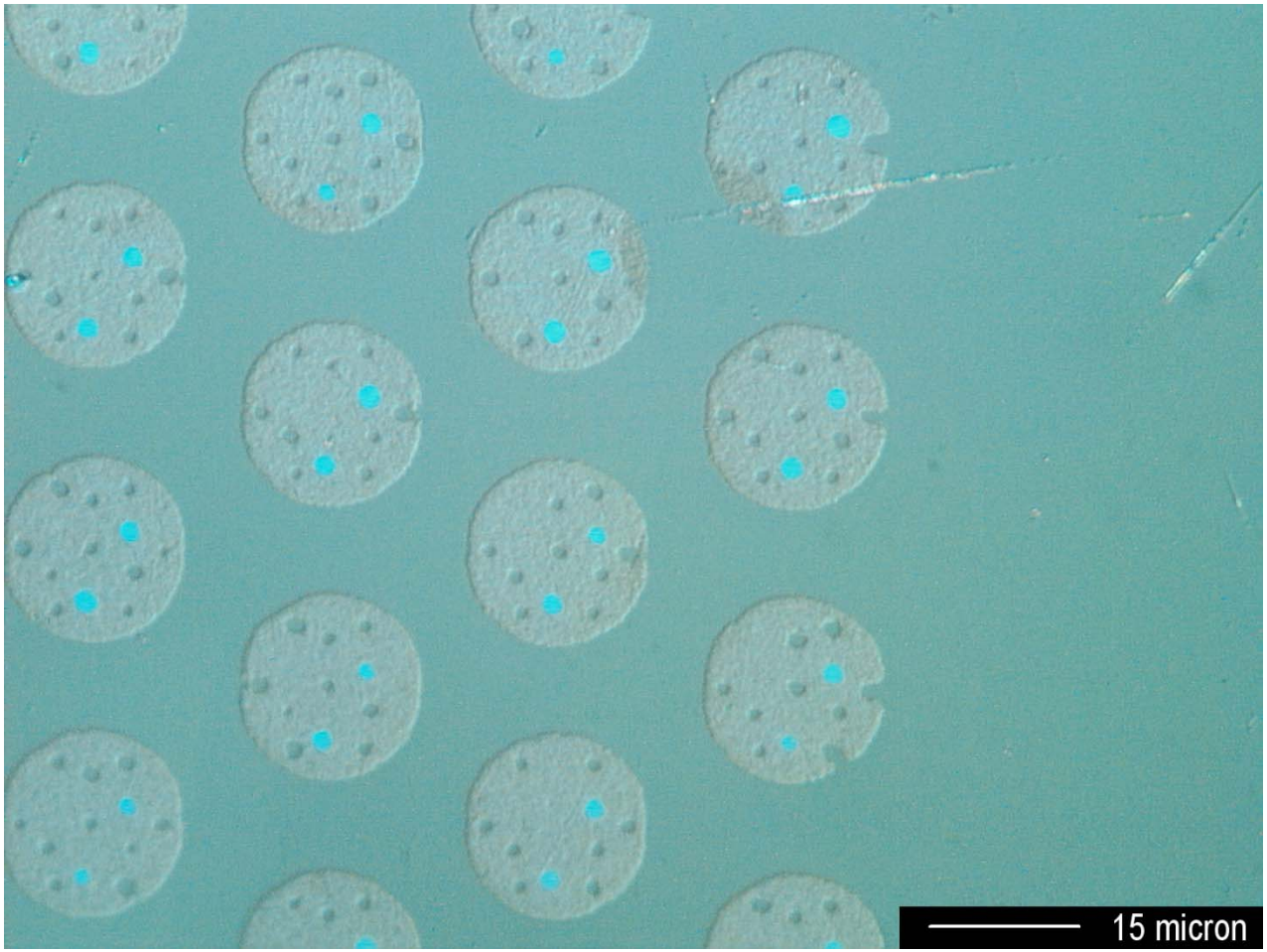
Tegal 1 – Plasma Line 411 Plasma Cleaning/Photo resist Strip
Tegal 2 – Plasma Line 412 Plasma Cleaning/Photo resist Strip
Tegal 3 – Plasma Line 512 Surface Activation for Bonding process
Gases _ O2

Xactix e-1 XeF2 Etcher – Silicon Etch

Almost infinite selectivity of Silicon to PR, SiO2, SI3N4 and Aluminum.
Utilizes Xenon Difluoride (XeF2) in vapor phase.
Restrictions: Silicon & Glass substrates allowed.
All other materials must be approved.

Positronium Test Structures

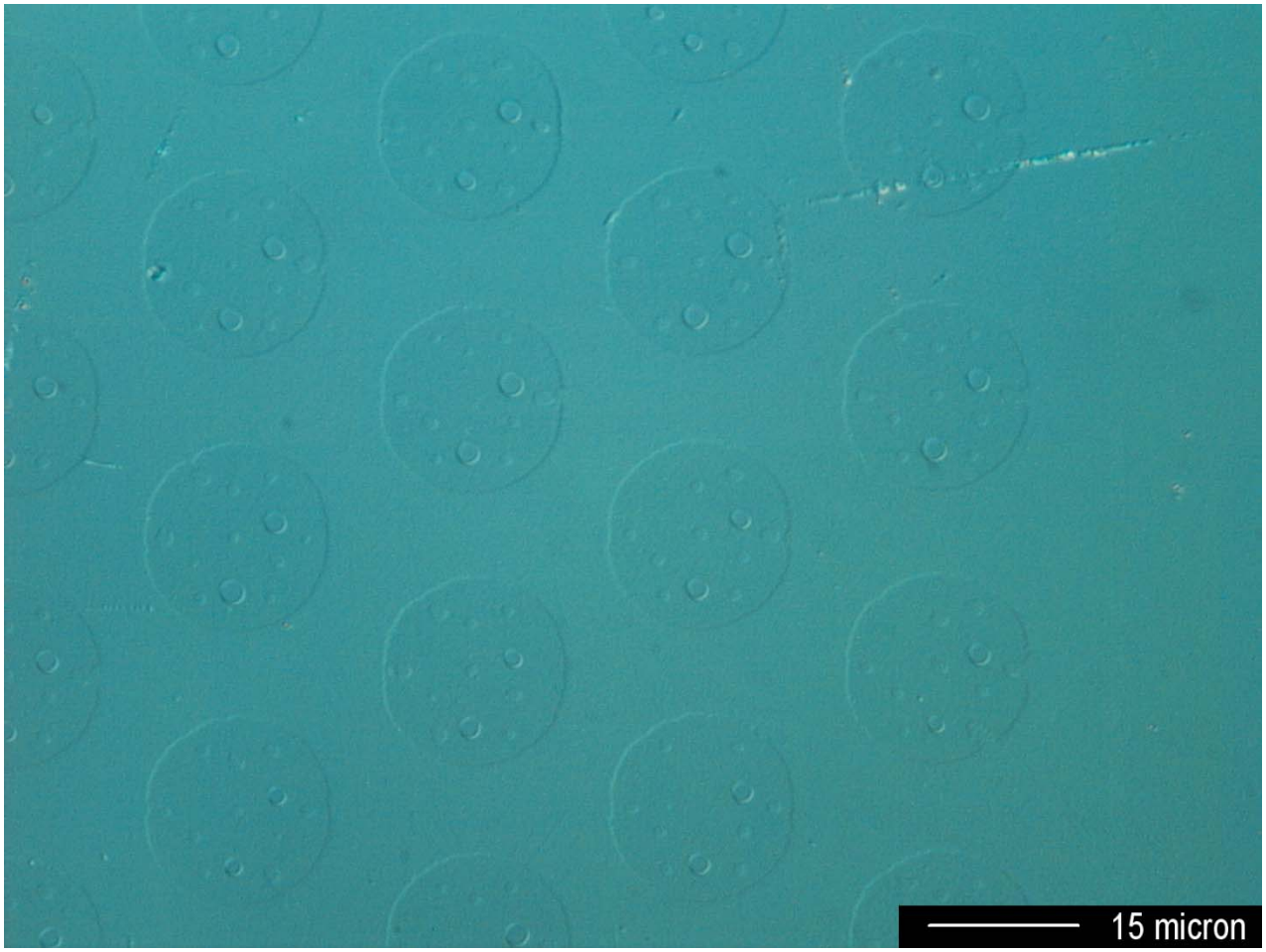
Before XeF2 sample – Blister_Rt-Nm-4



Positronium Test Structures

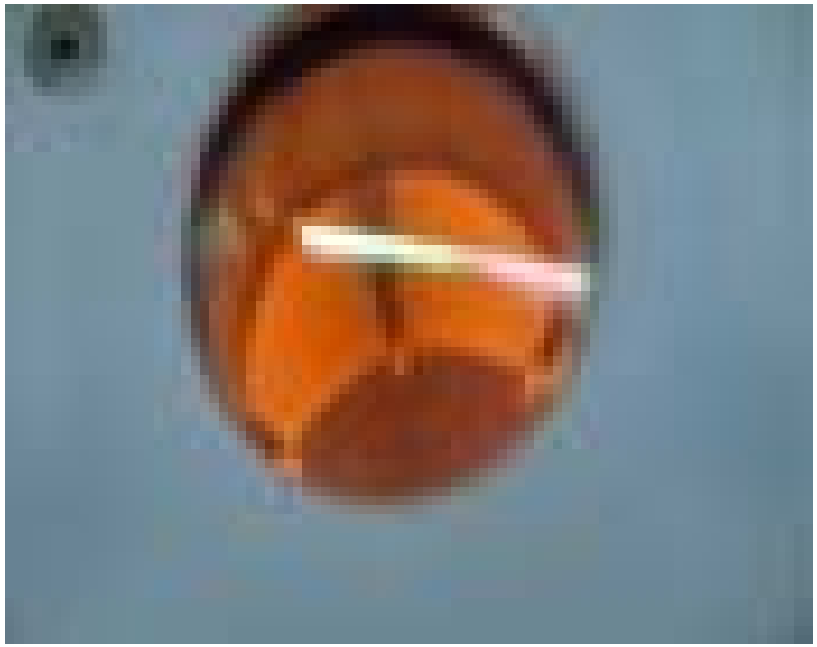
60 cycles on sample 7 – Blister_Rt-Nm-2

Zeiss Axiophot images



Chamber Conditioning

Current condition efforts include 10-20 minute O2 clean followed by a suggested seasoning run of 5-10 minutes for all fluorine & chlorine based tools. Typical season run would be the current recipe that will be used for etching.



Equipment Maintenance

- Preventative maintenance is currently performed on an annual basis for both PlasmaLab 80+ RIE's & both STS ICP etchers. This is scheduled with the manufacturers representative typically 2weeks prior to the effort beginning & can take at most a week to complete.
- We also have annual PM's performed on all of the mechanical & dry pumps attached to these tools by Vac-Tech Inc. An exact or suitable replacement is delivered & installed during the rebuild/maintenance cycle.

Future Equipment Acquisitions

- Advanced ICP Oxide Etcher; flexible substrates up to 8”, this in response to an ever increasing request from ASU’s Bio-Design Institute.
- Ion Milling capabilities