

# Etching systems at U of MN

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## NFC information.

NFC has a 3000 square feet of cleanroom.

The class 10 area is contained in 4 bays.

Two other non-cleanroom processing areas.

Staff of 15

( 11 Technical, 4 Administration )

### Users:

Grad students

local companies

A few universities are doing research.



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## NFC information.

New physics building with cleanroom to be completed by end of 2013. This will be a 5 bay 5000 square feet clean room 40% class 100 & the rest class 1000. Main emphasis will be nanotechnology research, other non cleanroom space for working labs.





# Etching systems at U of MN

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## Etching Systems

PlasmaTherm Deep Trench Etcher, Si etch

STS general purpose etcher, Fluorine gases

Av etcher Fluorine gases and methanol

FEI Quanta 200 3D

Oxford 100 ICP fluorine and chlorine gases

Xactix XeF<sub>2</sub> etcher

Ion Mill Intlac Nanoquest waiting to be replace older Technics system.

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## Deep Trench Etcher

Plasmatherm SLR-770

Set for 4" wafers

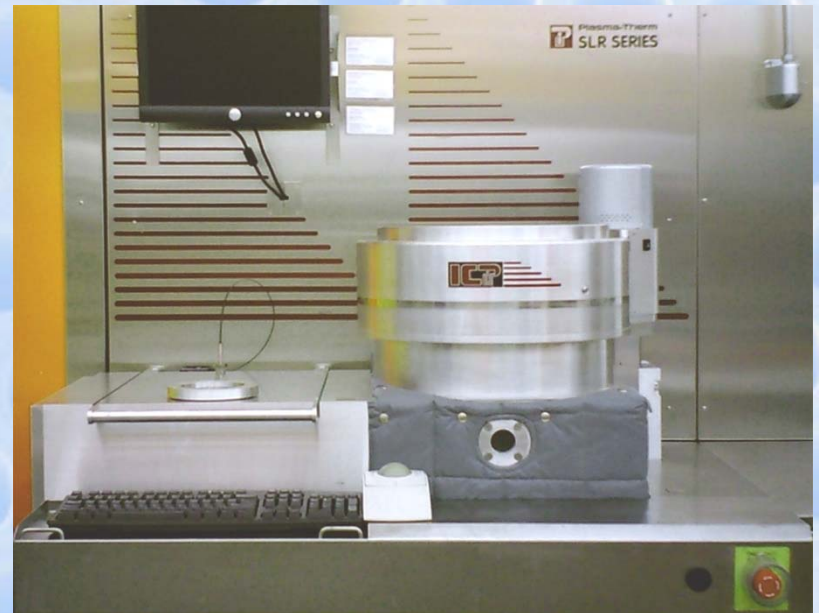
Electrostatic chuck

Gases: C<sub>4</sub>F<sub>8</sub> SF<sub>6</sub> Ar O<sub>2</sub>

Si etching only. Masking, Oxide, Nitride, PECVD, Resist, and Al<sub>2</sub>O<sub>3</sub> ALD film.

Staff only for recipe editing.

Good up time





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## STS Etcher

Model 320 PC

Gases: Ar CF4 CHF3 O2 SF6

600 Watt supply use at 300 or less.

Platen cooled by chiller, set to 25C, tested up to 75C.

Great up time ! Runs DOS=easy

User allowed to create recipes

Minor issues are chiller pumps and turbo pumps .

Hassle to make update/changes.



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## STS Etcher

Common Process activity:

System etches most normal materials.

Low selectivity on most films;

Except Si V.S. Oxide using SF<sub>6</sub>

User allowed to create recipes.

A second system was needed to handle user demand. There can be a waiting line on busy days.





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## AV Etcher

### AV Etcher

Gases, Ar, N<sub>2</sub>, O<sub>2</sub>, SF<sub>6</sub>, CHF<sub>3</sub>, CF<sub>4</sub> and methanol.

Off loaded some of the work from STS etcher.

Users are slow to start using it.

Staff only for recipe editing, but the variables can be changed for each run.



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## FEI Quanta 200 3D

Dual beam E-beam system Ion Beam and Ga Ion column.

Wide range of processing is done with this system.





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## Oxford Etcher

- Plasmalab System100 (ICP 180)

Gasses: Ar, N<sub>2</sub>, O<sub>2</sub>, SF<sub>6</sub>, CHF<sub>3</sub>, CF<sub>4</sub>, CL<sub>2</sub>, and BCl<sub>3</sub>.

Chiller unit installed instead of LN<sub>2</sub>.

Currently setup for 4 inch wafers

Staff only for recipe editing.



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## Xenon di-fluoride (XeF<sub>2</sub>) etcher

E1 Series system from Xactix, inc.

Just installed and starting to use it.

Staff only for recipe editing, but the variables can be changed for each run.





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## Ion Mill

Ion Mill Intlac Nanoquest II  
to be installed June 2013

22cm RF Ion source  
with LFN Low Frequency Neutralizer

Will be set for 4 and 6 inch



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DRIE etching of Si substrate until the front side layer of  $\text{Al}_2\text{O}_3$ , which is used as a suspended support structure.

Hard mask work to increase the etch time of HSQ or ZEP.

Patterning HSQ using ebeam and then etching the pattern into  $\text{Al}_2\text{O}_3$ .

Then this is used as hard mask to pattern the AlN layer. The HSQ would not last long enough for the AlN that is needed

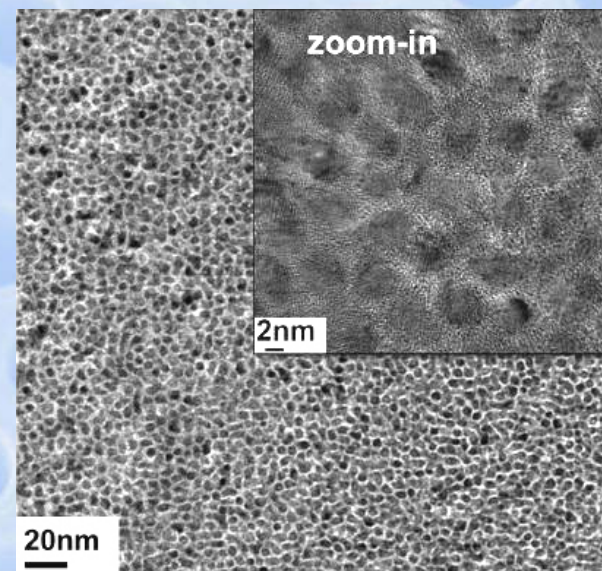
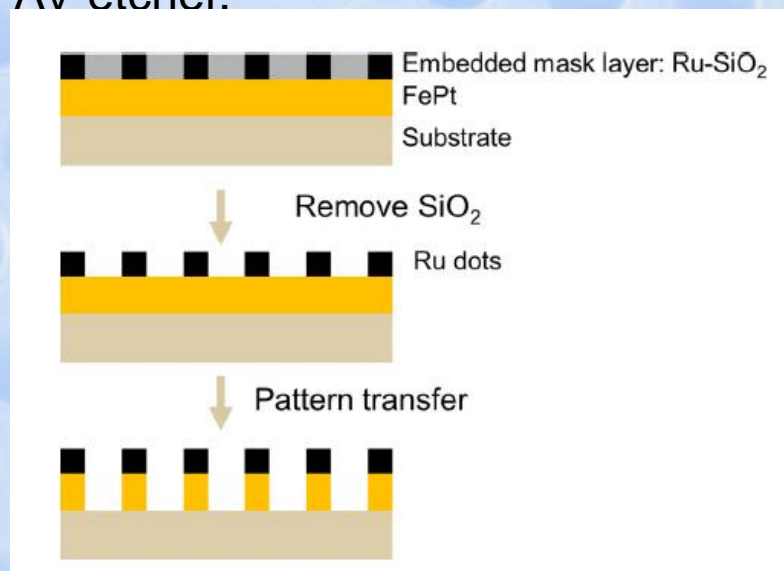


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## Nanopatterning process for FePt magnetic media

Hao Wang Group

Etching of FePt by using a masking layer of Ru-SiO<sub>2</sub> with ultra small grain size. Removal of SiO<sub>2</sub> with CH<sub>4</sub> and CHF<sub>3</sub> and then the remaining pattern is transferred by selectively etching the FePt using methanol, using the AV etcher.



Grain size is 4.6nm center to center is 6.3 nm

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## Future plans to modify or upgrade systems

Add more gas to Oxford system, HBr, C<sub>4</sub>F<sub>8</sub> and others?

Add more clamps sizes to hold 6 inch wafers and another clamp for masks for the Oxford.

Upgrade of AV etcher to Vision 322 RIE/PE