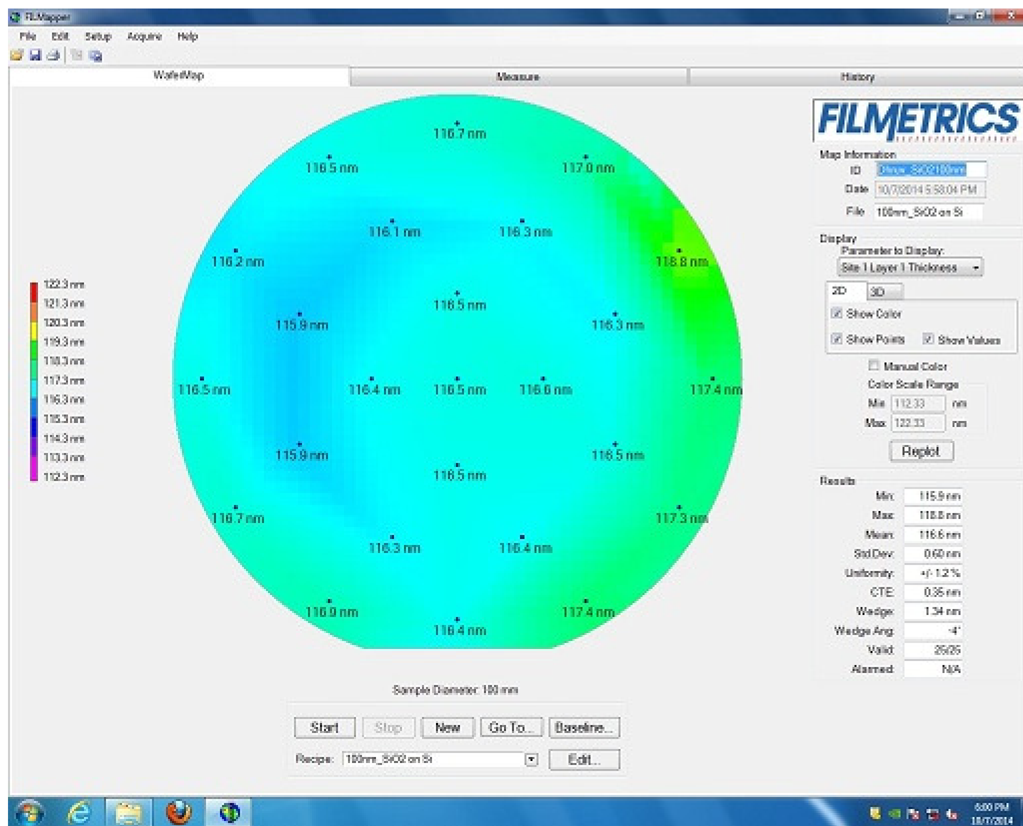
Thicknesses and Pinholes of SiO2, SiNx, and a-Si Films prepared by PECVD, No 2, (Graduate Student Fellow Program)

Prepared by Dhruv Turakhia (11/10/2014)

SiO2

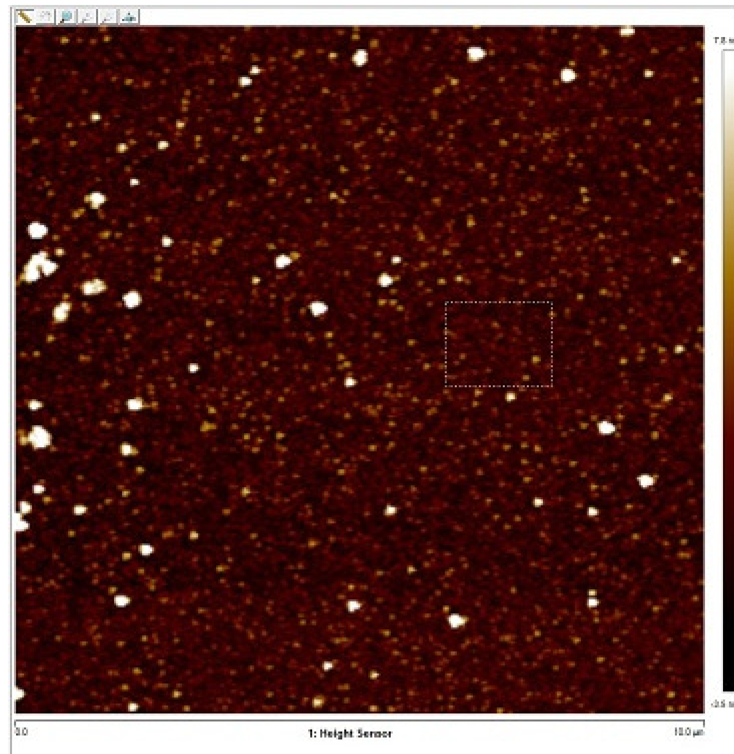
Thickness

- 10/20/14
- Default recipe
- Deposition rate = 60.2 nm/min
    - Filmetrics F50: thickness mean = 116.6 nm and uniformity = 1.2 % for 1.9 min deposition.



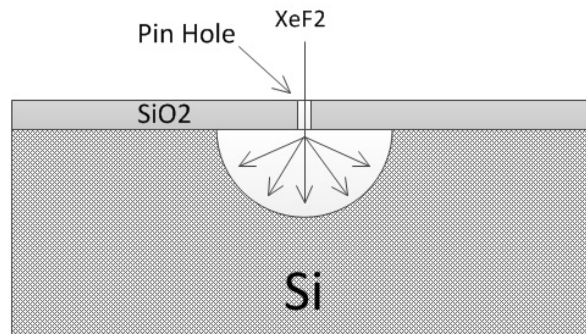
Surface Roughness

- 11/10/14
- Default recipe
- Thickness: 100 nm
- AFM image
    - 10 µm x 10 µm
    - PV: 5.64 nm
    - rms: 0.853 nm
    - Ra: 0.663 nm



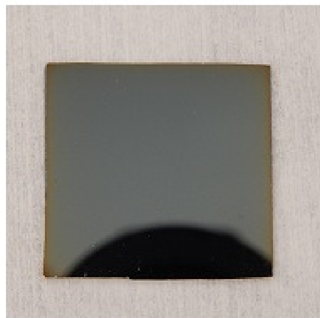
Pin Holes

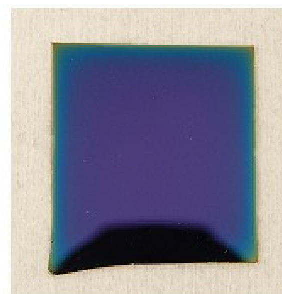
- 11/17/2014
- XeF_2 Ecther
  - The number of cycles: 30
  - Etch time: 60 sec
  - The pressure of XeF_2: 3.0 Torr.
  - The pressure of N_2: 2.0 Torr
  - The following pictures are the surfaces of 25, 50, 100, 200, and 300 nm thick SiO_2 after XeF_2 etching.



XeF2 etching of Si through pin hole

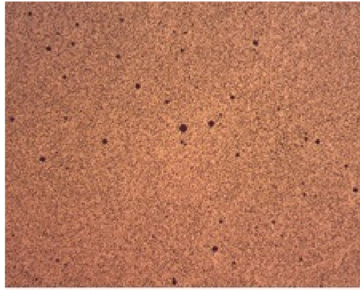
25 nm thick SiO2 on Si wafer 50 nm thick SiO2 on Si wafer 100 nm thick SiO2 on Si wafer



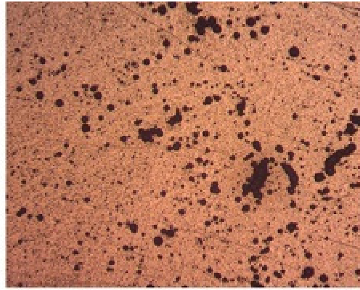


200 nm thick SiO2 on Si wafer 300 nm thick SiO2 on Si wafer

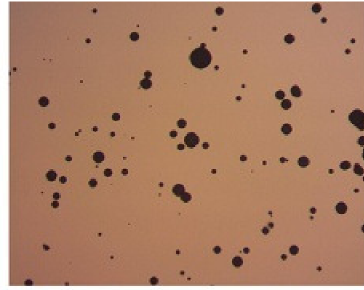
Photos of Si etching using XeF2
through various film thickness of SiO2 prepared by PECVD



25 nm thick SiO2

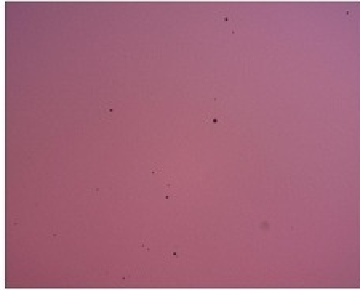


50 nm thick SiO2



100 nm thick SiO2

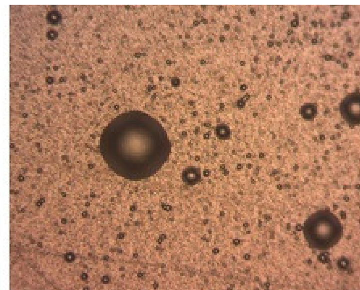
200 nm thick SiO2



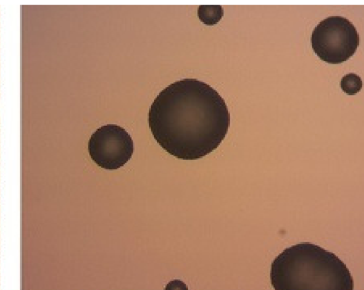
300 nm thick SiO2

Optical microscope images (x32) of Si etching using XeF2 through various film thickness of SiO2 prepared by PECVD

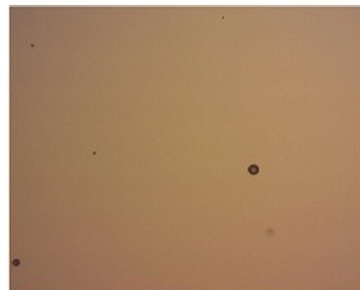
25 nm thick SiO2



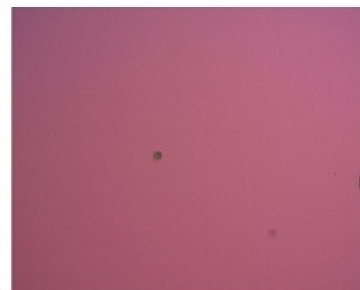
50 nm thick SiO2



100 nm thick SiO2



200 nm thick SiO2



300 nm thick SiO2

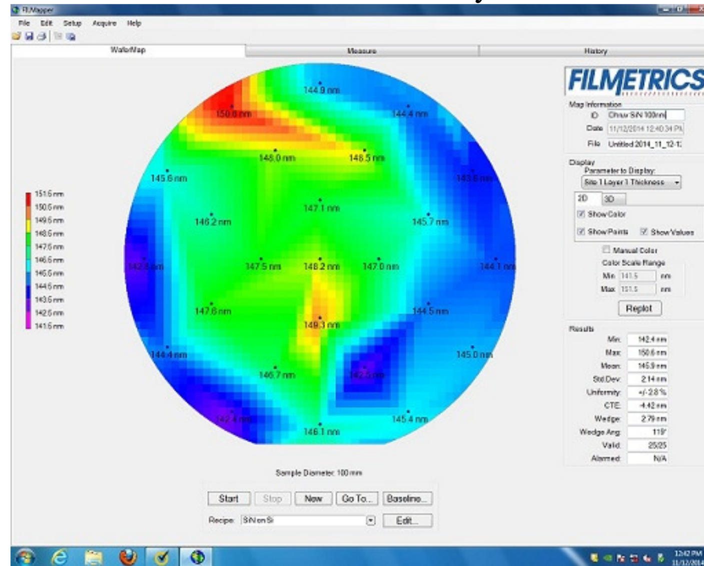
Optical microscope images (x200) of Si etching using XeF2 through various film thickness of SiO2 prepared by PECVD

AFM images of the depression of the 200 nm thick SiO_2 film after Si etching, assuming that SiO_2 film was collapsed due to removal of the bottom Si through the pin hole.

Si3N4

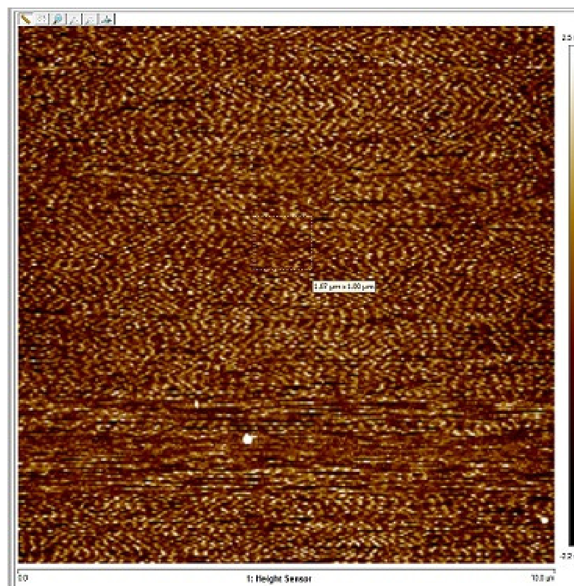
Thickness

- 11/17/2014
  - Thickness mean = 145.9 nm and uniformity = 2.8 %.



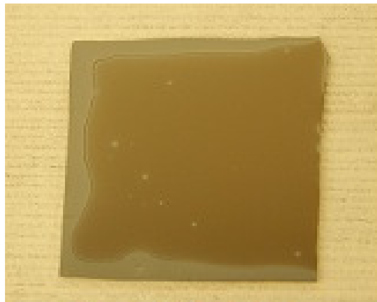
Surface Roughness

- 11/17/2014
- Thickness: 100 nm
- AFM image
  - 10 µm x 10 µm
  - PV: 3.30 nm
  - rms: 0.556 nm
  - Ra: 0.440 nm

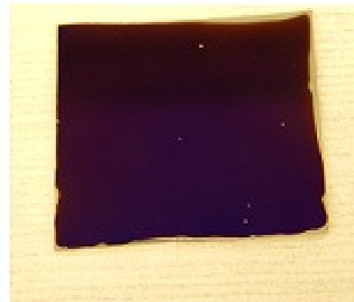


Pin Holes

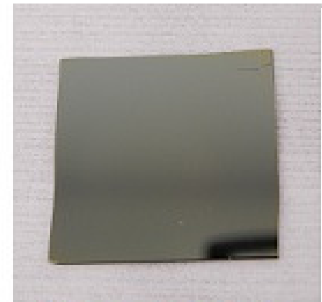
- 11/17/2014
- XeF2 Ecther
  - The number of cycles: 30
  - Etch time: 60 sec
  - The pressure of XeF2: 3.0 Torr.
  - The pressure of N2: 2.0 Torr
  - The following pictures are the surfaces of 25, 50, 100, 200, and 300 nm thick SiO2 after XeF2 etching.



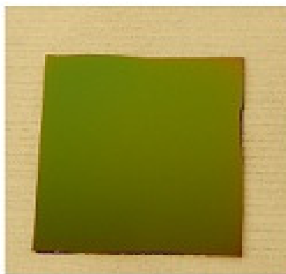
25 nm thick SiNx



50 nm thick SiNx



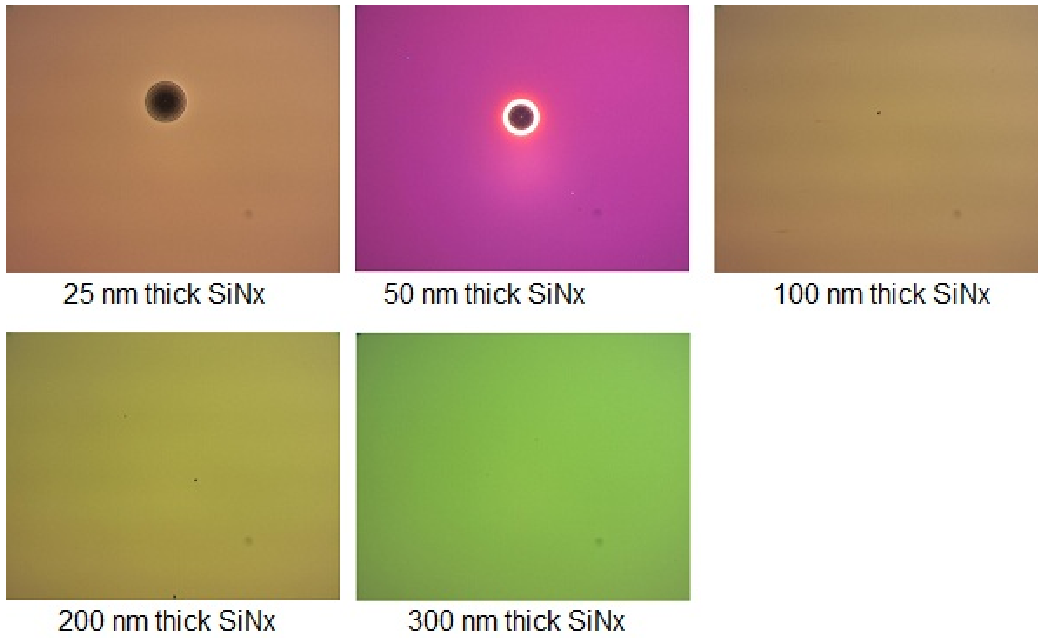
100 nm thick SiNx



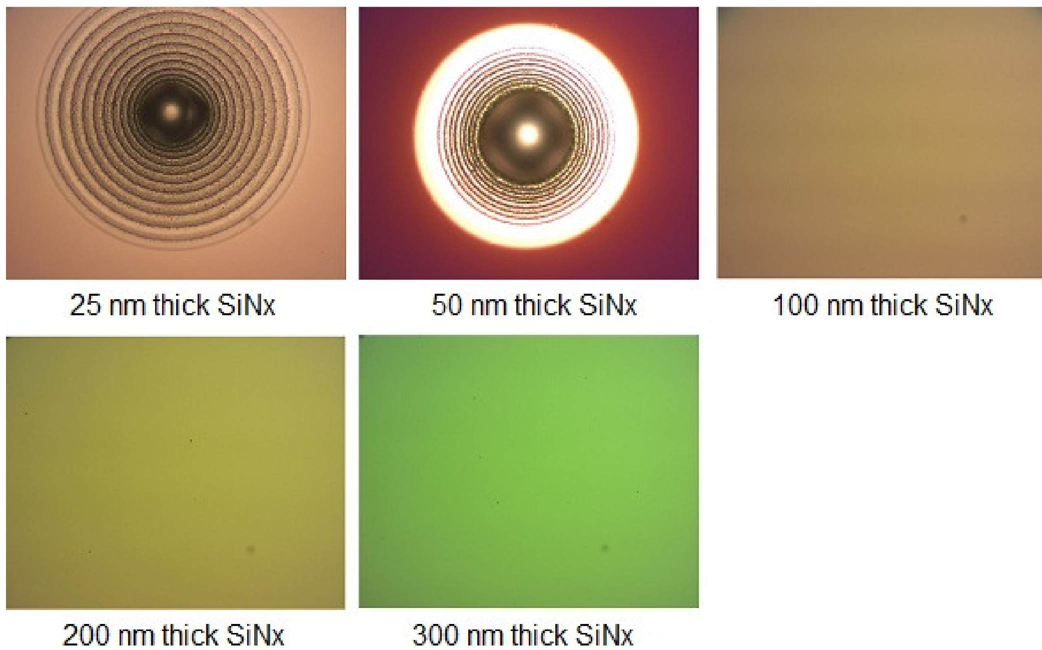
200 thick SiNx

300 nm thick SiNx

Photos of Si etching XeF2 through various film thickness of SiNx prepared by PECVD



Optical microscope Images (x32) of Si etching using XeF2 through various film thickness of SiNx prepared by PECVD

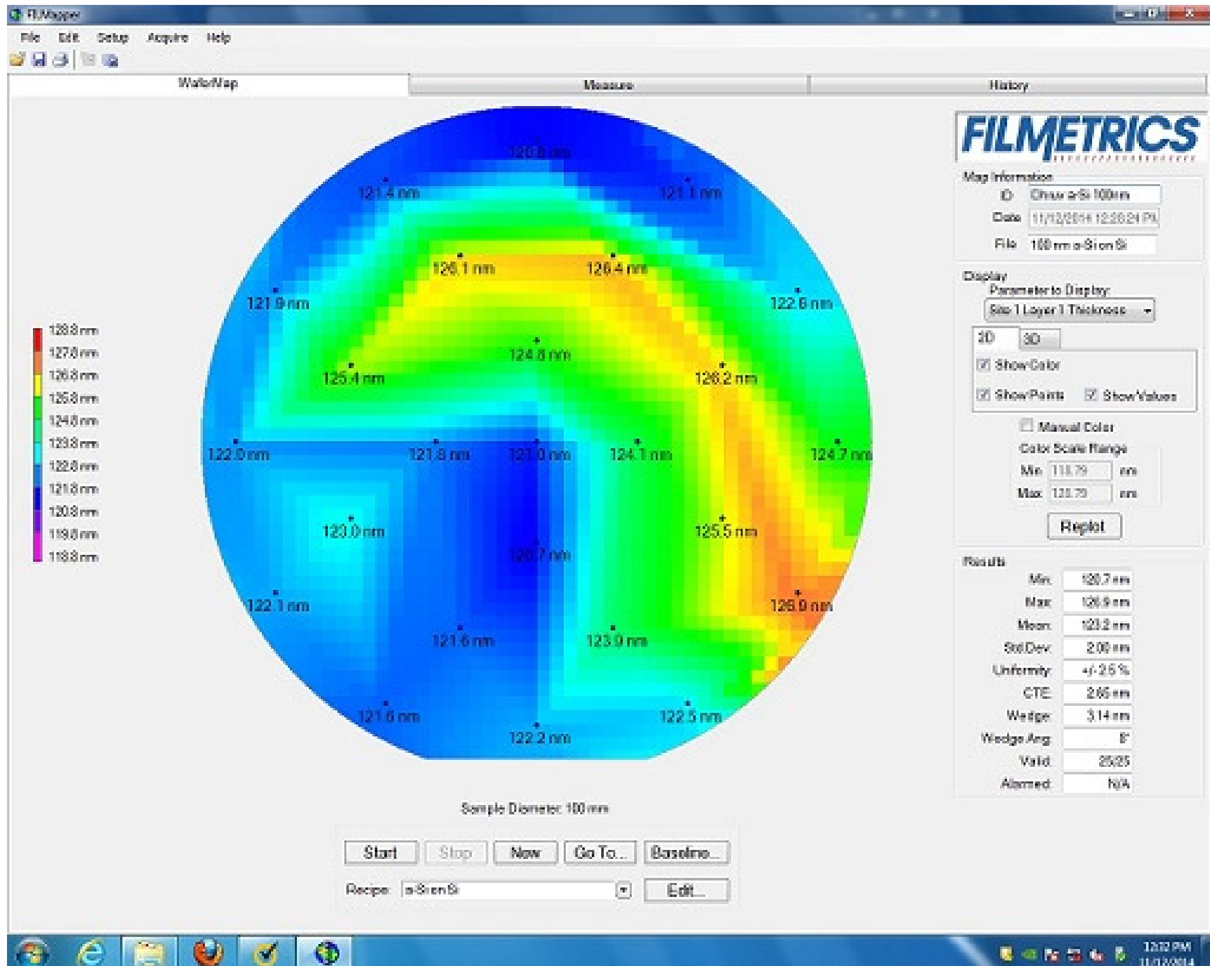


Optical microscope images (x200) of Si etching using XeF2 through various film thickness of SiNx prepared by PECVD

a-Si (deposited on PECVD 100 nm thick SiO2)

Thickness

- 11/17/2014
- Filmetrics F50: thickness mean = 123.2 nm and uniformity = 2.5 %.



Surface Roughness

- 11/17/2014
- Thickness: 100 nm
- AFM image
    - 10 µm x 10 µm
    - PV: 2.10 nm
    - rms: 0.336 nm
    - Ra: 0.262 nm