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4-28-2015

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# Thicknesses and Pinholes of SiO<sub>2</sub>, SiN<sub>x</sub>, and a-Si Films prepared by PECVD, No 2

## Keywords

Thicknesses, Pinholes, SiO<sub>2</sub>, SiN<sub>x</sub>, a-Si, PECVD

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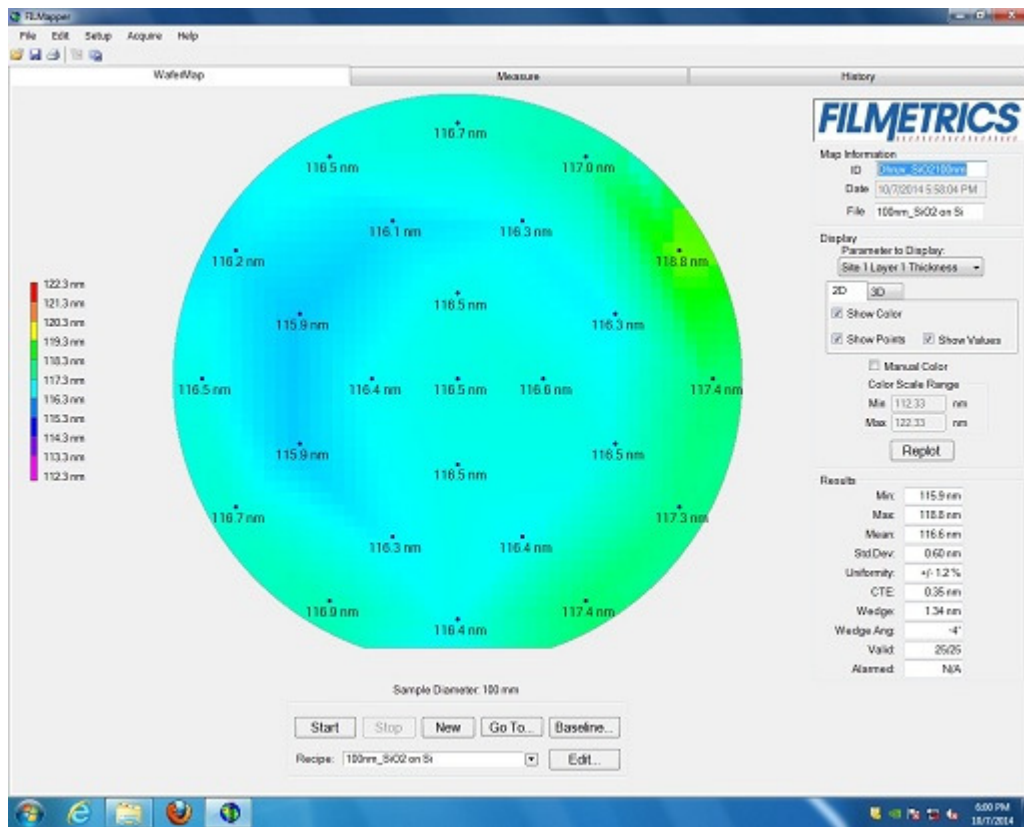
# Thicknesses and Pinholes of SiO<sub>2</sub>, SiN<sub>x</sub>, and a-Si Films prepared by PECVD, No 2, (Graduate Student Fellow Program)

Prepared by Dhruv Turakhia (11/10/2014)

## SiO<sub>2</sub>

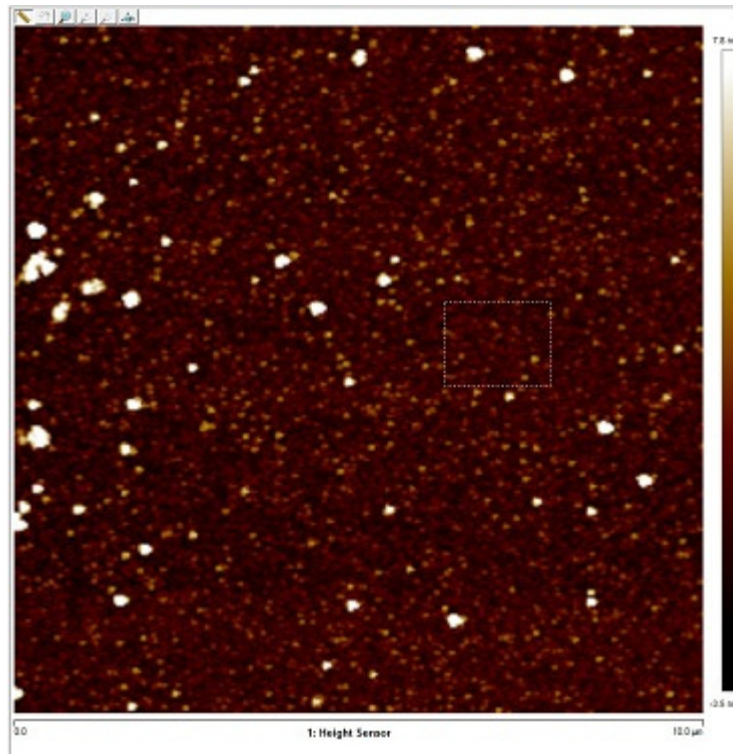
### Thickness

- 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.



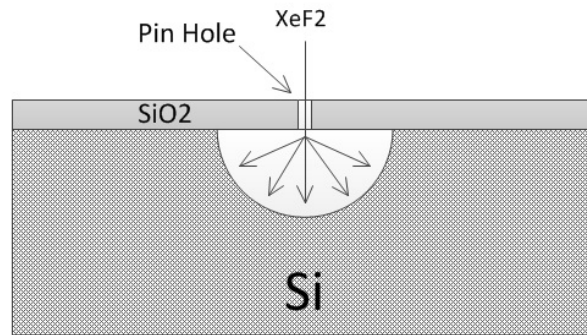
## Surface Roughness

- 11/10/14
- Default recipe
- Thickness: 100 nm
- AFM image
  - 10  $\mu\text{m}$  x 10  $\mu\text{m}$
  - PV: 5.64 nm
  - rms: 0.853 nm
  - Ra: 0.663 nm



## Pin Holes

- 11/17/2014
- XeF<sub>2</sub> Etcher
  - The number of cycles: 30
  - Etch time: 60 sec
  - The pressure of XeF<sub>2</sub>: 3.0 Torr.
  - The pressure of N<sub>2</sub>: 2.0 Torr
  - The following pictures are the surfaces of 25, 50, 100, 200, and 300 nm thick SiO<sub>2</sub> after XeF<sub>2</sub> etching.



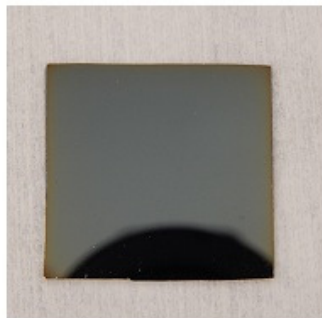
XeF<sub>2</sub> etching of Si through pin hole



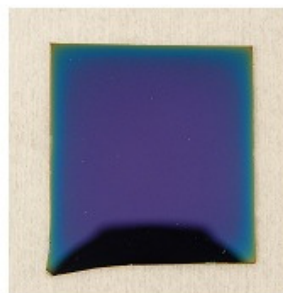
25 nm thick SiO<sub>2</sub> on Si wafer

50 nm thick SiO<sub>2</sub> on Si wafer

100 nm thick SiO<sub>2</sub> on Si wafer



200 nm thick SiO<sub>2</sub> on Si wafer



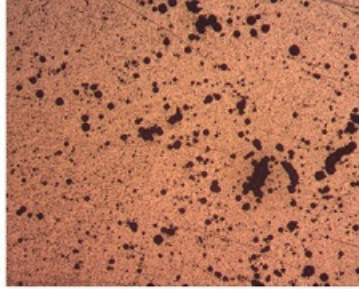
300 nm thick SiO<sub>2</sub> on Si wafer

Photos of Si etching using XeF<sub>2</sub>  
through various film thickness of SiO<sub>2</sub> prepared by PECVD

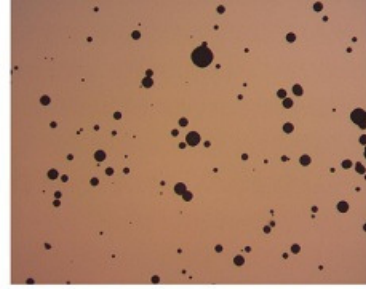




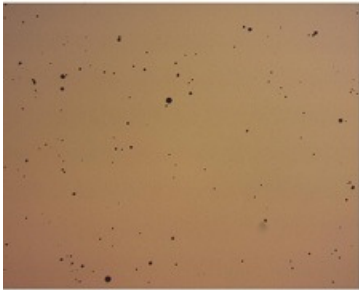
25 nm thick SiO<sub>2</sub>



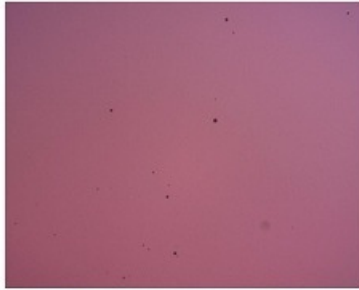
50 nm thick SiO<sub>2</sub>



100 nm thick SiO<sub>2</sub>



200 nm thick SiO<sub>2</sub>

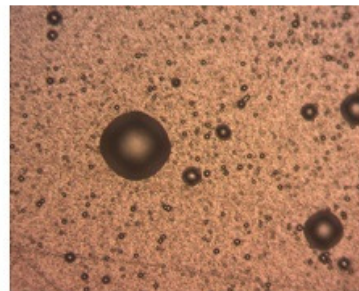


300 nm thick SiO<sub>2</sub>

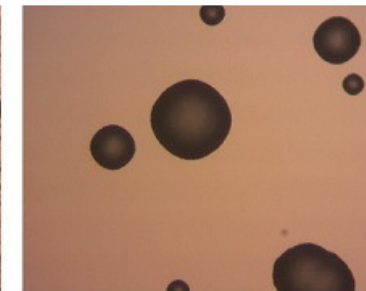
Optical microscope images (x32) of Si etching using XeF<sub>2</sub> through various film thickness of SiO<sub>2</sub> prepared by PECVD



25 nm thick SiO<sub>2</sub>



50 nm thick SiO<sub>2</sub>



100 nm thick SiO<sub>2</sub>



200 nm thick SiO<sub>2</sub>



300 nm thick SiO<sub>2</sub>

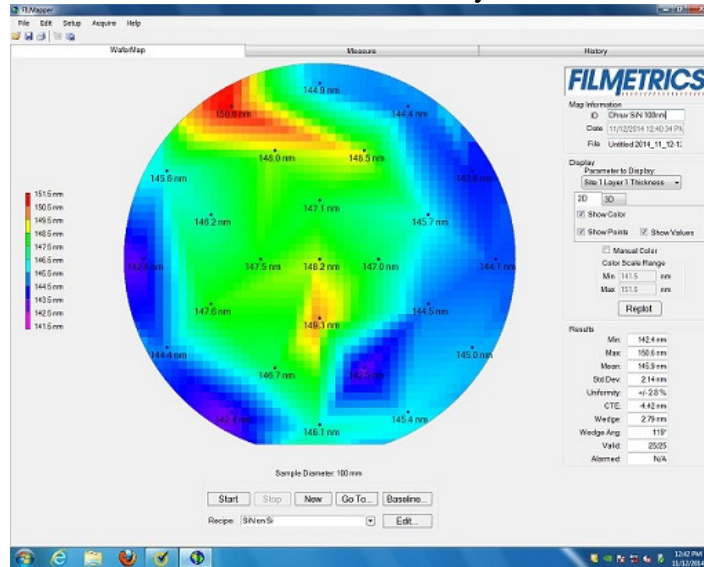
Optical microscope images (x200) of Si etching using XeF<sub>2</sub> through various film thickness of SiO<sub>2</sub> prepared by PECVD



# Si3N4

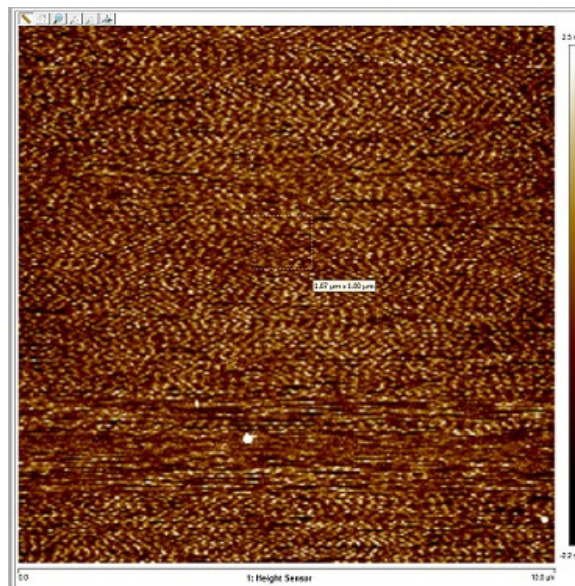
## Thickness

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



## Surface Roughness

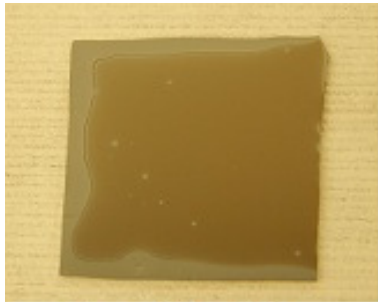
- 11/17/2014
- Thickness: 100 nm
- AFM image
  - 10  $\mu\text{m}$  x 10  $\mu\text{m}$
  - PV: 3.30 nm
  - rms: 0.556 nm
  - Ra: 0.440 nm



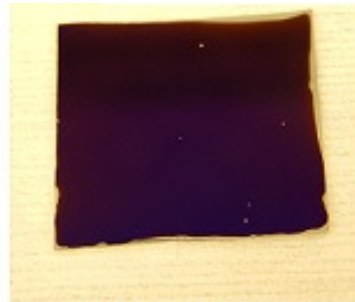


## Pin Holes

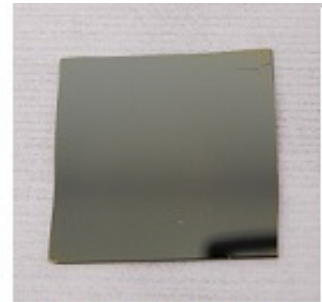
- 11/17/2014
- XeF<sub>2</sub> Etcher
  - The number of cycles: 30
  - Etch time: 60 sec
  - The pressure of XeF<sub>2</sub>: 3.0 Torr.
  - The pressure of N<sub>2</sub>: 2.0 Torr
  - The following pictures are the surfaces of 25, 50, 100, 200, and 300 nm thick SiO<sub>2</sub> after XeF<sub>2</sub> etching.



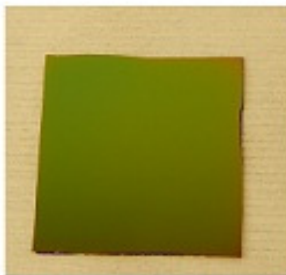
25 nm thick SiNx



50 nm thick SiNx



100 nm thick SiNx

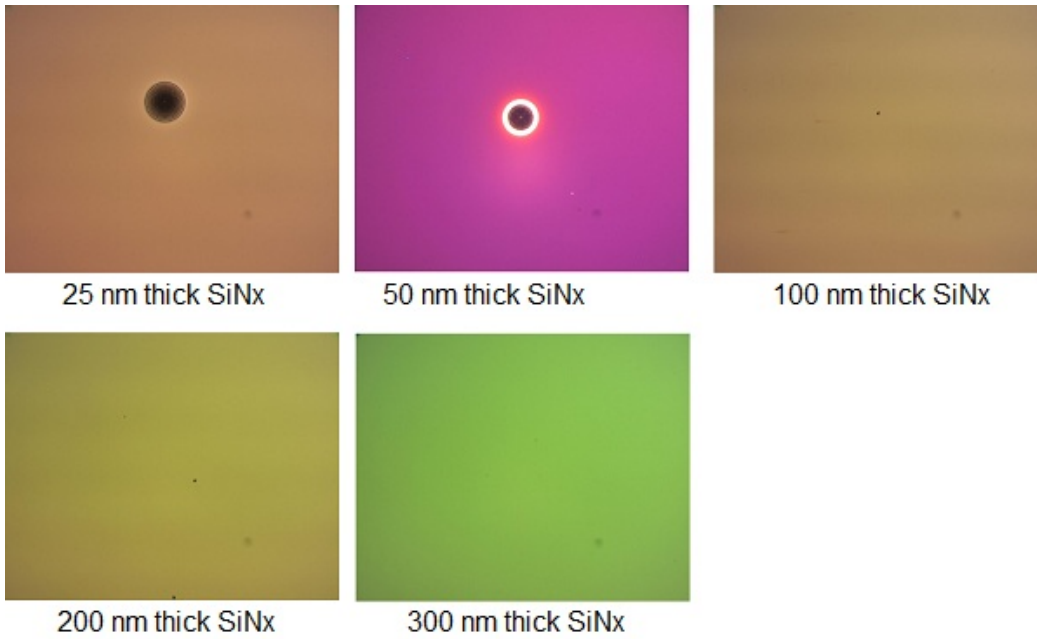


200 thick SiNx

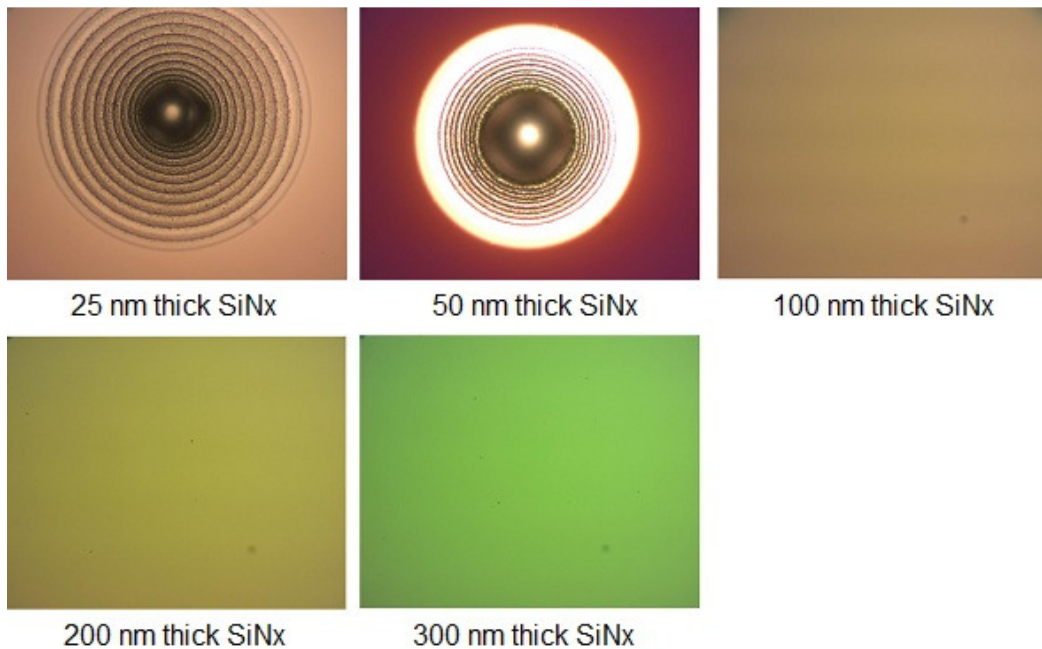


300 nm thick SiNx

Photos of Si etching XeF<sub>2</sub> through various film thickness of SiNx prepared by PECVD



Optical microscope Images (x32) of Si etching using XeF<sub>2</sub> through various film thickness of SiNx prepared by PECVD

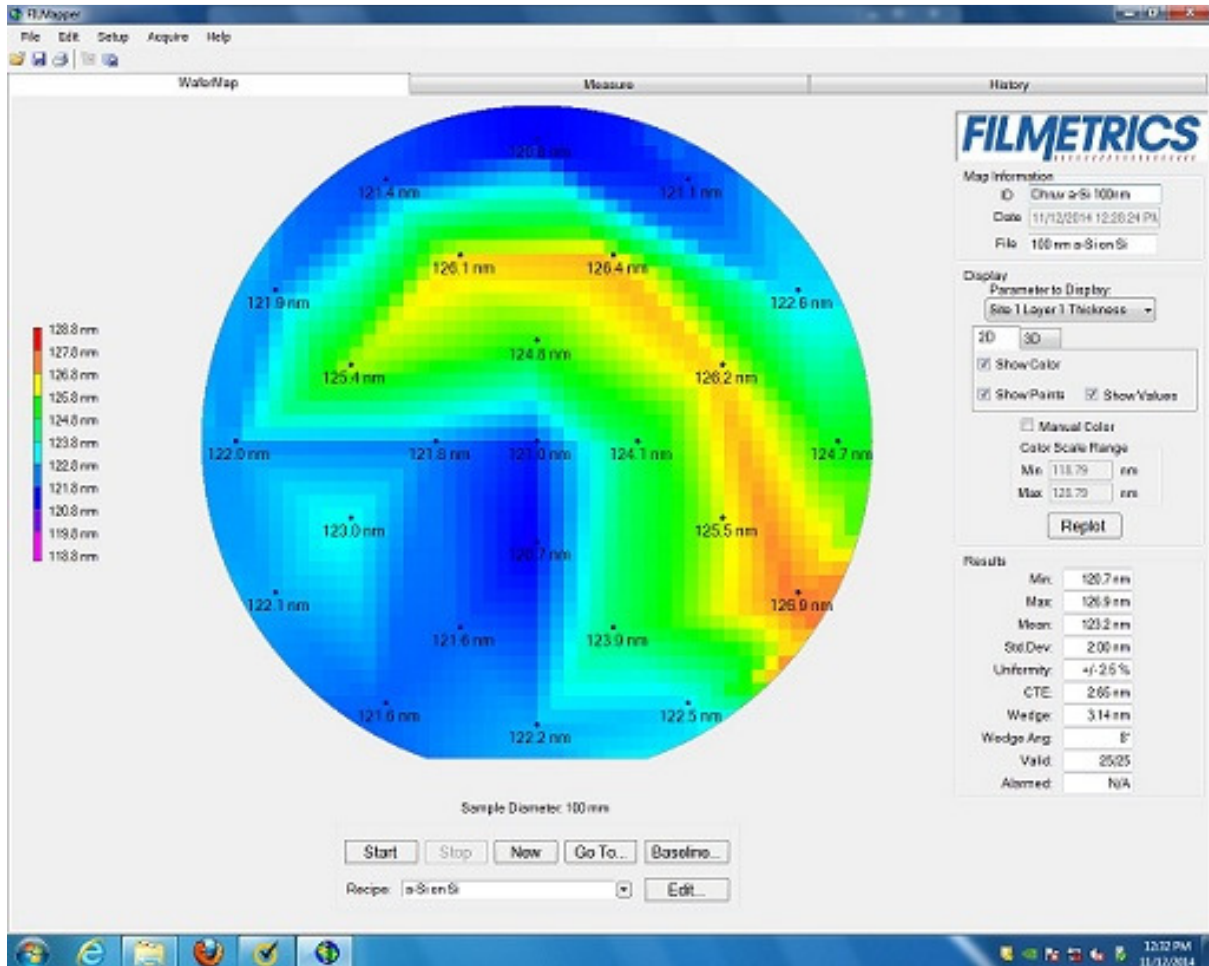


Optical microscope images (x200) of Si etching using XeF<sub>2</sub> through various film thickness of SiNx prepared by PECVD

## a-Si (deposited on PECVD 100 nm thick SiO<sub>2</sub>)

### 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  $\mu\text{m}$  x 10  $\mu\text{m}$
  - PV: 2.10 nm
  - rms: 0.336 nm
  - Ra: 0.262 nm

