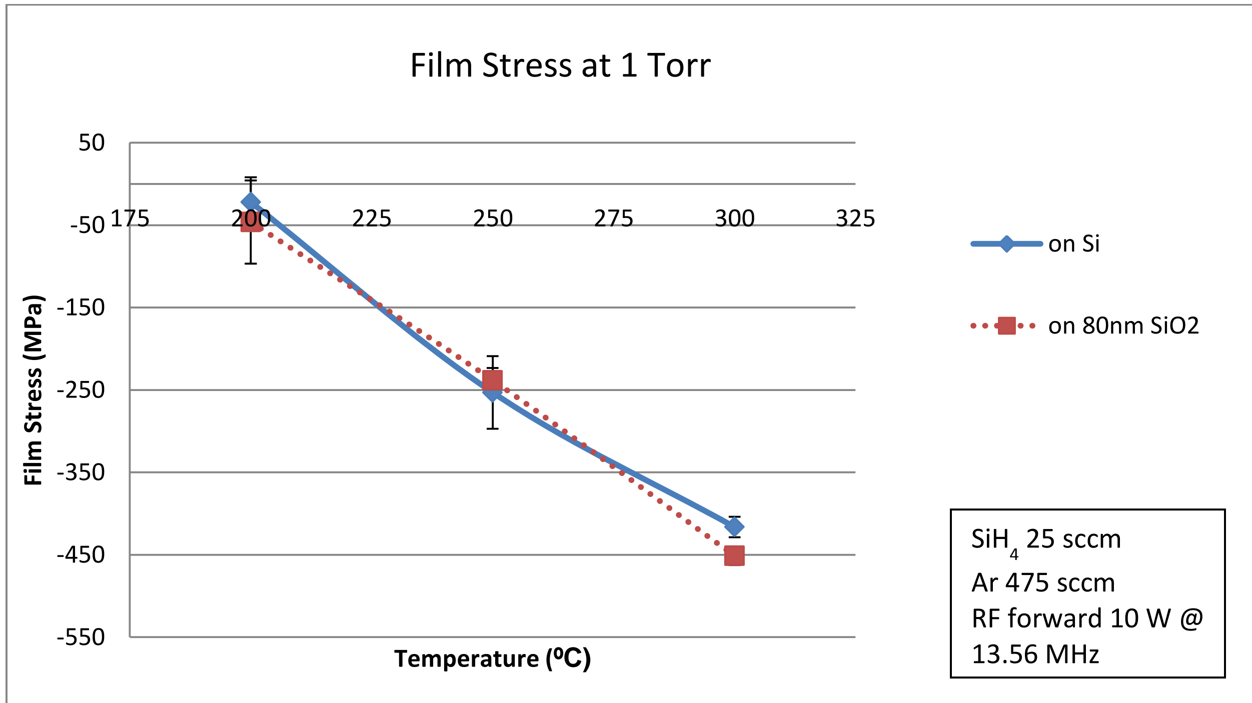
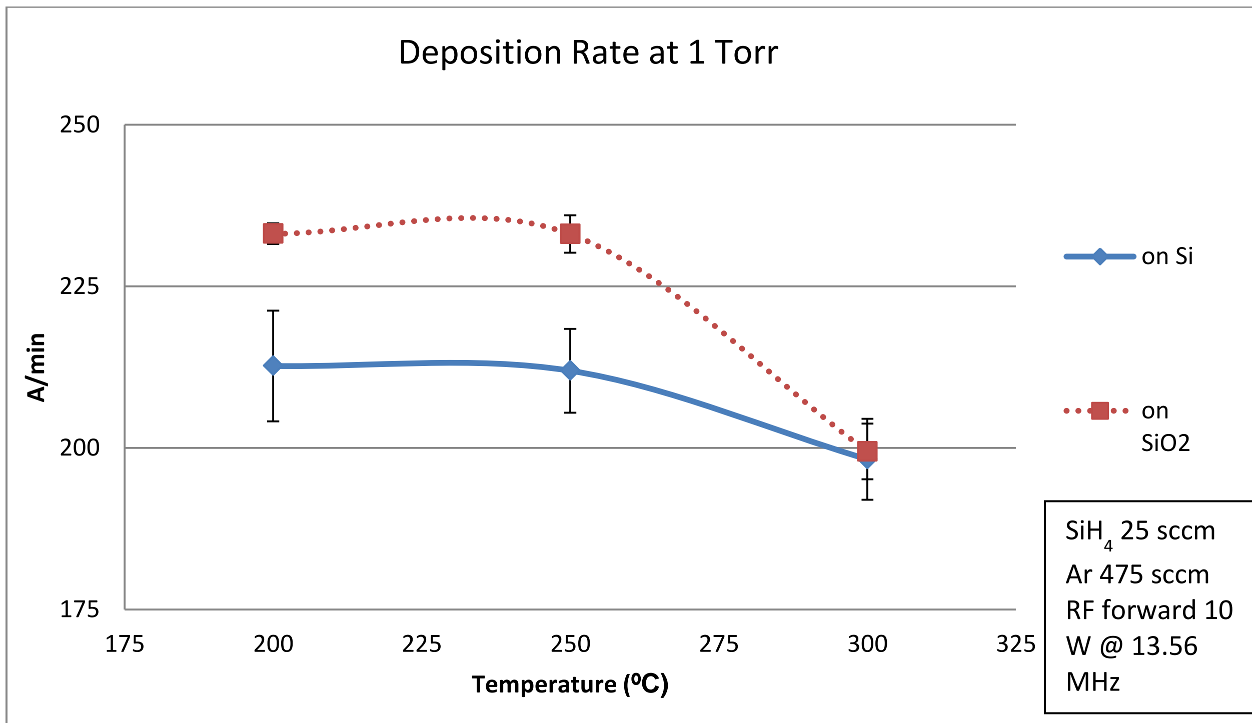
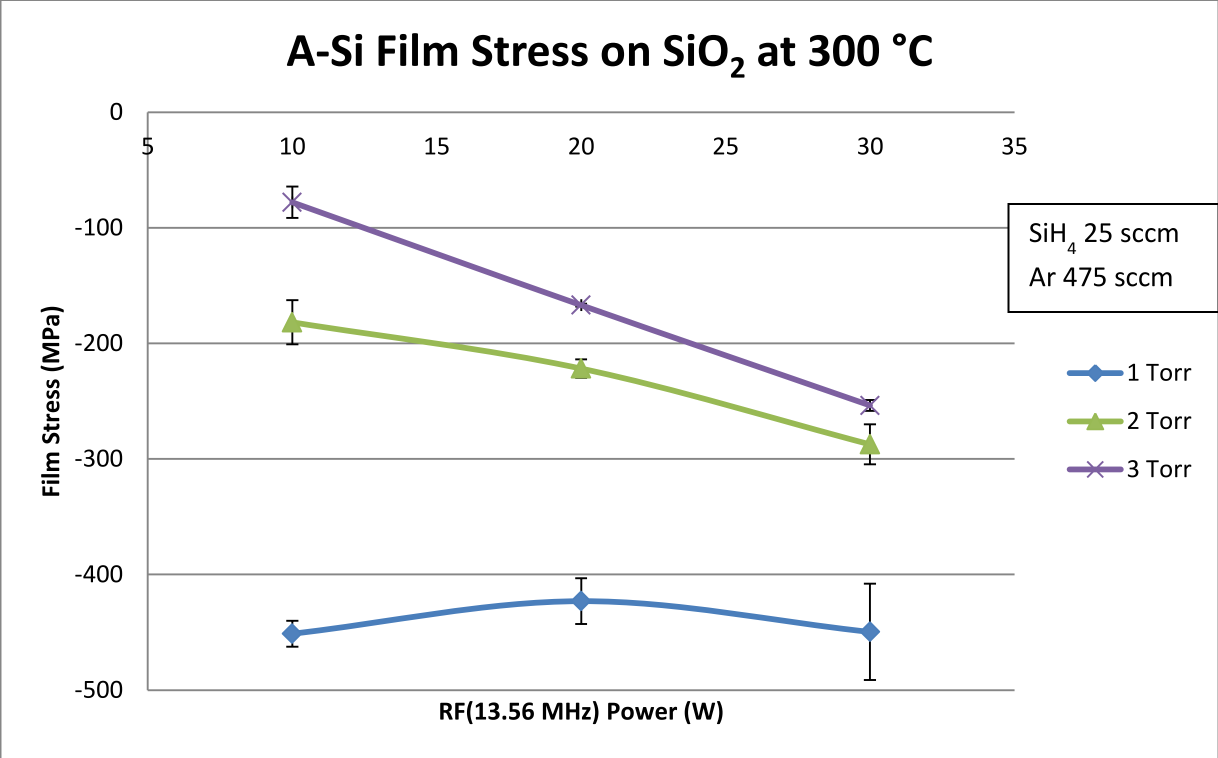
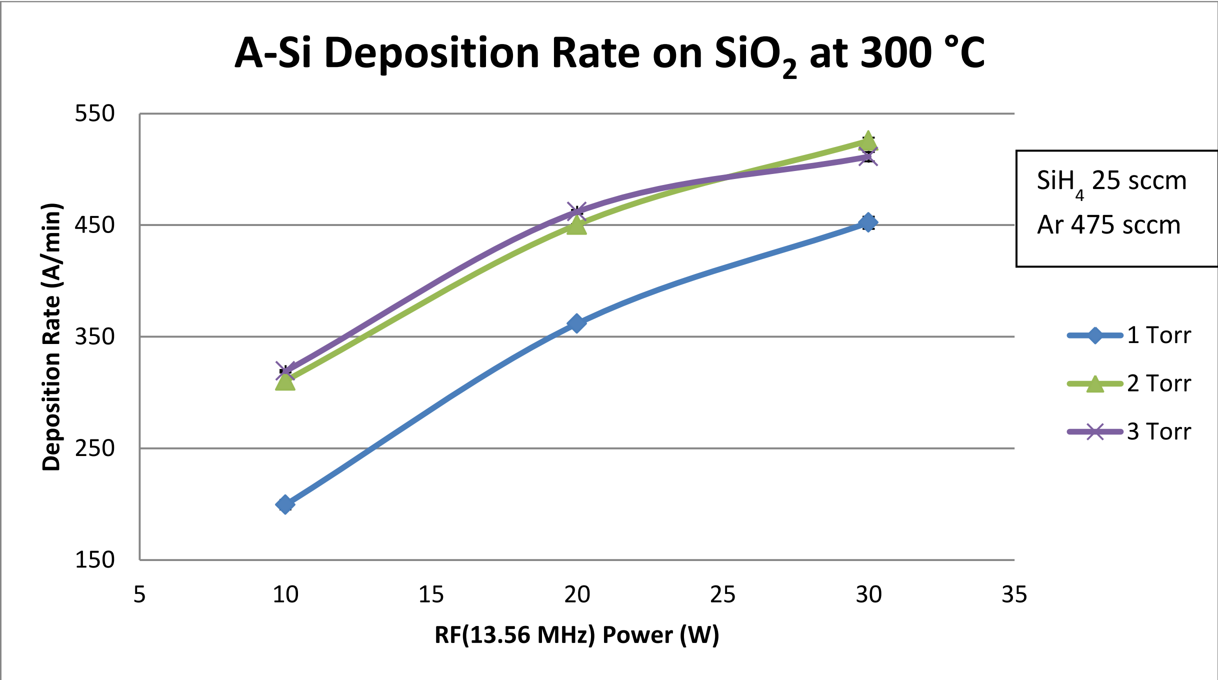
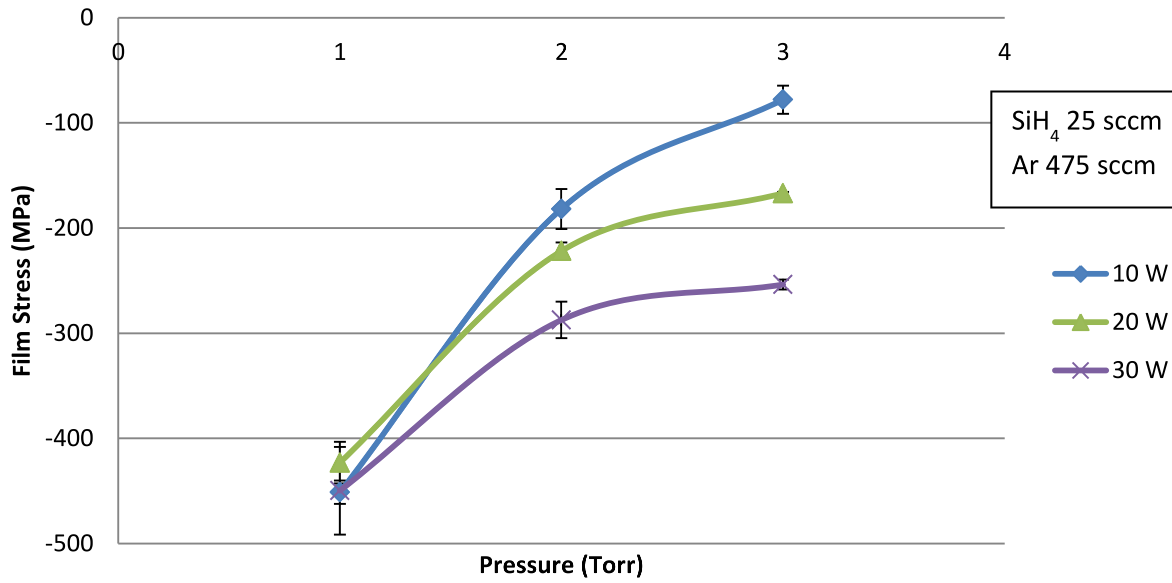
Oxford PECVD Amorphous Si Deposition

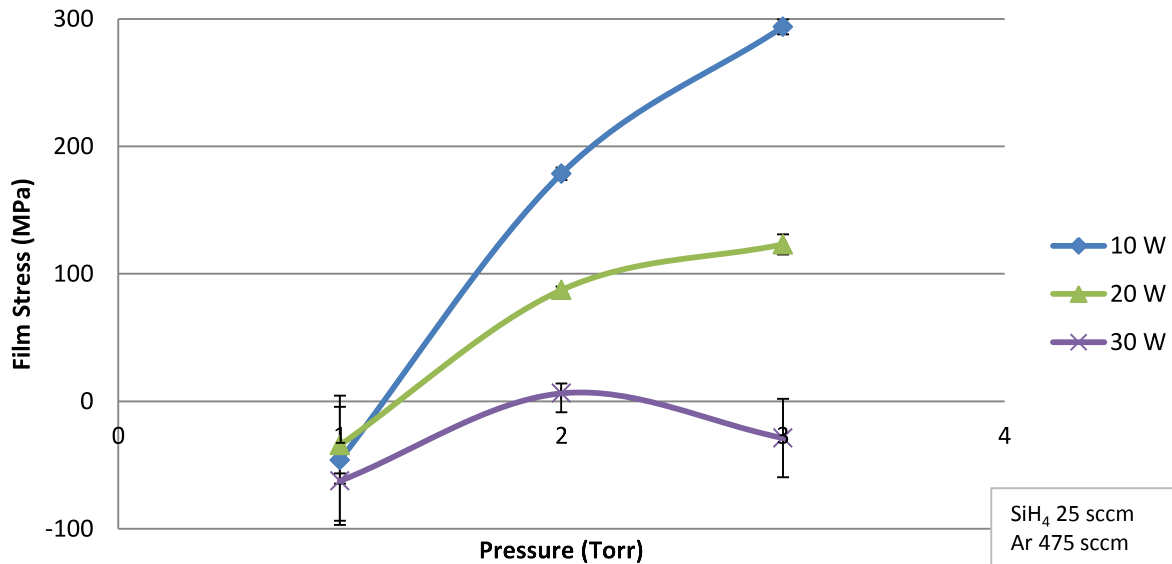


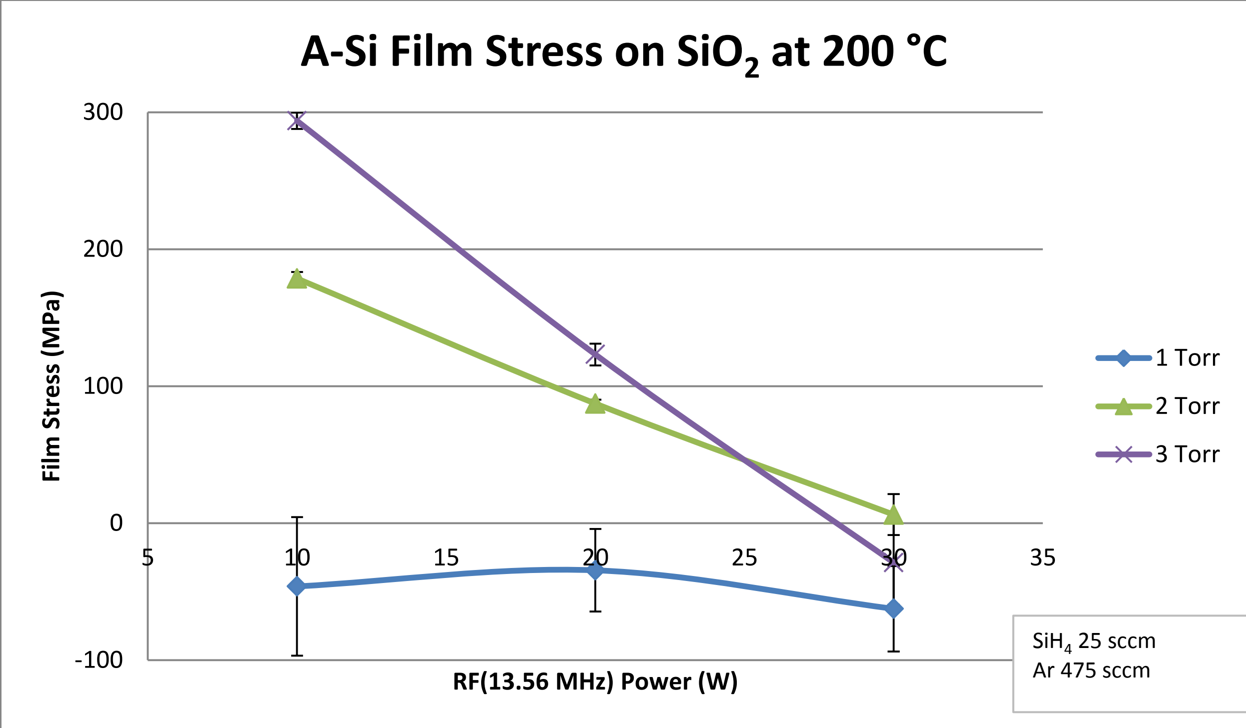


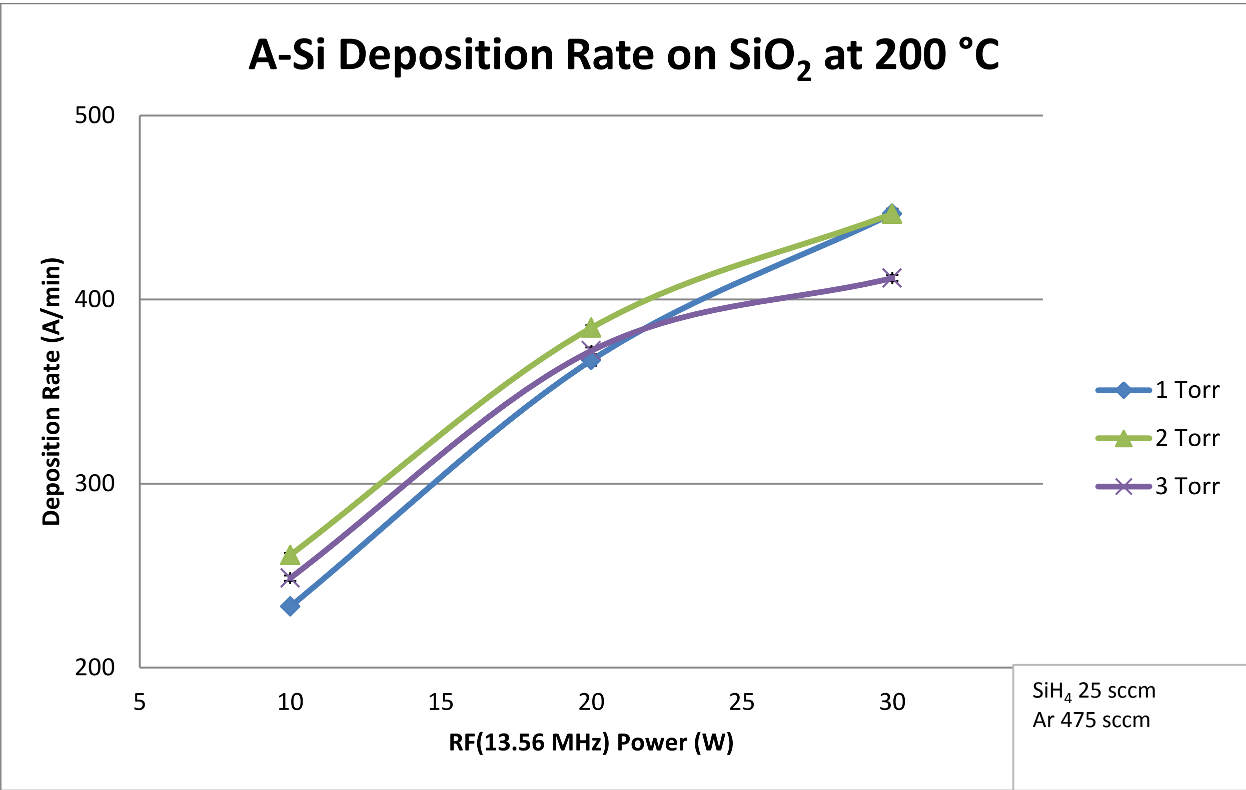

A-Si Film Stress on SiO_2 at 300 °C
Film Stress (MPa)
0
-100
-200
-300
-400
-500
5
10
15
20
25
30
35
RF(13.56 MHz) Power (W)
SiH_4 25 sccm
Ar 475 sccm
1 Torr
2 Torr
3 Torr


A-Si Deposition Rate on SiO_2 at 300 °C
Deposition Rate (A/min)
550
450
350
250
150
5
10
15
20
25
30
35
RF(13.56 MHz) Power (W)
SiH_4 25 sccm
Ar 475 sccm
1 Torr
2 Torr
3 Torr


A-Si Film Stress on SiO2 at 300 °C
0
-100
-200
-300
-400
-500
0
1
2
3
4
Film Stress (MPa)
Pressure (Torr)
SiH4 25 sccm
Ar 475 sccm
10 W
20 W
30 W


A-Si Film Stress on SiO2 at 200 °C
300
200
100
0
-100
0
1
2
3
4
Film Stress (MPa)
Pressure (Torr)
10 W
20 W
30 W
SiH4 25 sccm
Ar 475 sccm


A-Si Film Stress on SiO_2 at 200 °C
Film Stress (MPa)
300
200
100
0
-100
5
10
15
20
25
30
35
RF(13.56 MHz) Power (W)
1 Torr
2 Torr
3 Torr
SiH_4 25 sccm
Ar 475 sccm


A-Si Deposition Rate on SiO_2 at 200 °C
Deposition Rate (A/min)
500
400
300
200
5
10
15
20
25
30
RF(13.56 MHz) Power (W)
1 Torr
2 Torr
3 Torr
SiH_4 25 sccm
Ar 475 sccm

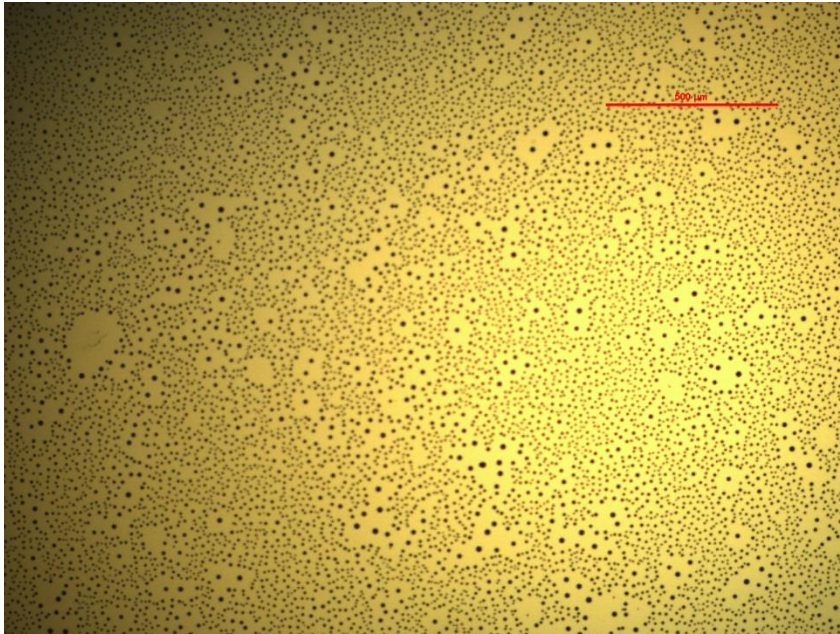
1. On a bare Si Wafer

SiH_4 25 sccm, Ar 475 sccm, RF forward 10 W @ 13.56 MHz, Pressure 1000 mTorr

(1) 300°C

Deposition rate: 19.8 nm/min

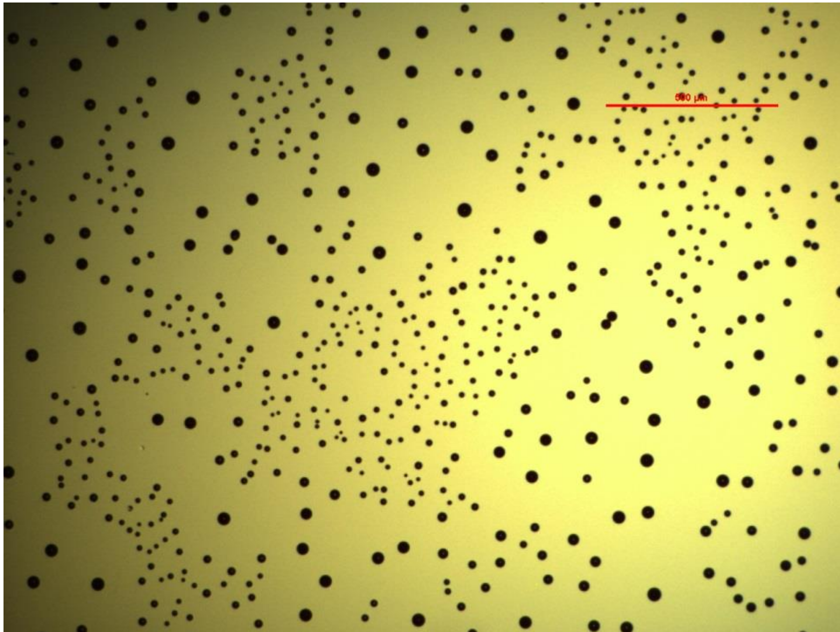
Film stress: -411 MPa film uniformity: +/- 38.2% bubbles



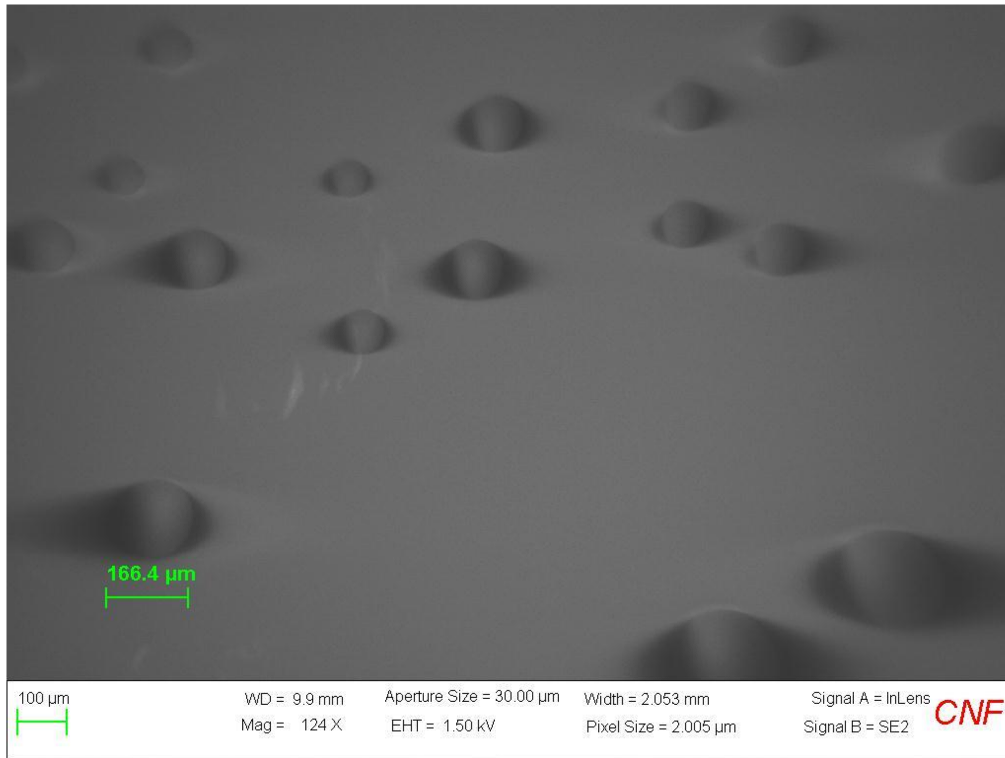
(2) 250°C

Deposition rate: 21.1 nm/min

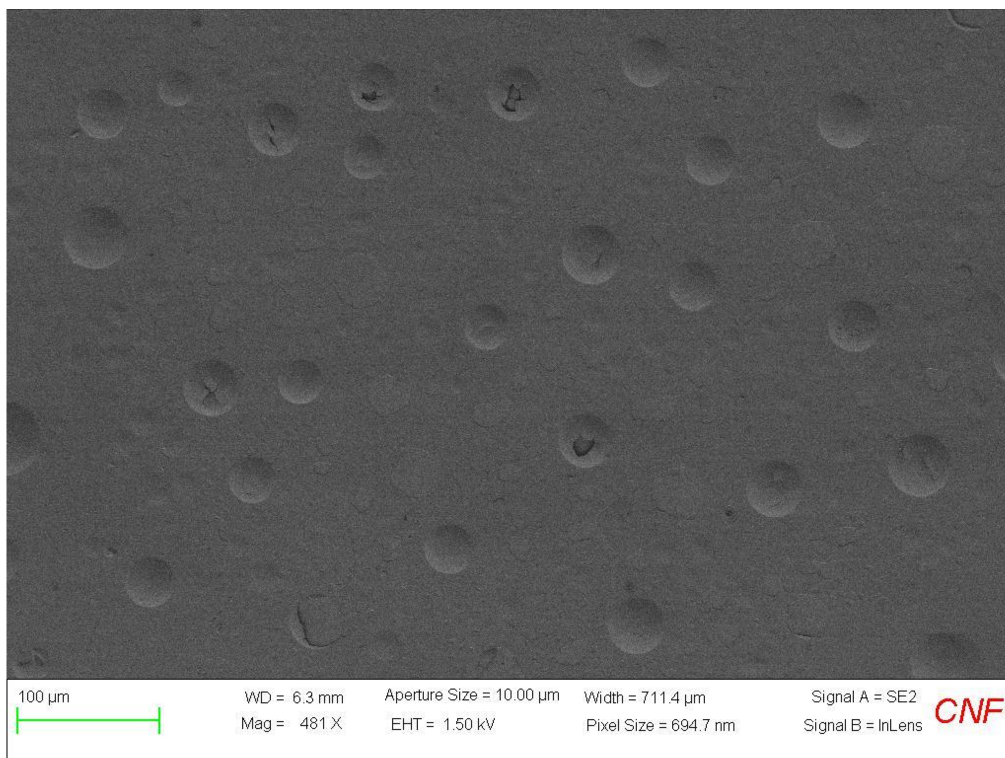
Film stress: -253 MPa film uniformity: +/- 3.1% bubbles



SEM images



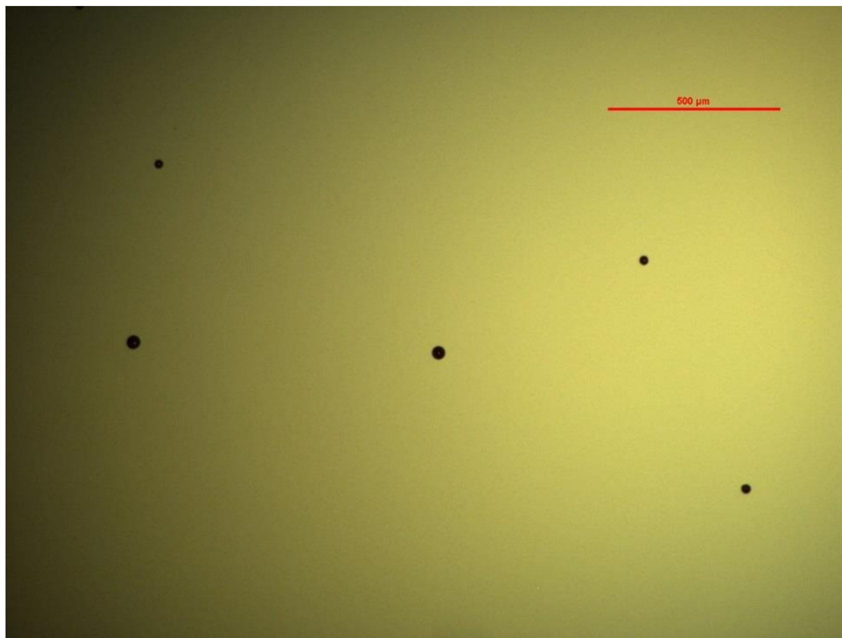
After being annealed at 400 °C for 5 mins:



(3) 200°C

Deposition rate: 21.3 nm/min

Film stress: -22 MPa film uniformity: +/- 1.9% bubbles



2. On an 80 nm SiO_2 layer coated wafer

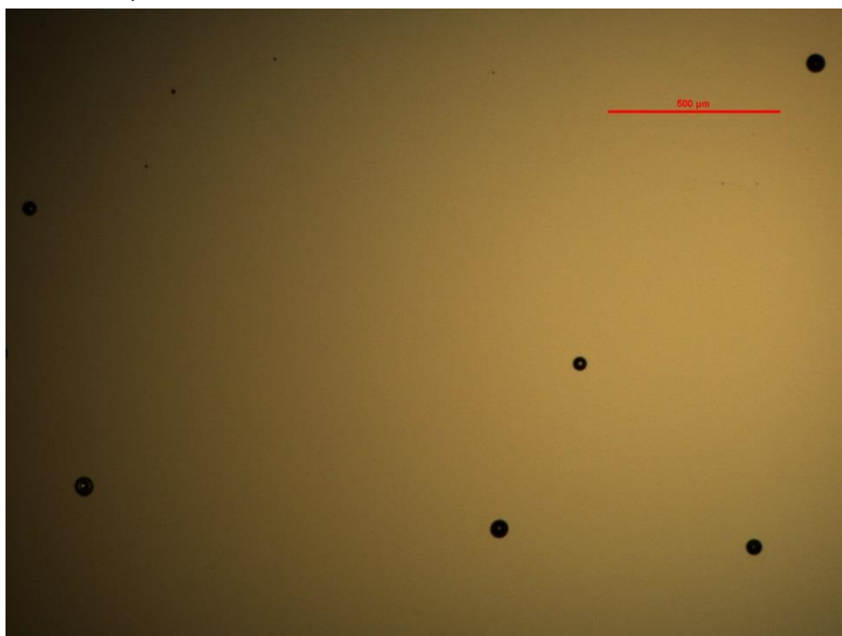
2.1 SiH_4 25 sccm, Ar 475 sccm, RF forward 10 W @ 13.56 MHz, Pressure 1000 mTorr

(1) 300°C

Deposition rate: 19.9 nm/min

Film stress: -447.076 MPa film uniformity: +/- 4.6%

15mins deposition film: bubble condition similar to 200 °C 15mins a-Si on a bare Si wafer



(2) 250°C

Deposition rate: 23.3 nm/min

Film stress: -233.623 MPa film uniformity: +/- 2.6%

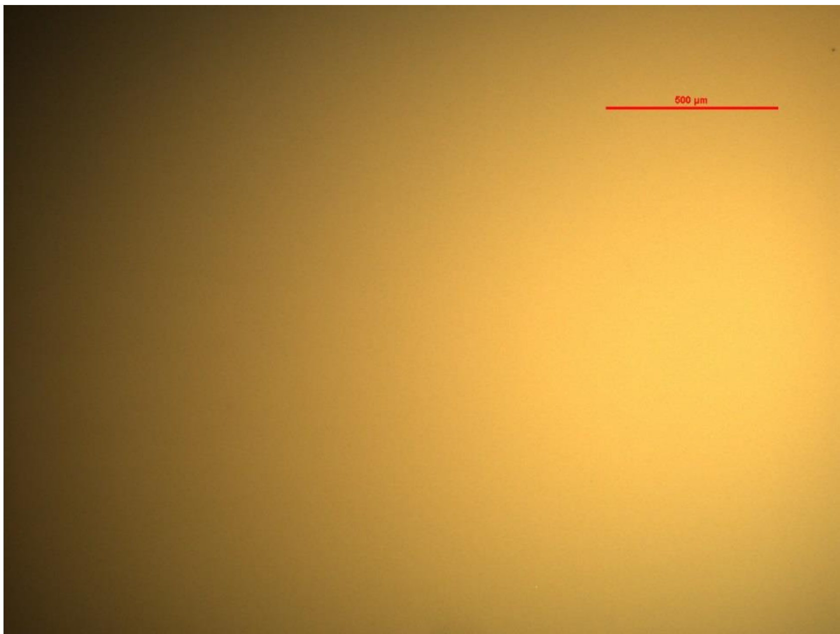
Good film with some small bubbles near the edge

(3) 200°C

Deposition rate: 23.3 nm/min

Film stress: -34.5 MPa film uniformity: +/- 2.1%

Good film, no bubble



2.2 SiH_4 25 sccm, Ar 475 sccm, 300 °C

(1) RF forward 10 W @ 13.56 MHz, Pressure 3000 mTorr

Deposition rate: 32 nm/min

Film stress: -96.7881 MPa film uniformity: +/- 3.4%

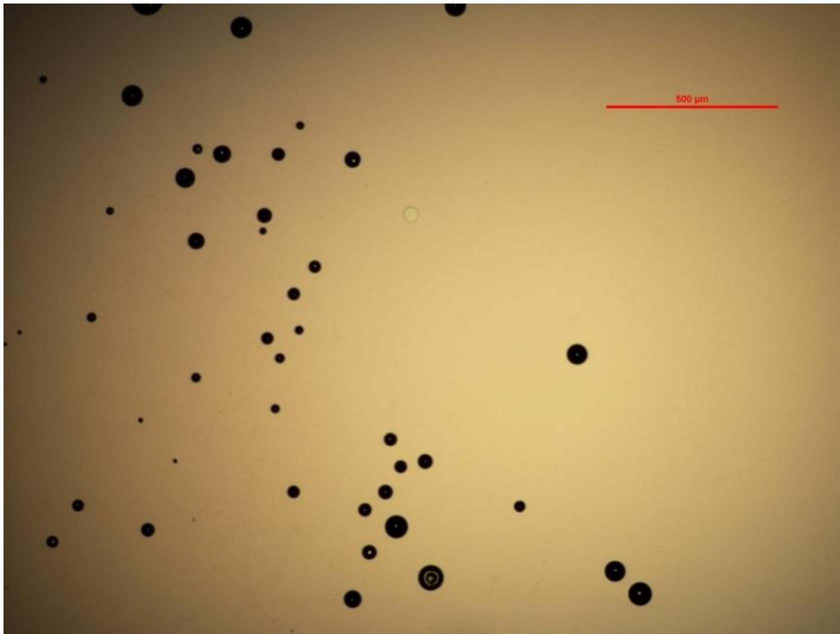
Good film

(2) RF forward 10 W @ 13.56 MHz, Pressure 2000 mTorr

Deposition rate: 31 nm/min

Film stress: -180.581 MPa film uniformity: +/- 2.7%

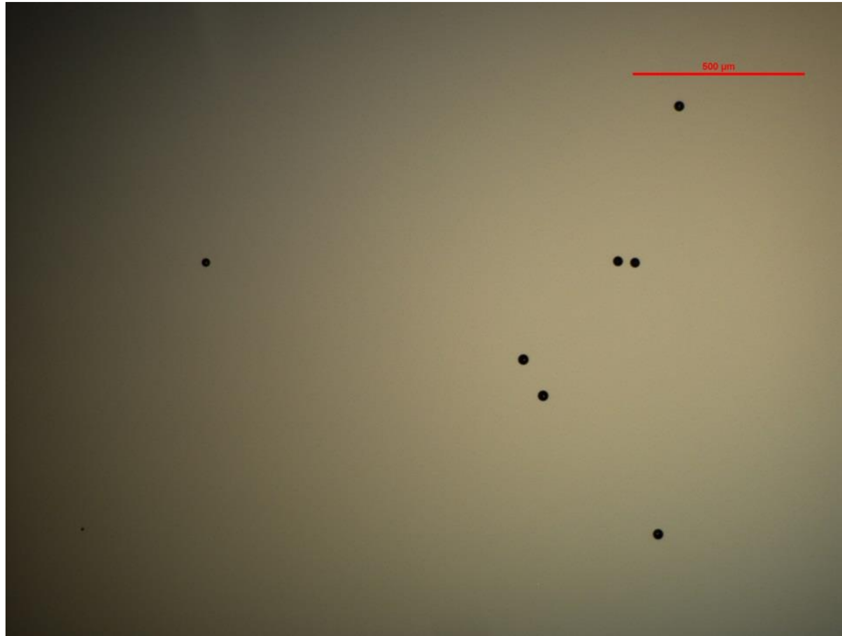
Some bubbles near edges



(3) RF forward 30 W @ 13.56 MHz, Pressure 1000 mTorr
Deposition rate: 45 nm/min
Film stress: -449.668 MPa film uniformity: +/- 3.1%
Some bubbles

(4) RF forward 30 W @ 13.56 MHz, Pressure 1000 mTorr
Deposition rate: 36 nm/min
Film stress: -423.042 MPa film uniformity: +/- 3.8%
Few bubbles

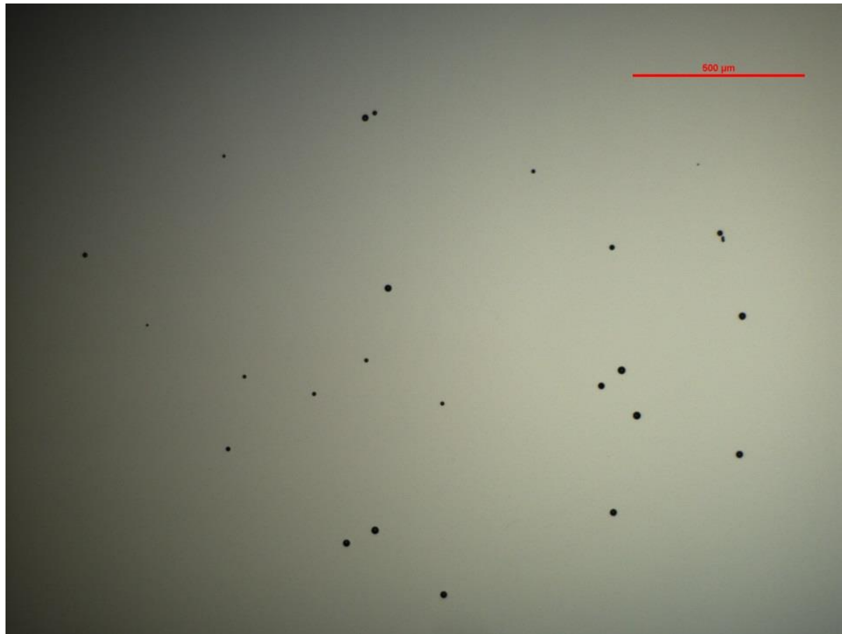
(5) RF forward 30 W @ 13.56 MHz, Pressure 3000 mTorr
Deposition rate: 51 nm/min
Film stress: -253.704 MPa film uniformity: +/- 1.9%
few bubbles



(6) RF forward 20 W @ 13.56 MHz, Pressure 3000 mTorr
Deposition rate: 46.1 nm/min
Film stress: -166.948 MPa film uniformity: +/- 2.8%
some bubbles

(7) RF forward 20 W @ 13.56 MHz, Pressure 2000 mTorr
Deposition rate: 45 nm/min
Film stress: -221.818 MPa film uniformity: +/- 2.1%
some bubbles

(8) RF forward 30 W @ 13.56 MHz, Pressure 2000 mTorr
Deposition rate: 52.5 nm/min
Film stress: -287.398 MPa film uniformity: +/- 1.9%
some bubbles



2.3 SiH_4 25 sccm, Ar 475 sccm, 200 °C

(1) RF forward 10 W @ 13.56 MHz, Pressure 3000 mTorr
Deposition rate: 24.9 nm/min
Film stress: 293.6912 MPa film uniformity: +/- 4.8%
Good film

(2) RF forward 10 W @ 13.56 MHz, Pressure 2000 mTorr
Deposition rate: 26.2 nm/min
Film stress: 178.5841 MPa film uniformity: +/- 2.7%
Good film

(3) RF forward 30 W @ 13.56 MHz, Pressure 1000 mTorr
Deposition rate: 44.6 nm/min
Film stress: -62.5593 MPa film uniformity: +/- 1.8%
Good film

(4) RF forward 20 W @ 13.56 MHz, Pressure 1000 mTorr
Deposition rate: 36.7 nm/min
Film stress: -34.4363 MPa film uniformity: +/- 2.1%
Good film

(5) RF forward 30 W @ 13.56 MHz, Pressure 3000 mTorr
Deposition rate: 41.2 nm/min
Film stress: -28.8 MPa film uniformity: +/- 1.3%
Good film

(6) RF forward 20 W @ 13.56 MHz, Pressure 3000 mTorr
Deposition rate: 37.2 nm/min
Film stress: 123.1 MPa film uniformity: +/- 2.8%
Good film

(7) RF forward 20 W @ 13.56 MHz, Pressure 2000 mTorr
Deposition rate: 38.5 nm/min
Film stress: 87.3 MPa film uniformity: +/- 2.0%
Good film

(8) RF forward 30 W @ 13.56 MHz, Pressure 2000 mTorr
Deposition rate: 44.66 nm/min
Film stress: 6.23 MPa film uniformity: +/- 3.5%
Good film