

Spool: 180.0°C

Helium Pressure: 6,000.0 mTorr

Lid: 150.0°C

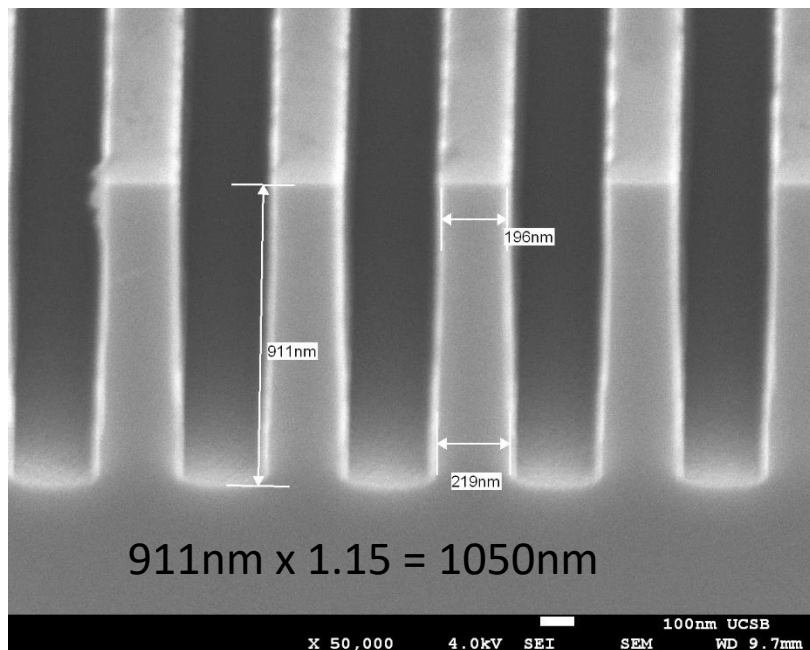
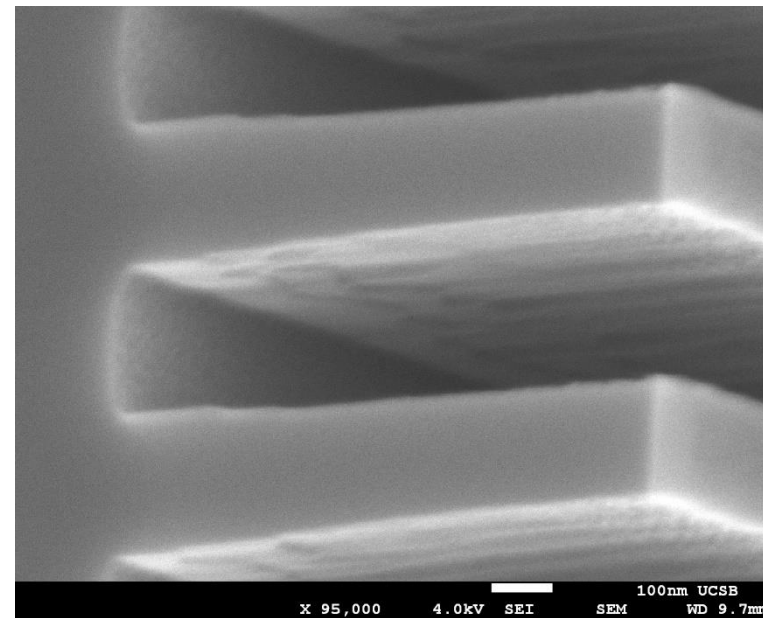
Liner: 70.0°C

Electrode: 15.0°C

- 1) < Initial >
- 2) < Chuck >
- 3) Light
- 4) Si Etch
- 5) Discharge
- 6) < Dechuck >
- 7) < End >

	1.	2.	3.	4.	5.	6.	7.
	< Initial >	< Chuck >	Light	Si Etch	Discharge	< Dechuck >	< End >
Duration	0:10.0		0:03.0	2:00.0	0:05.0		0:10.0
Pressure	1.0	15.0	15.0	5.0	20.0		1.0
T.V. Pos						100.0	
C4F8		22.0	22.0	21.0	↓ 1.0	0.0	
SF6		↓ 18.0	↓ 18.0	19.0	↓ 1.0	0.0	
Ar		0.0	0.0	0.0	50.0	0.0	
LF Bias		0	0	0	0	0	
HF Bias		0.0	50.0	30.0	0.0	0.0	
Mode		Manual	Auto	Auto	Auto	Auto	
Load		50.0					
Tune		50.0					
ICP		0	800	600	600	0	
Mode		Manual	Auto	Auto	Auto	Auto	
Load		33.0					
Tune		65.0					

## Standard Etch, NOT Pulsed



510nm/min for 3.5:1 AR  
 20-25nm mesa increase at 1um depth  
 Sidewall roughness limited by mask  
 284nm SiO2 etched: ~4:1 Etch Ratio

21:19 C4F8:SF6  
 5mT, 600W/30W

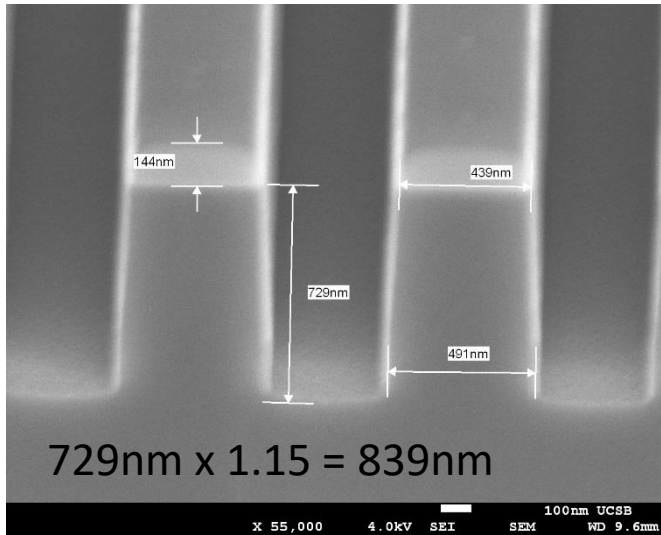
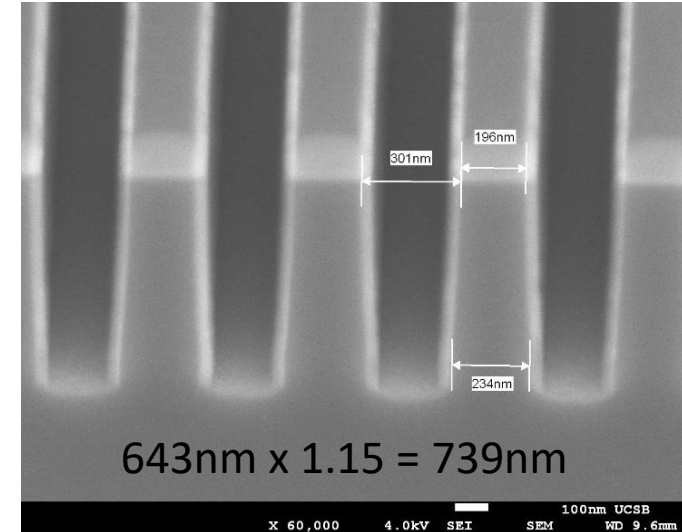
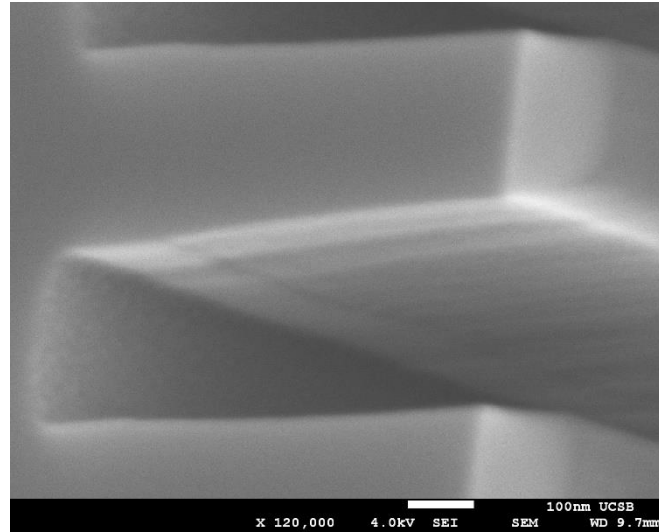
Spool: 180.0°C  
 Lid: 150.0°C  
 Liner: 70.0°C  
 Electrode: 15.0°C

Helium Pressure: 6,000.0 mTorr

- 1) < Initial >
- 2) < Chuck >
- 3) Light
- 4) Si Etch
- 5) Discharge
- 6) < Dechuck >
- 7) < End >

	1.	2.	3.	4.	5.	6.	7.
	< Initial >	< Chuck >	Light	Si Etch	Discharge	< Dechuck >	< End >
Duration	0:10.0		0:03.0	1:30.0	0:05.0		0:10.0
Pressure	1.0	15.0	15.0	5.0	20.0		1.0
T.V. Pos						100.0	
C4F8		22.0	22.0	22.0	1.0	0.0	
SF6		18.0	18.0	18.0	1.0	0.0	
Ar		0.0	0.0	0.0	50.0	0.0	
LF Bias		0	0	0	0	0	
HF Bias		0.0	50.0	30.0	0.0	0.0	
Mode		Manual	Auto	Auto	Auto	Auto	
Load		50.0					
Tune		50.0					
ICP		0	800	600	600	0	
Mode		Manual	Auto	Auto	Auto	Auto	
Load		33.0					
Tune		65.0					

# NOT Pulsed, Small Gas Change Only



493 nm/min for 2.5:1 Aspect Ratio  
 30-35nm increase at 740nm depth  
 ~4:1 Etch ratio with SiO2

22:18 C4F8:SF6  
 5mT, 600W/30W

Spool: 180.0°C

Helium Pressure: 6,000.0 mTorr

Lid: 150.0°C

Liner: 70.0°C

Electrode: 15.0°C

- 1) < Initial >
- 2) < Chuck >
- 3) Light
- 4) Si Etch Match
- 5) Si Etch Pulsed
- 6) Discharge
- 7) Cooldown
- 8) < Dechuck >
- 9) < End >

# Using Pulsed HF Bias for Rate Control

	1.	2.	3.	4.	5.	6.	7.	8.	9.
	< Initial >	< Chuck >	Light	Si Etch Match	Si Etch Pulsed	Discharge	Cooldown	< Dechuck >	< End >
Duration	0:10.0		0:03.0	0:01.0	2:00.0	0:05.0	0:30.0		0:10.0
Pressure	1.0	5.0	5.0	5.0	5.0	20.0			1.0
T.V. Pos							100.0	100.0	
C4F8		25.0	25.0	25.0	25.0	↓ 1.0	0.0	0.0	
SF6		↓ 15.0	↓ 15.0	15.0	15.0	↓ 1.0	0.0	0.0	
Ar		0.0	0.0	0.0	0.0	50.0	0.0	0.0	
LF Bias		0	0	0	0	0	0	0	
HF Bias		0.0	50.0	30.0	45.0	0.0	0.0	0.0	
Mode		Manual	Auto	Man→Auto	Hold	Auto	Auto	Auto	
Load		35.0		37.0					
Tune		35.0		32.0					
ICP		0	600	600	600	600	0	0	
Mode		Manual	Auto	Auto	Auto	Auto	Auto	Auto	
Load		33.0							
Tune		65.0							

Recipe with pulsing of HF Bias for rate reduction  
 Si Etch Match step is for RF matching  
 Si Etch Pulse step is for actual etch step: Hold Match

Si Etch Pulsed step details:  
 Change period and On time for pulsing  
 RF Matching is on Hold from Match step  
 You cannot Auto Match HF Bias while pulsing!

Step Name: Si Etch Pulsed    Description:     Restart Step

**Step Termination**

End By: Fixed Time

Time: 2 : 0.0 min : s

**Gas (sccm)**

C4F8	21.0	<input type="checkbox"/>
SF6	19.0	<input type="checkbox"/>
Ar	0.0	<input type="checkbox"/>
O2	0.0	<input type="checkbox"/>
CF4	0.0	<input type="checkbox"/>

**RF**

LF Bias

Setpoint: 0 V

Waveform: 1

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HF Bias

Setpoint: 30 W

Pulse

Period: 1000 On: 200 μs

AMN Mode: Hold Position

Load/Tune: 50.0 / 50.0 %

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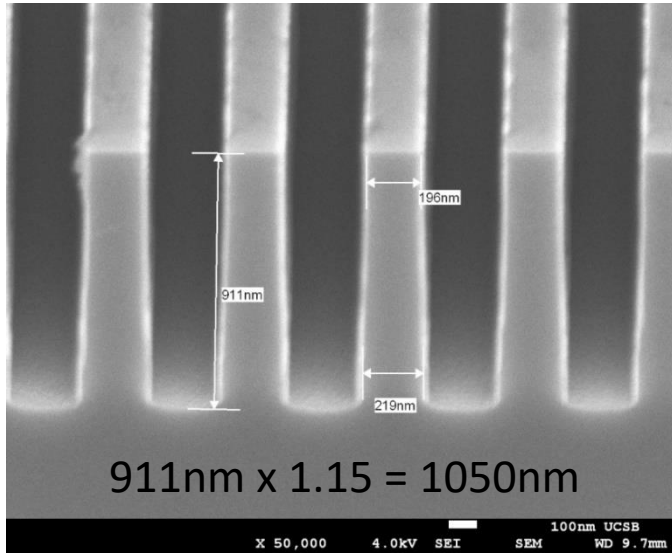
ICP

Setpoint: 600 W

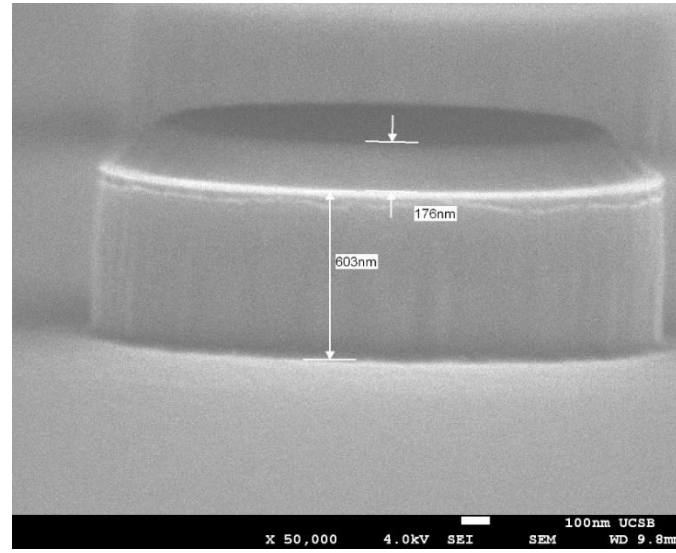
AMN Mode: Automatic

Load/Tune: 35.0 / 75.0 %

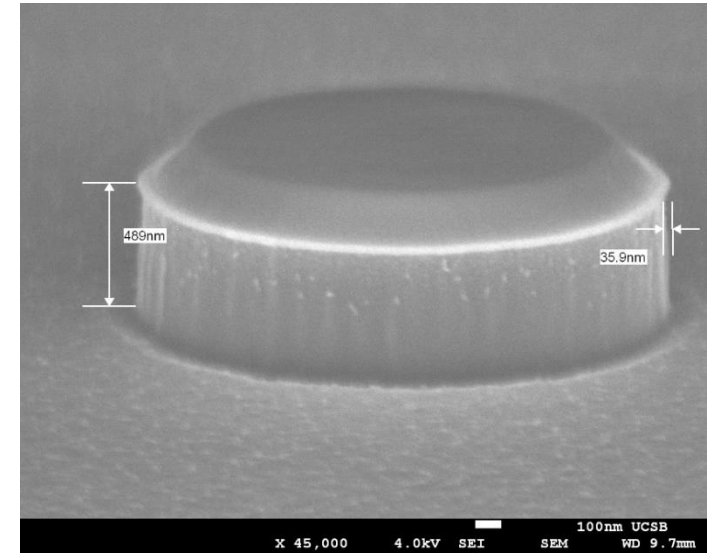
# Process Data 1: Trends changing pulse parameters and gas flows



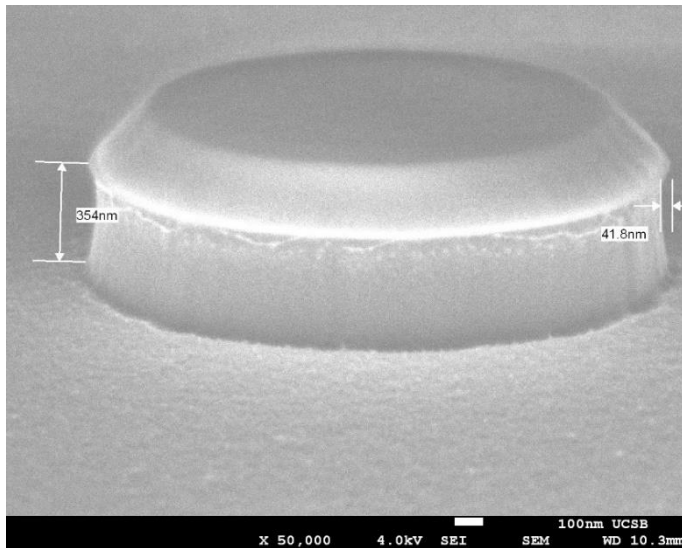
Std No pulsing: 525nm/min  
C4F8/SF6: 21/19, 30W HF



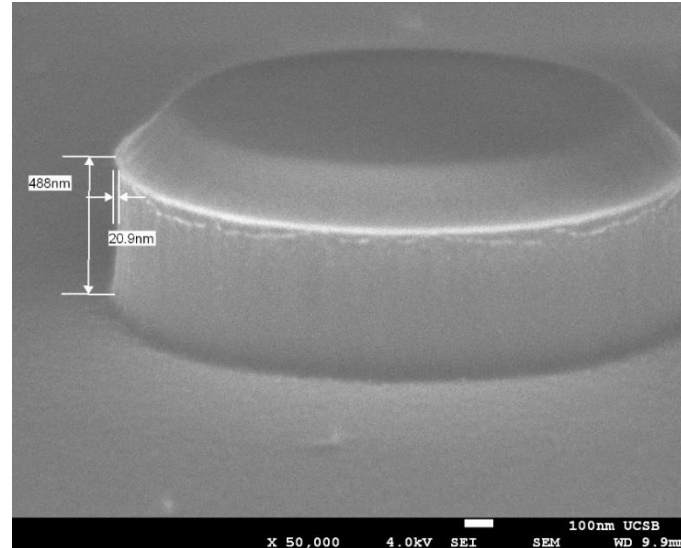
Perd/On time 1000/200us : 301nm/min  
C4F8/SF6: 21/19, 30W HF (#4)



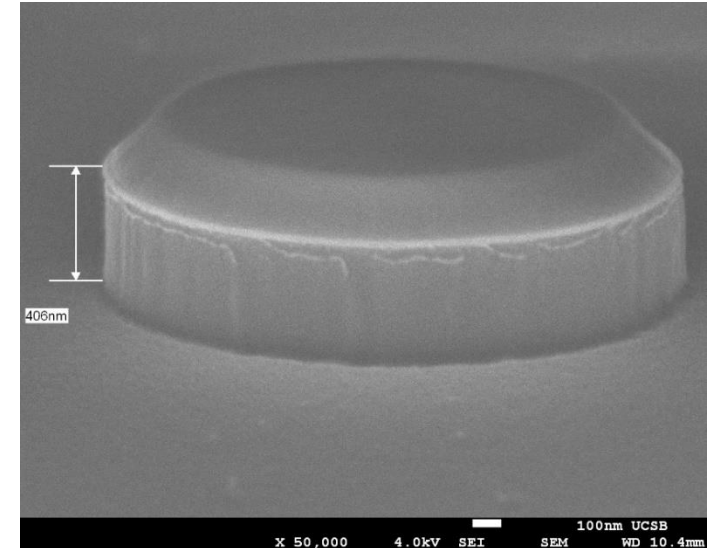
Perd/On time 1000/100us : 245nm/min  
C4F8/SF6: 21/19, 30W HF (#7)



Perd/On time 1000/50us : 176nm/min  
C4F8/SF6: 21/19, 30W HF (#8)



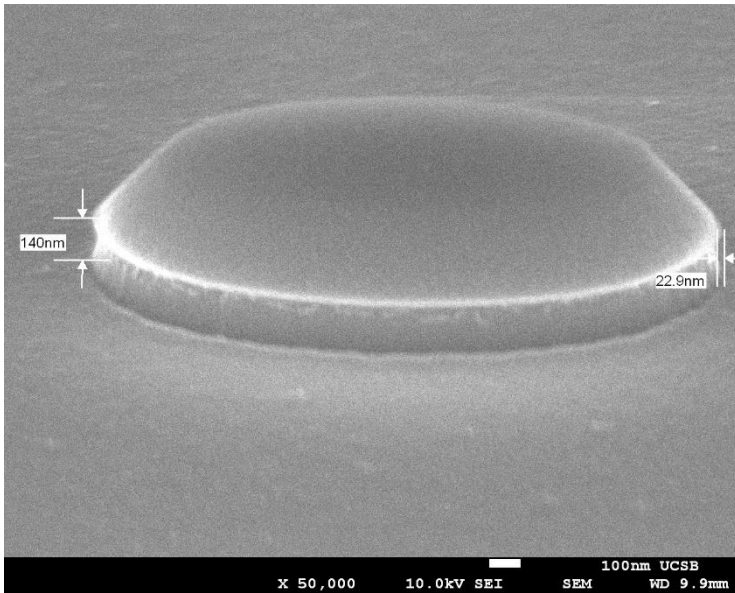
Perd/On time 1000/200us : 245nm/min  
C4F8/SF6: 21/19, 15W HF (#9)



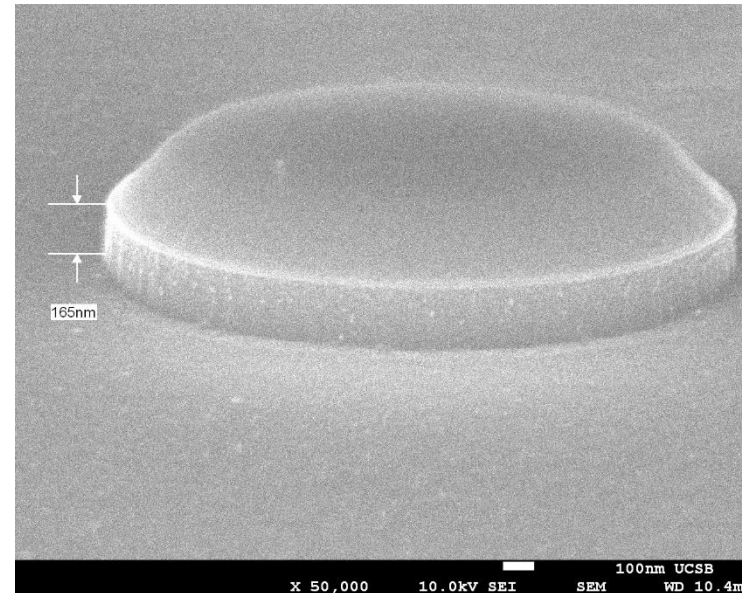
Perd/On time 1000/100us : 203nm/min  
C4F8/SF6: 22/18, 30W HF (#10)



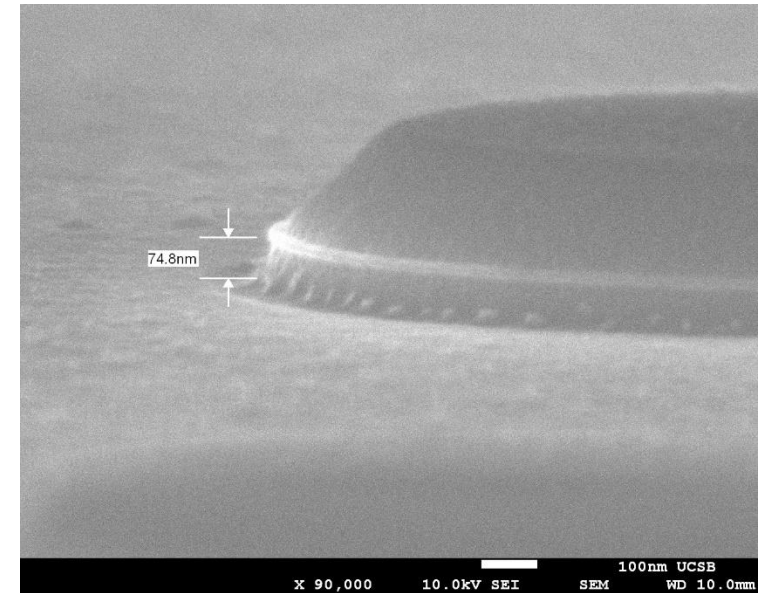
# Process Data 2: Attempts at very slow etch rates, gas flow changes with short pulses



Perd/On time 1000/50us : 70 nm/min  
C4F8/SF6: 23/17, 30W HF (#11)



Perd/On time 1000/50us : 95nm/min  
C4F8/SF6: 24/16, 60W HF (#14)



Perd/On time 1000/50us : 38nm/min  
C4F8/SF6: 25/15, 45W HF (#19)

