

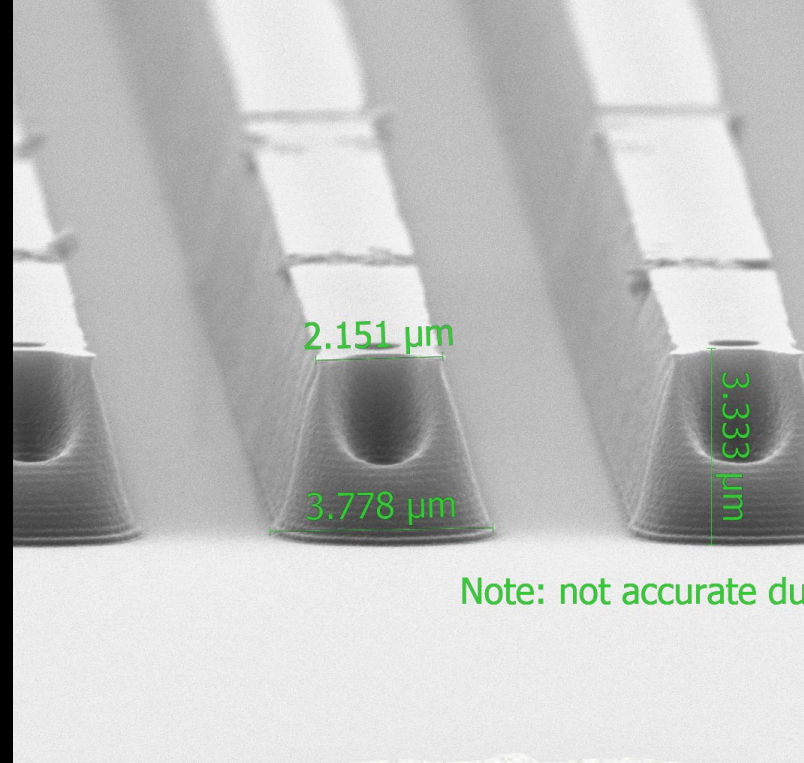
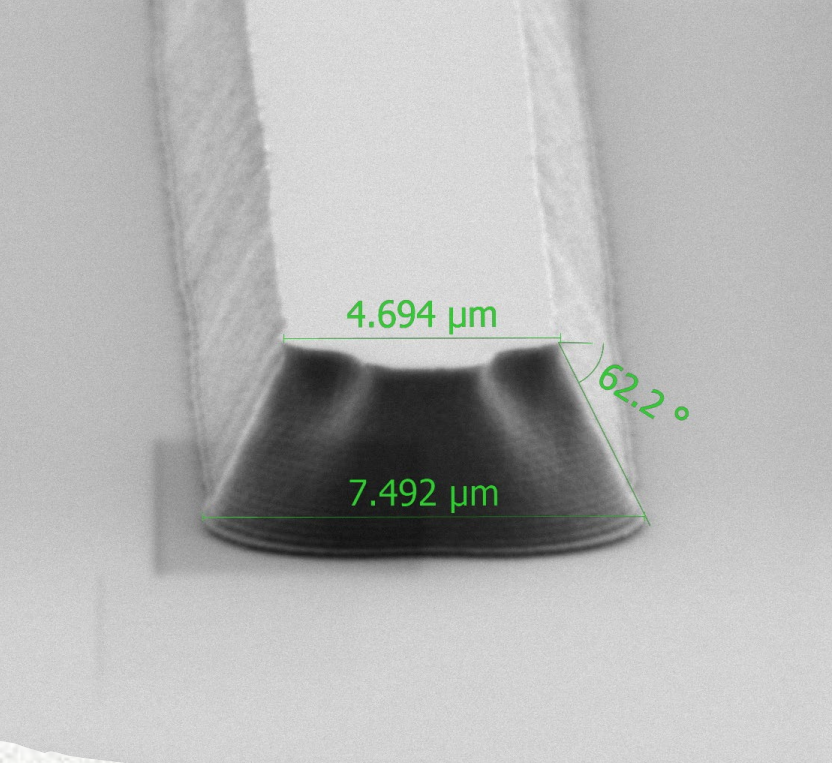
Characterization of 1827 and AZ 4620 Photoresist Profiles

- Goal: To achieve >87 deg Sidewalls
- Conditions: 12.1 mW/cm² at 436 nm
- Using an MA-6 Suss Mask Aligner
- All soft bakes at 115°C for 2 min, on a hot plate

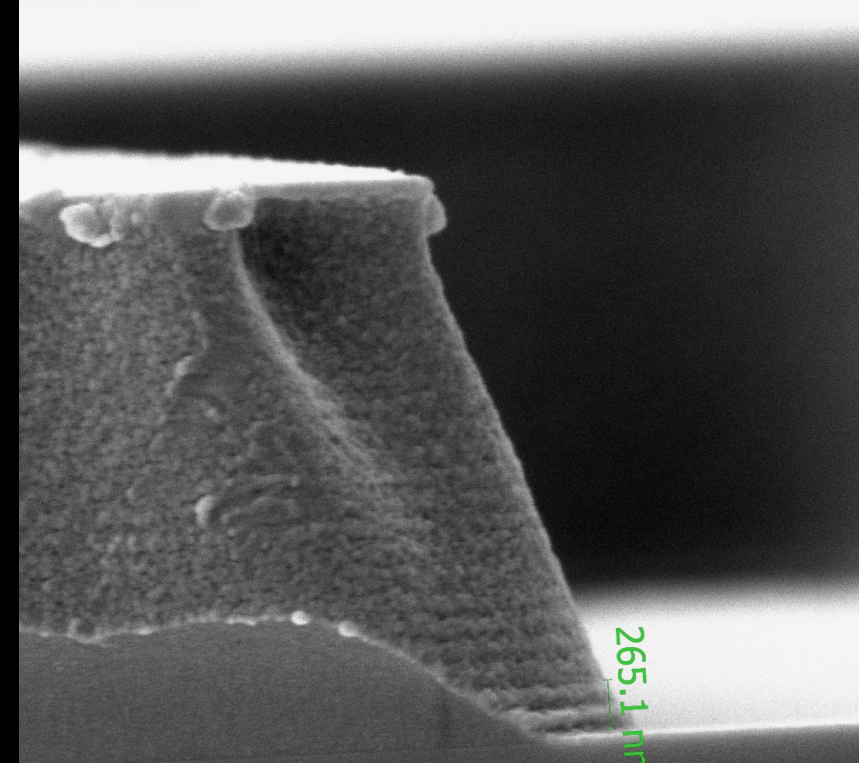


Resist: 1827 Hard Contact
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: 2 min, 115C

Develop: ?
Angle: N/A
Imaged: Feb. 20, 2023

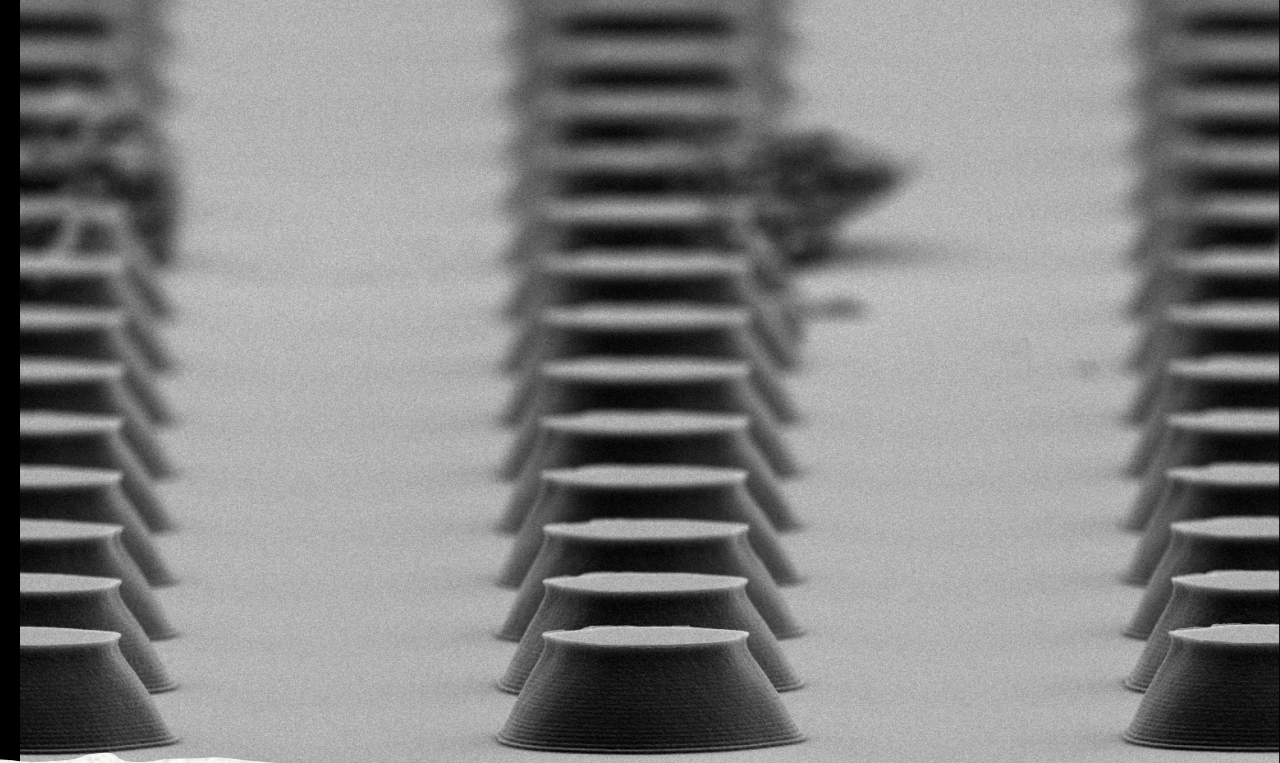
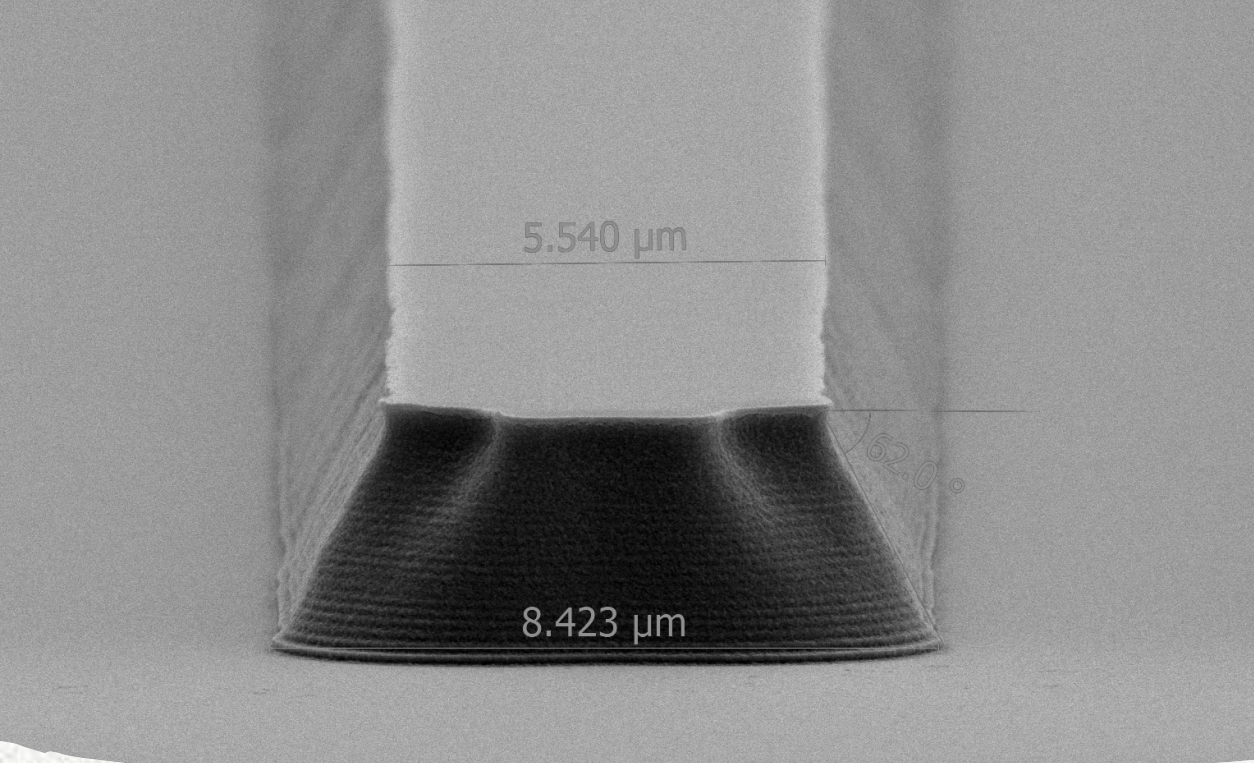


Note: not accurate due to



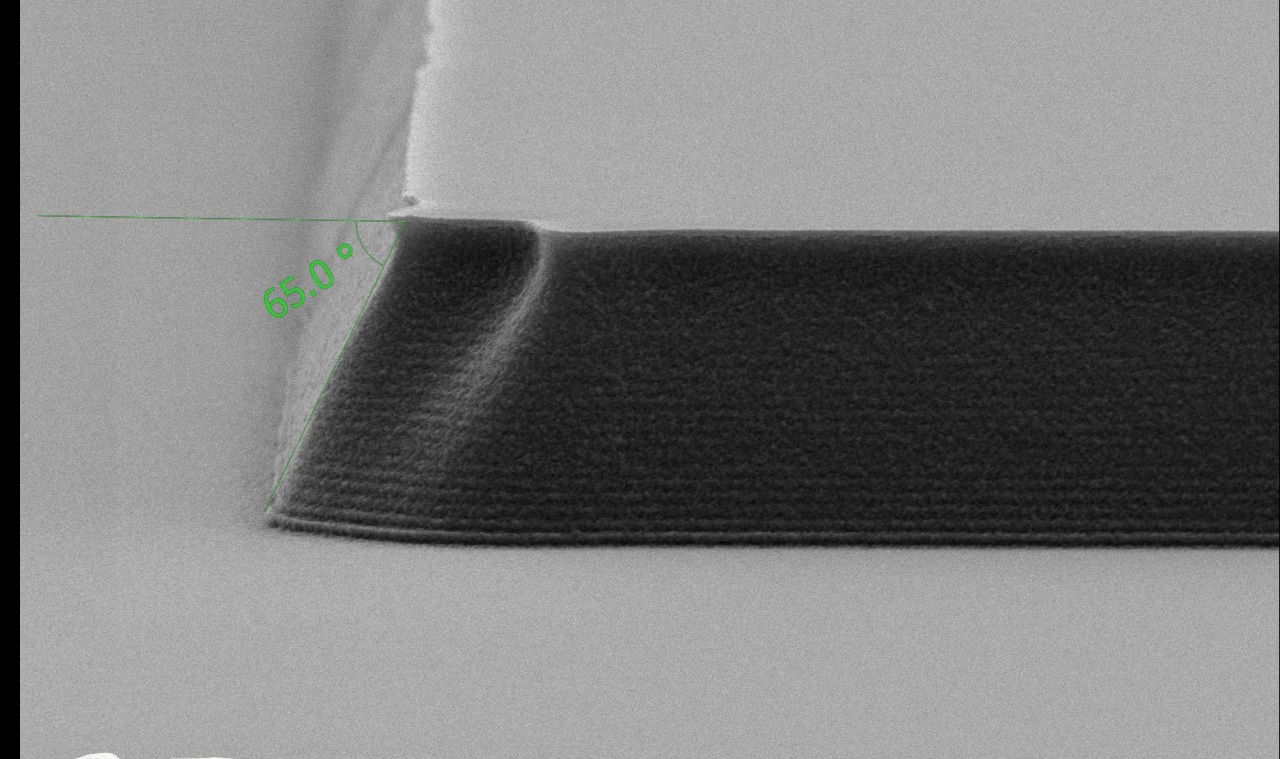
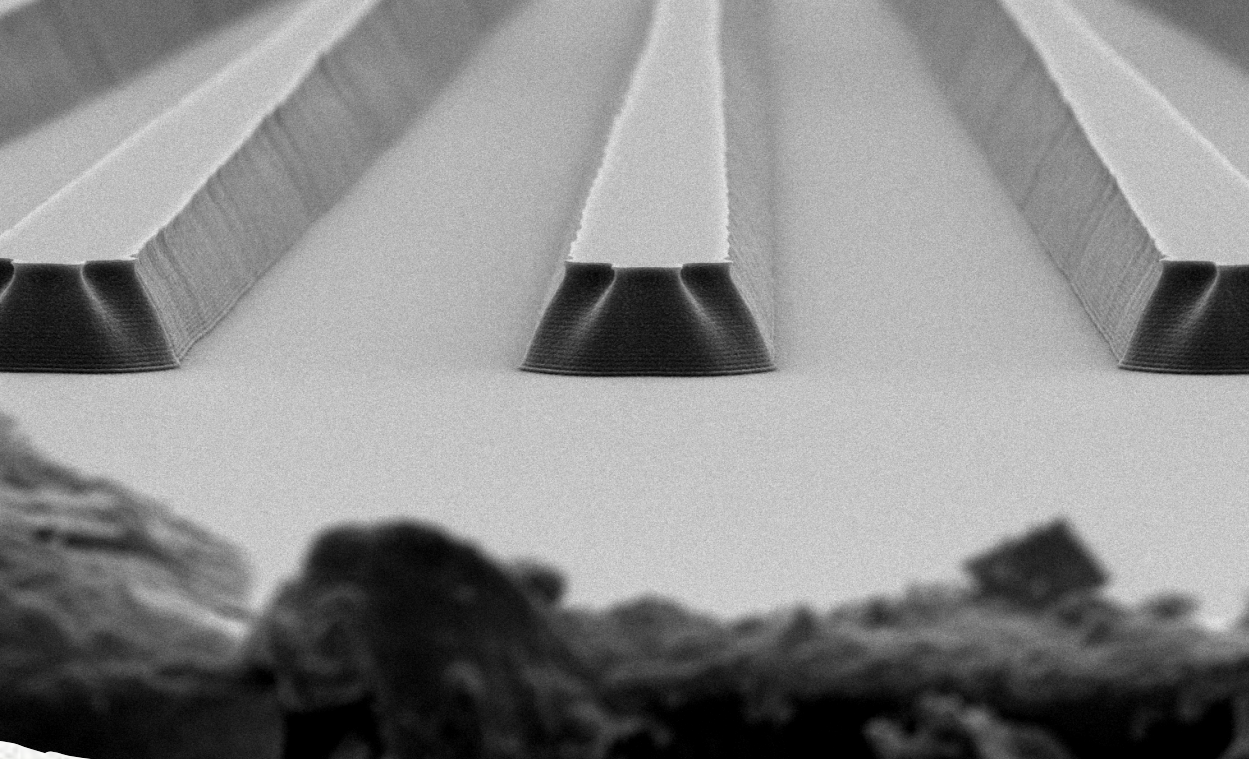
Resist: 1827 Hard Contact
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

Develop: ?
Angle: 62.2°
Imaged: Feb. 21, 2023



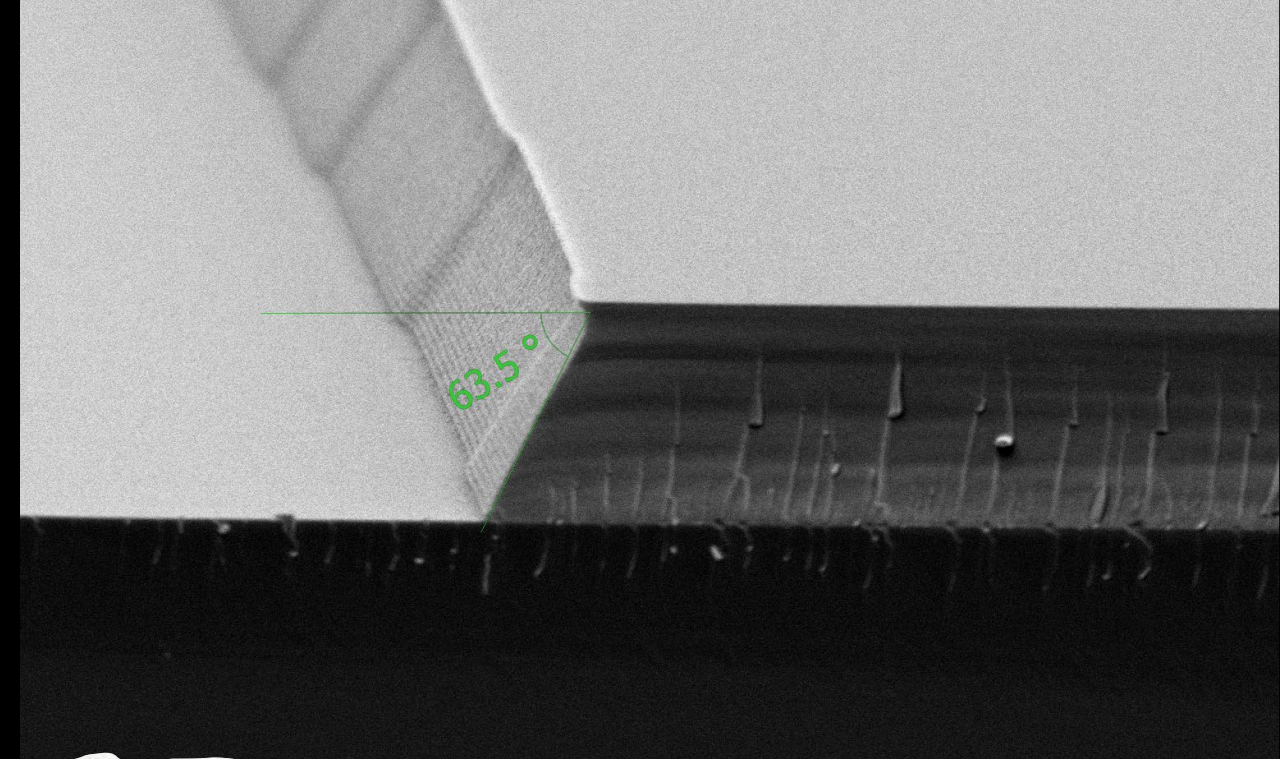
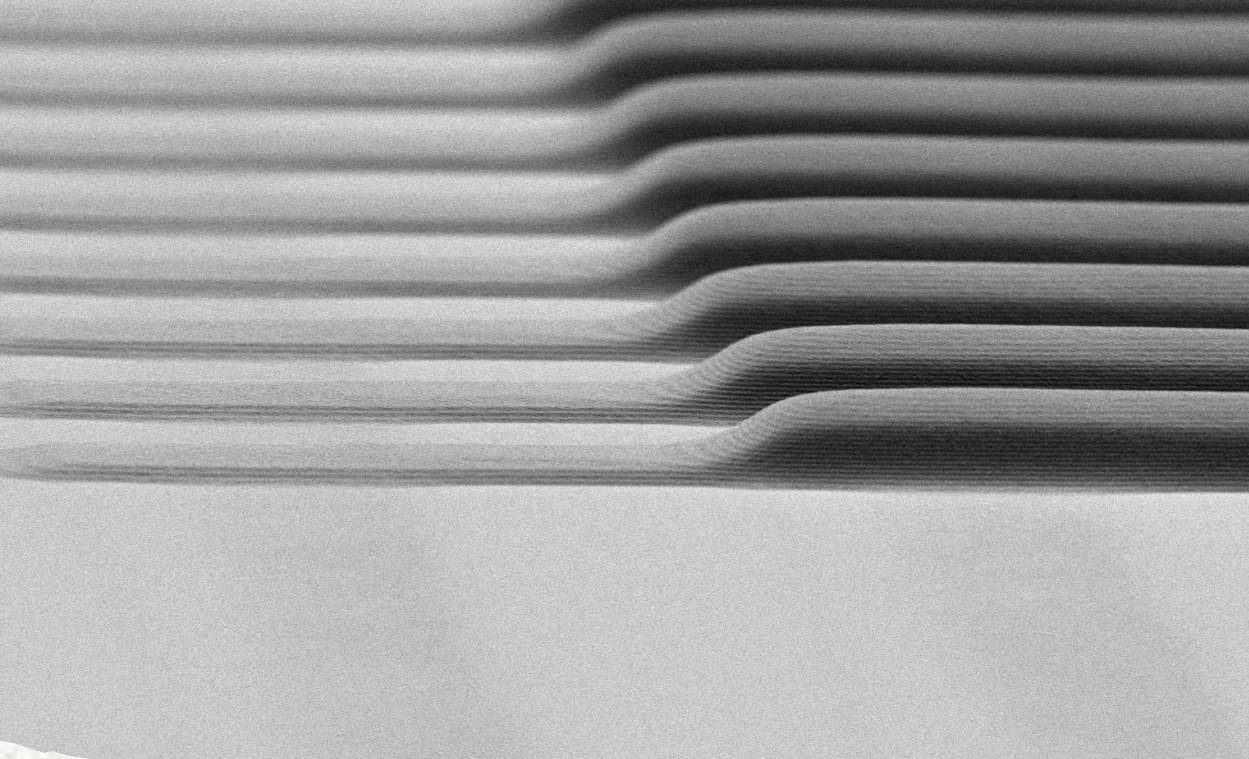
Resist: 1827 Hard Contact
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: Overnight at vacuum, 90°C

Develop: ?
Angle: 62.0°
Imaged: 2/22/2023



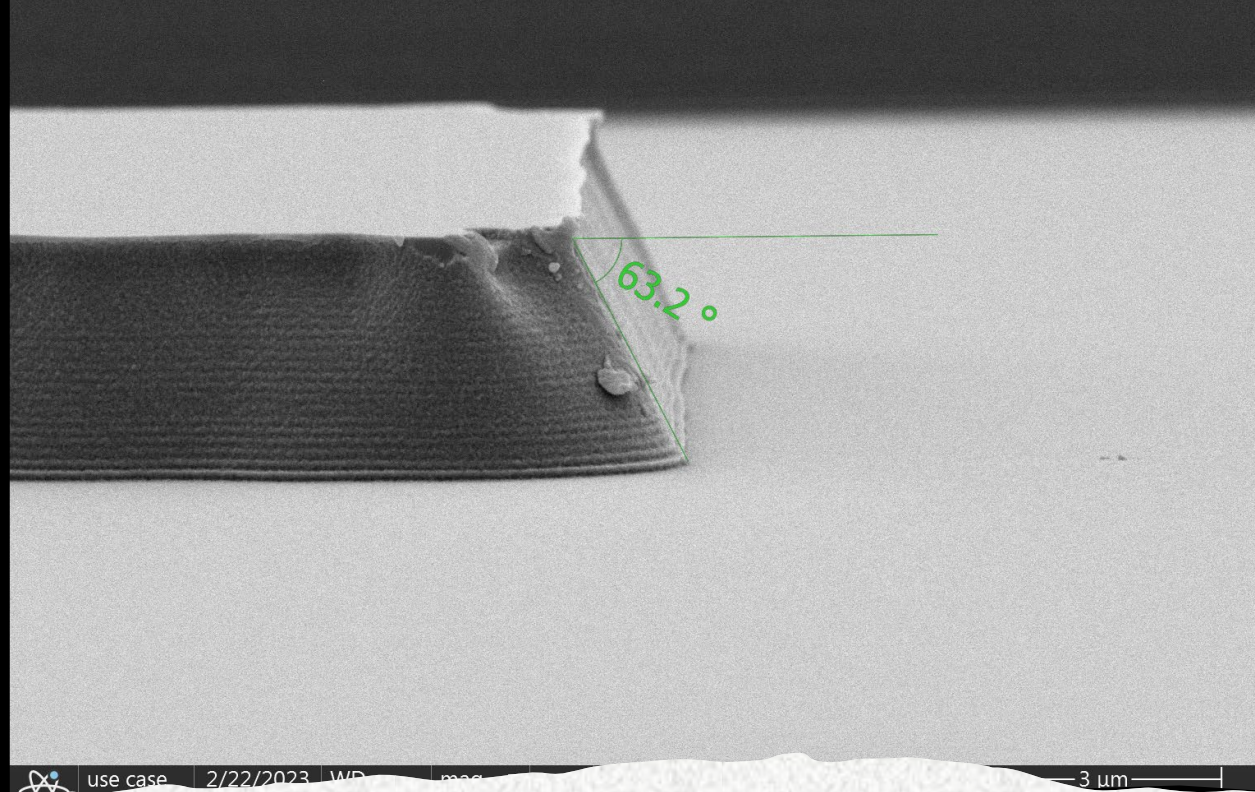
Resist: 1827 Hard Contact – Over expose
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 24 sec
Hard bake: None

Develop: ?
Angle: 65.0°
Imaged: 2/22/2023



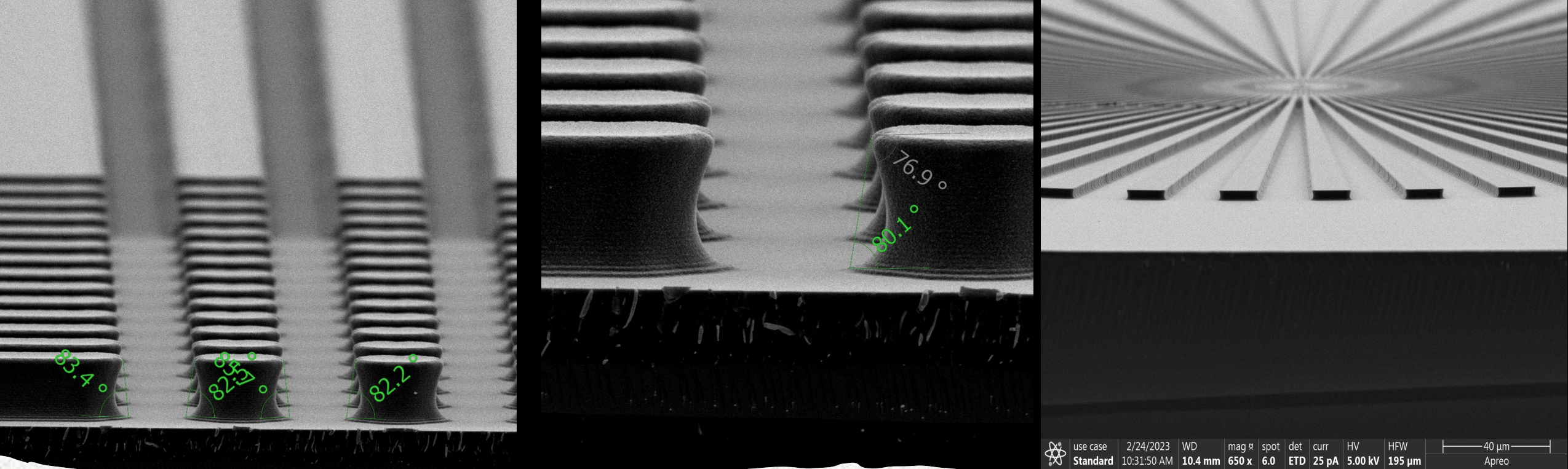
Resist: 1827 Direct write
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: N/A
Hard bake: None

Develop: ?
Angle: 63.5°
Imaged: 2/22/2023



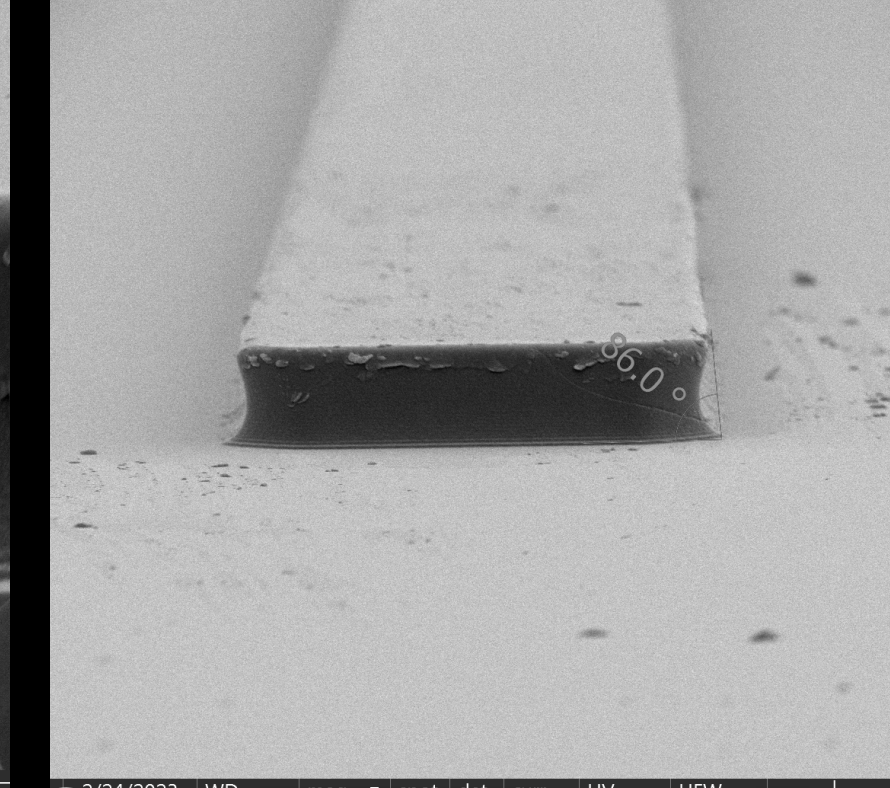
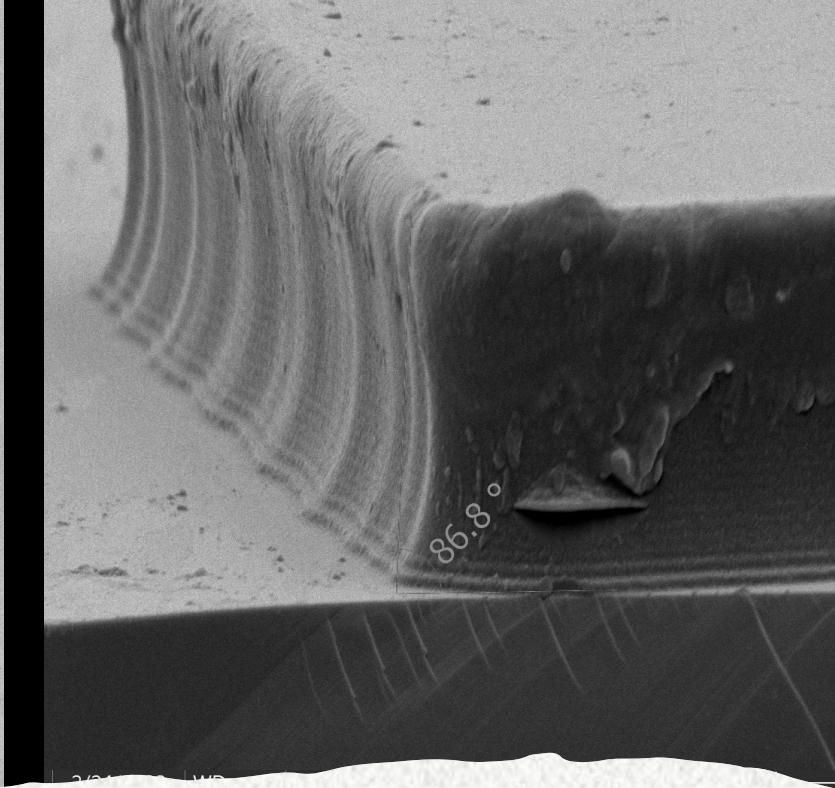
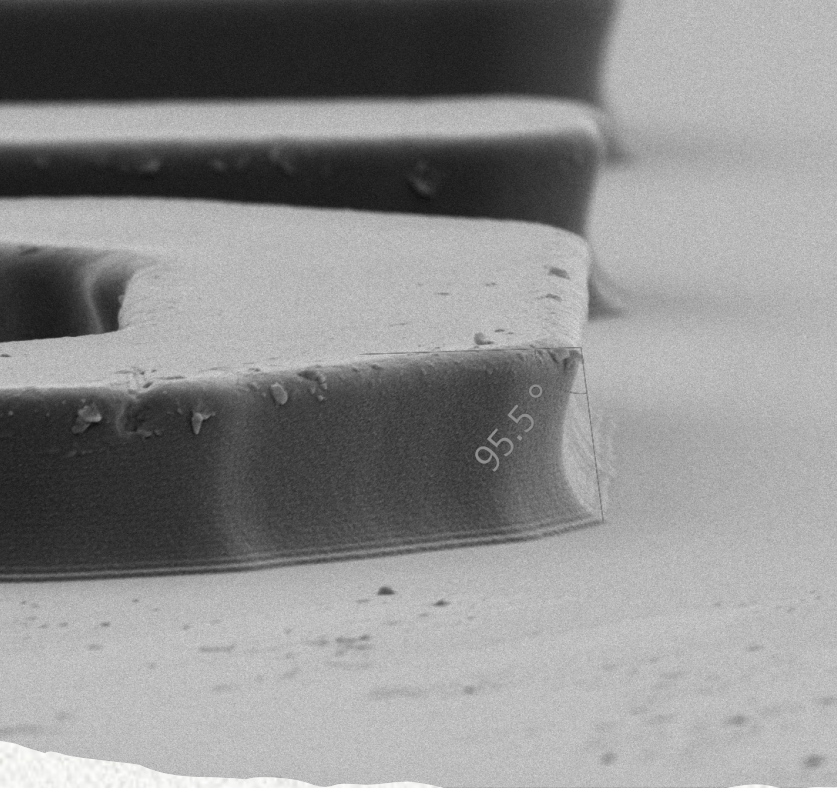
Resist: 1827 Hard Contact – Fresh resist
from freezer
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

Develop: ?
Angle: 63.2°
Imaged: 2/22/2023



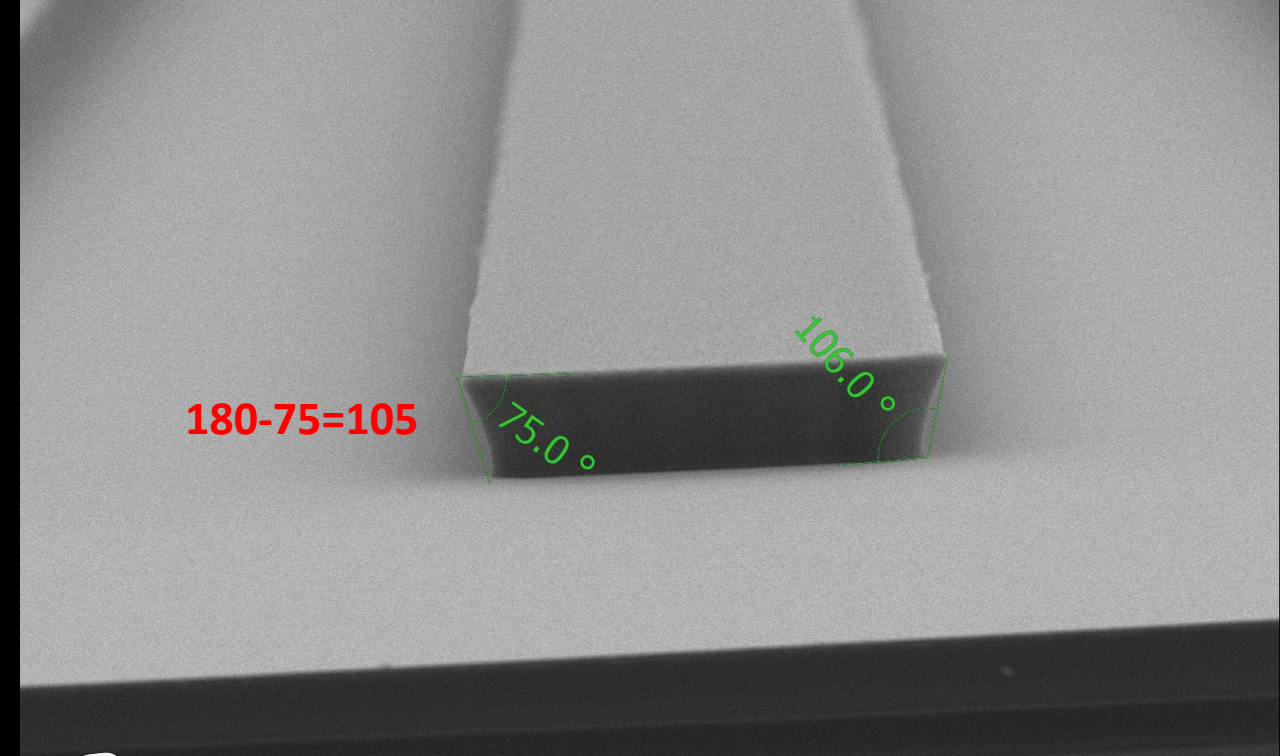
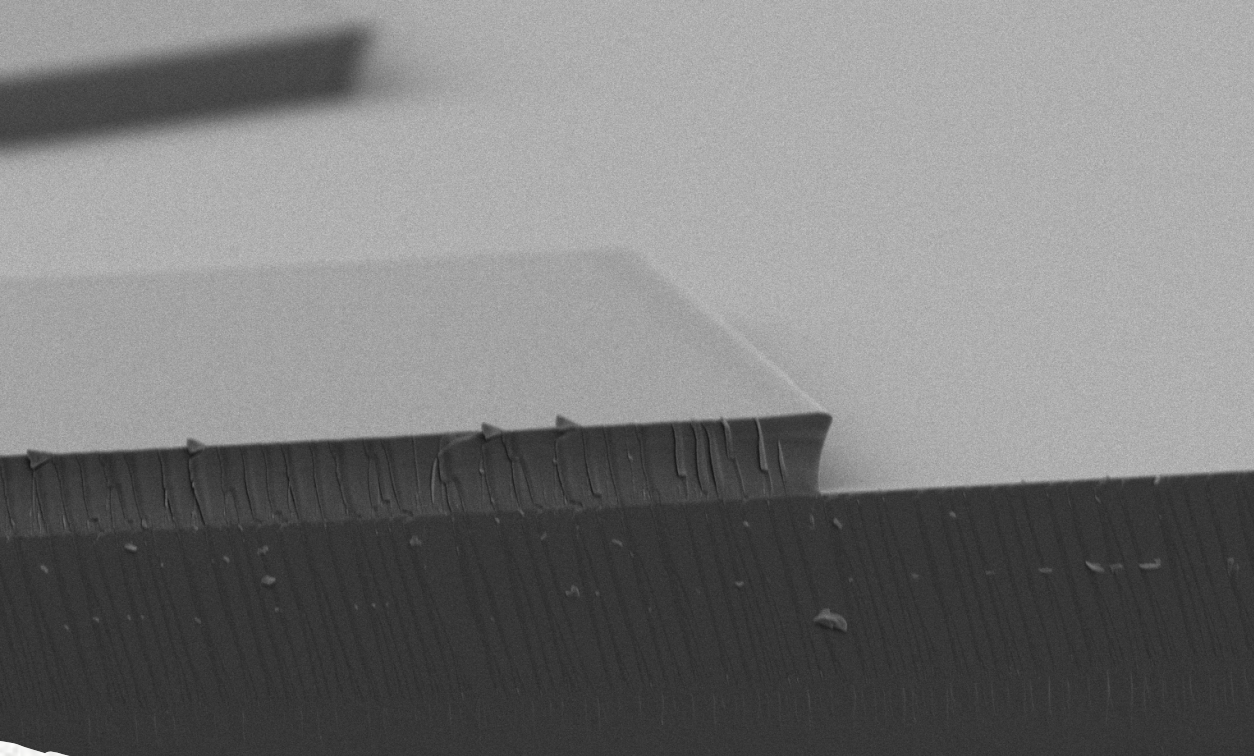
Resist: 1827 Hard Contact – Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake

Flood E.: 30 sec,
Develop: 2 min
Angle is 80 - 106°
Imaged Feb 24, 2023



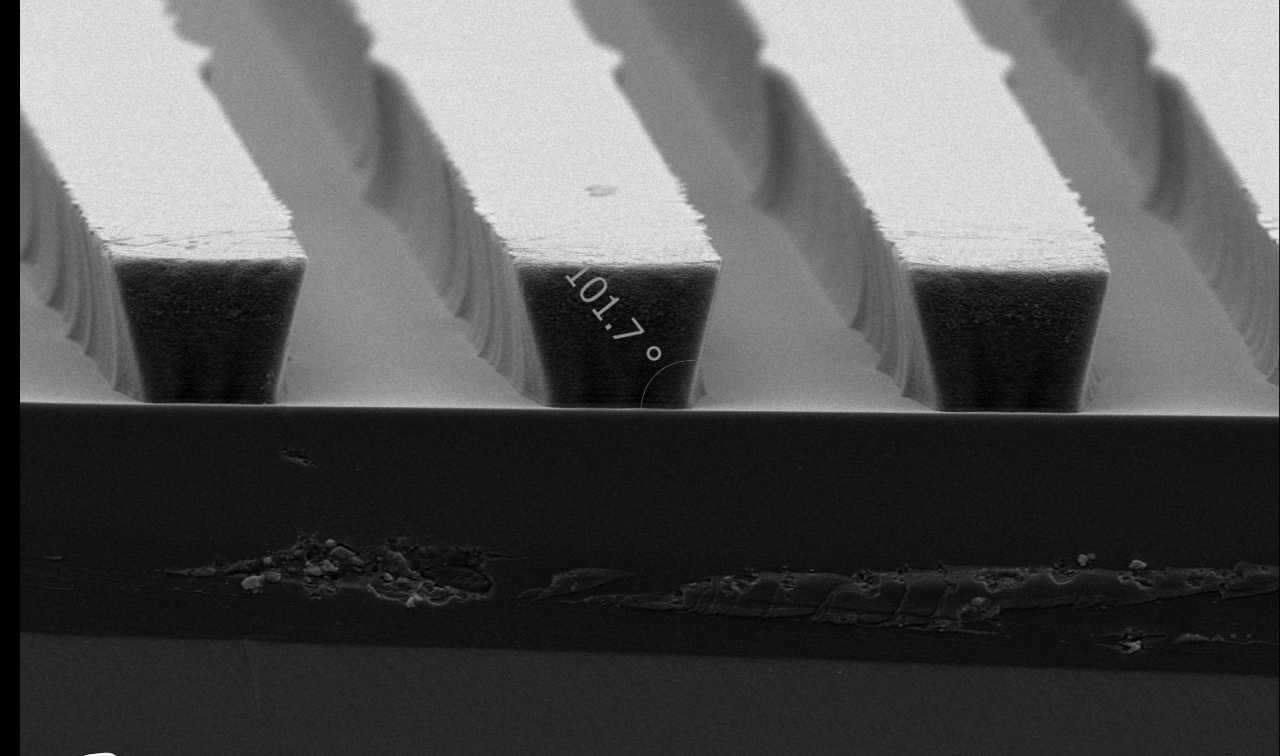
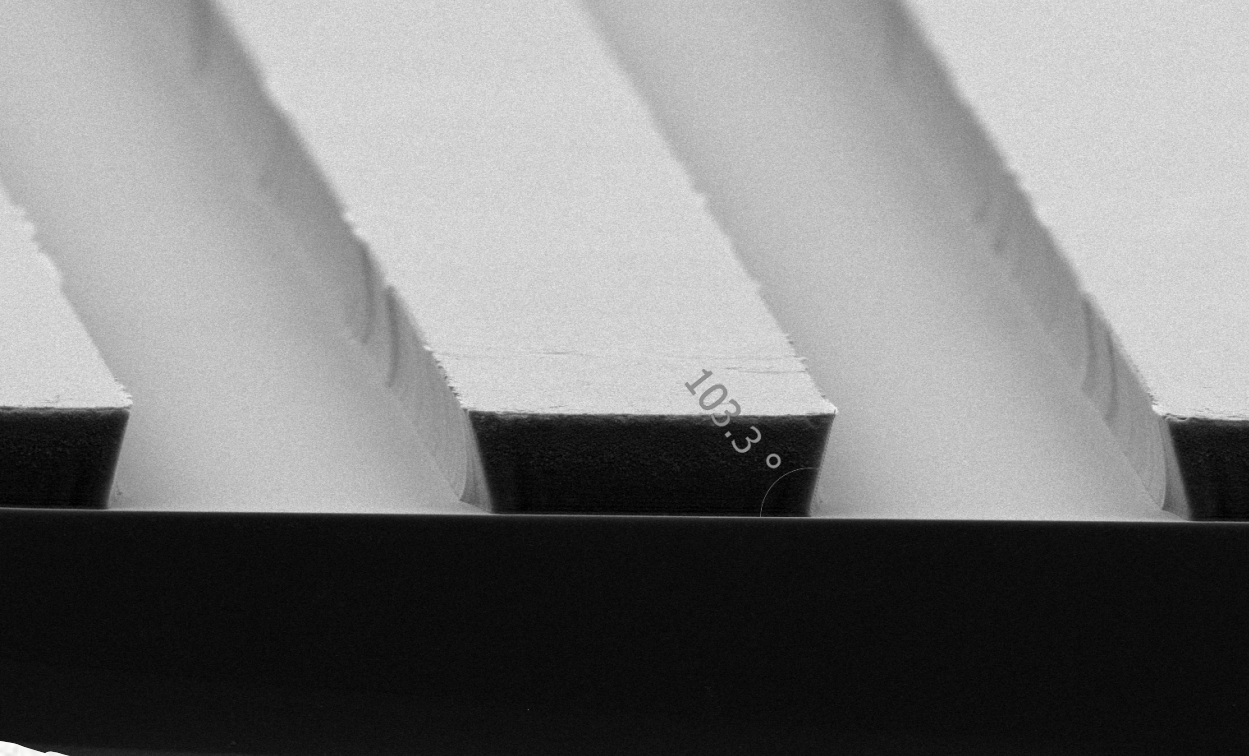
Resist: 1827 Hard Contact – Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake

Flood E.: 40 sec
Develop: 2 min
Angle is 86 - 95°
Imaged Feb 24, 2023



Resist: 1827 Hard Contact – Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake

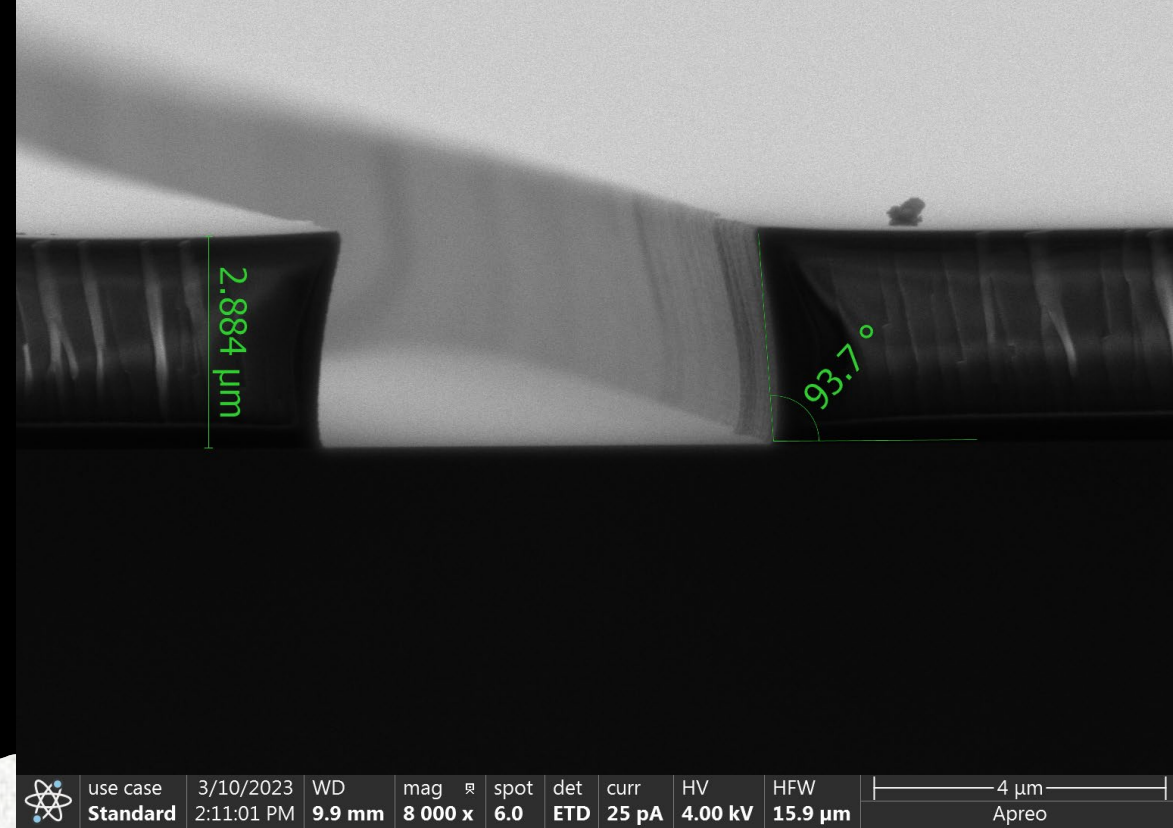
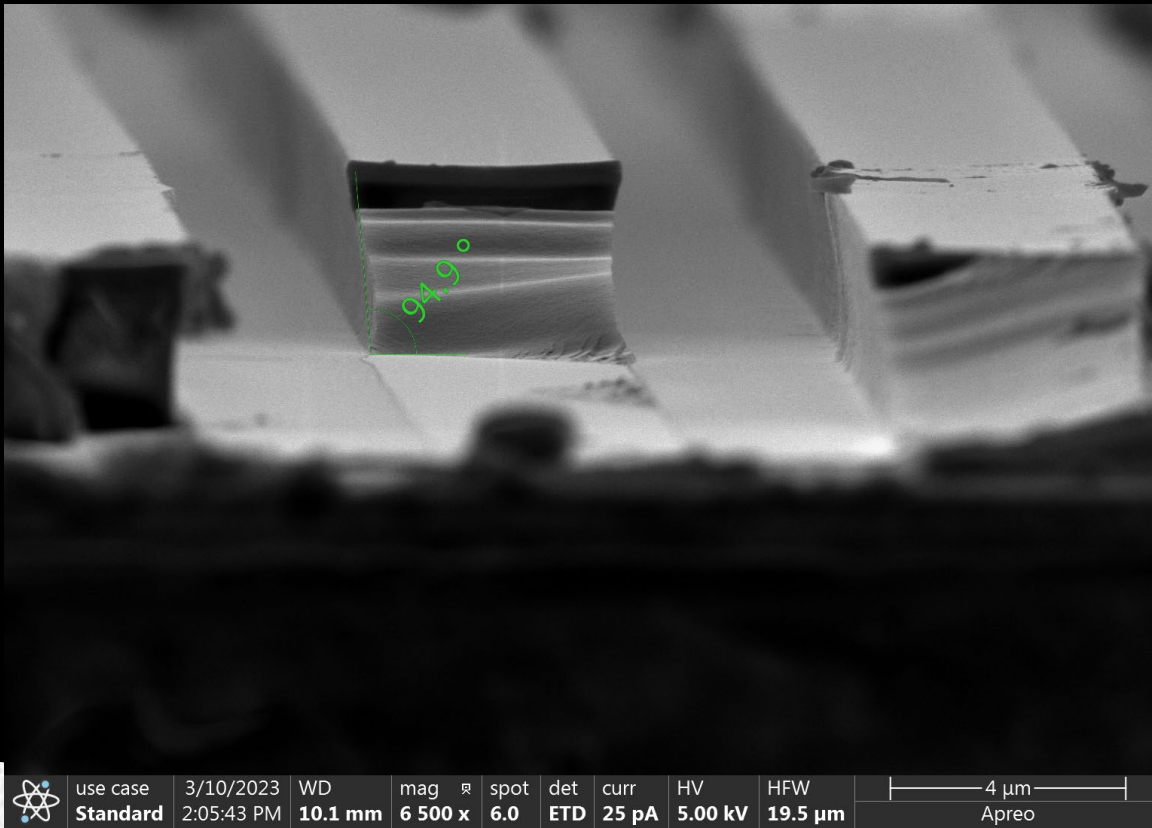
Flood E.: 40 sec
Develop: **3 min**
Angle: 105, 106°
Imaged Feb, 24 2023



3/3/2023 | WD | mag | spot | det | curr | HV | HEW |

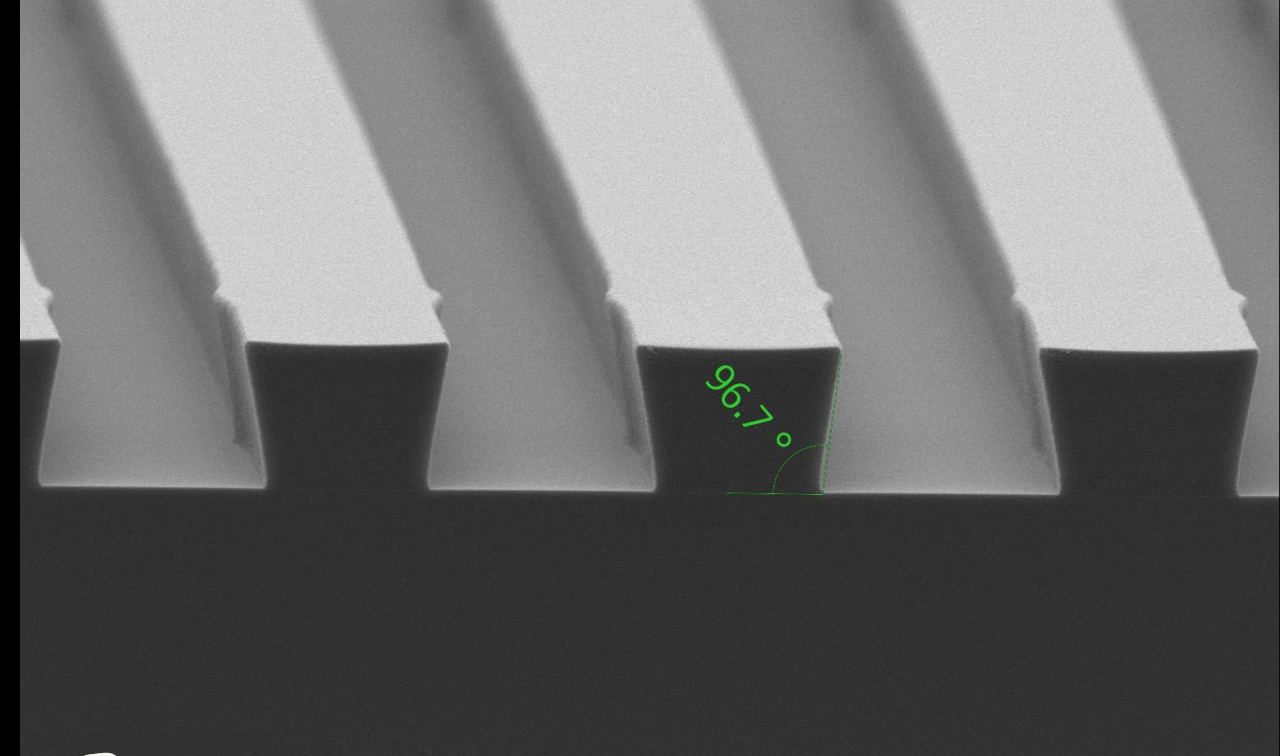
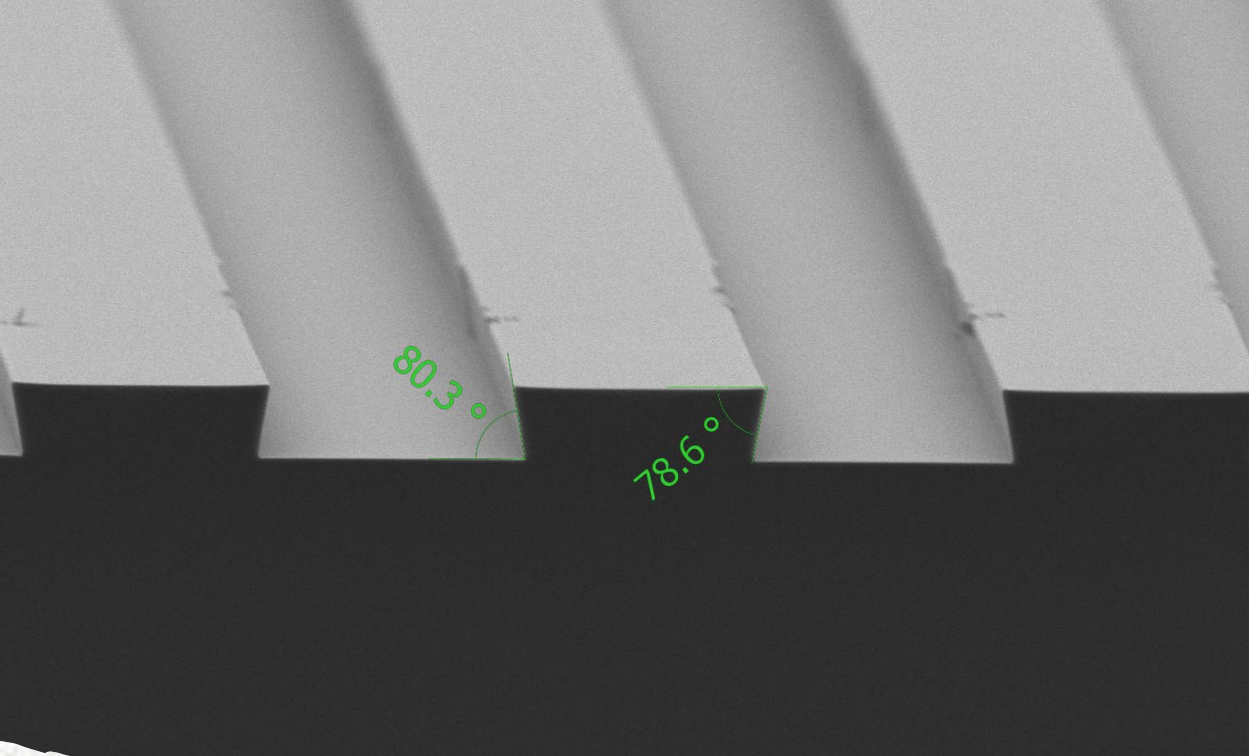
Resist: 1827 Hard Contact – Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake

Flood E.: 60 sec
Develop: 3 min
Angle: 103.3, 101.7°
Imaged: March, 3 2023



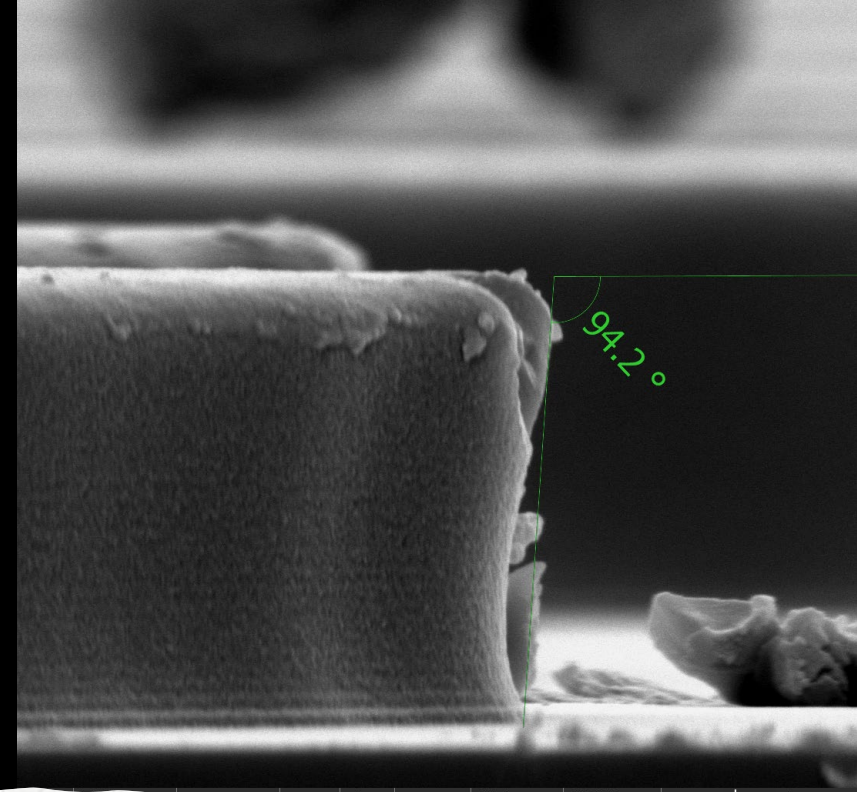
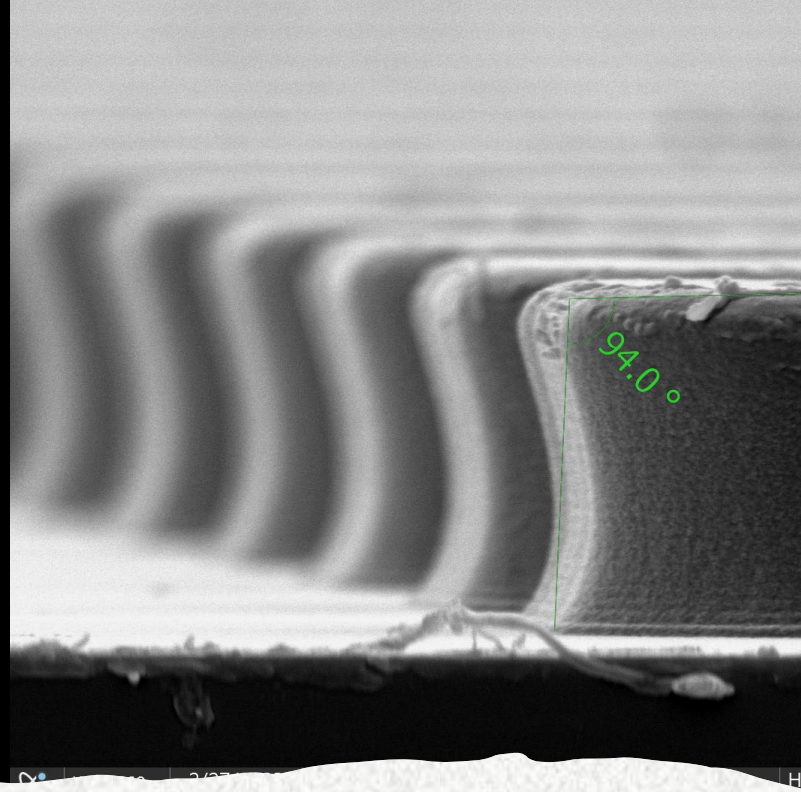
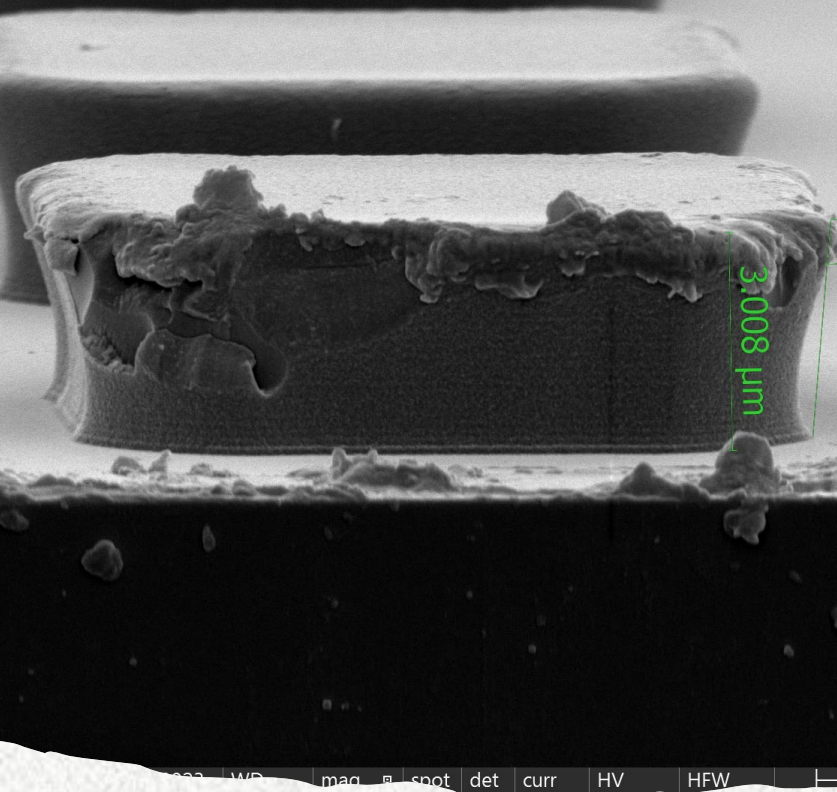
Resist: 1827 Hard Contact – Image Reversal
 Soft bake: 2 min at 115°C
 Spread 1 sec 500 RPM, 30 sec 3000 RPM
 Exposure time: 20 sec
 No Hard bake

Flood E.: 60 sec
 Develop: 4 min
 Angle: 102.9, 92.6, 96.7, 92.1, 94.4,
 94.9, 93.7
 Imaged: Mach 2 and 10, 2023



Resist: 1827 Hard Contact – Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake

Flood E.: 60 sec
Develop: **5 min**
Angle: 99.7°, 101.4, 96.7, 101.5, 98.4, 92.9
Imaged: March, 2 2023

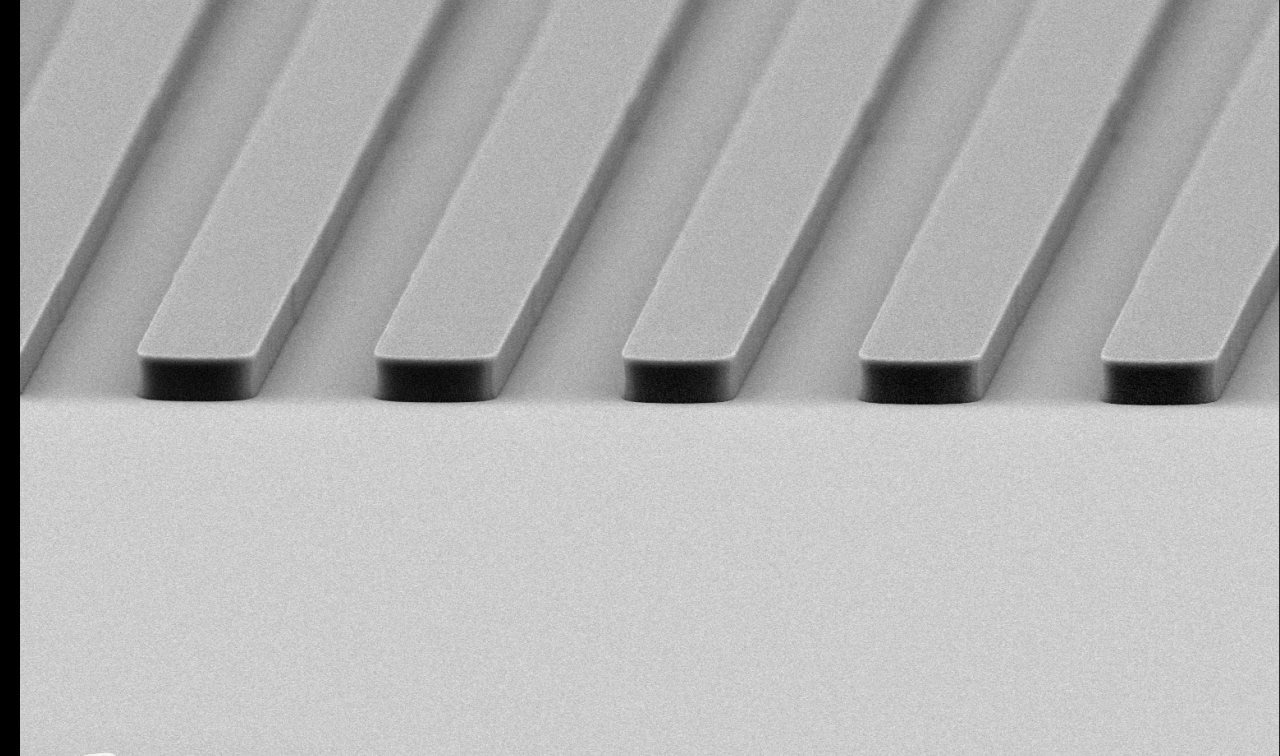


Resist: 1827 Hard Contact – Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake

Flood E.: 60 sec
Develop: **1:40 min**
Angle: 86.0, 94.2, 93.8
Imaged: Feb., 27 2023



180-81.7=98.3

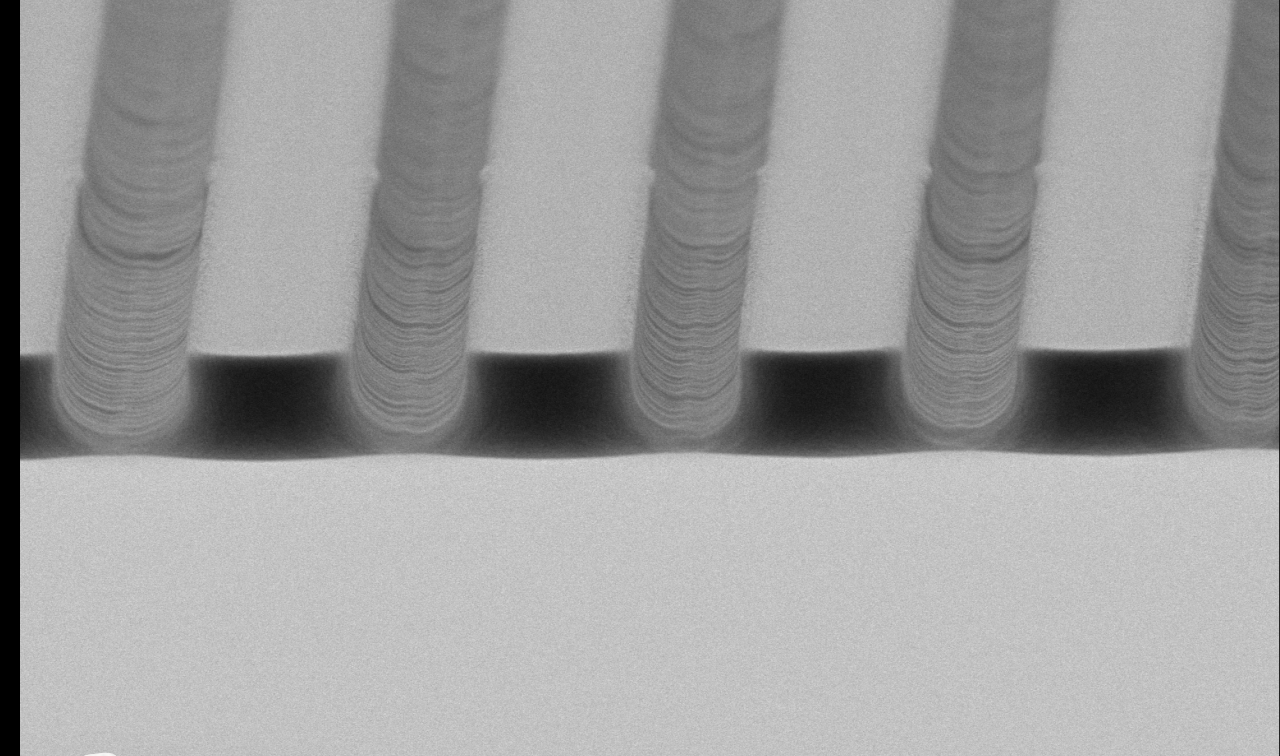
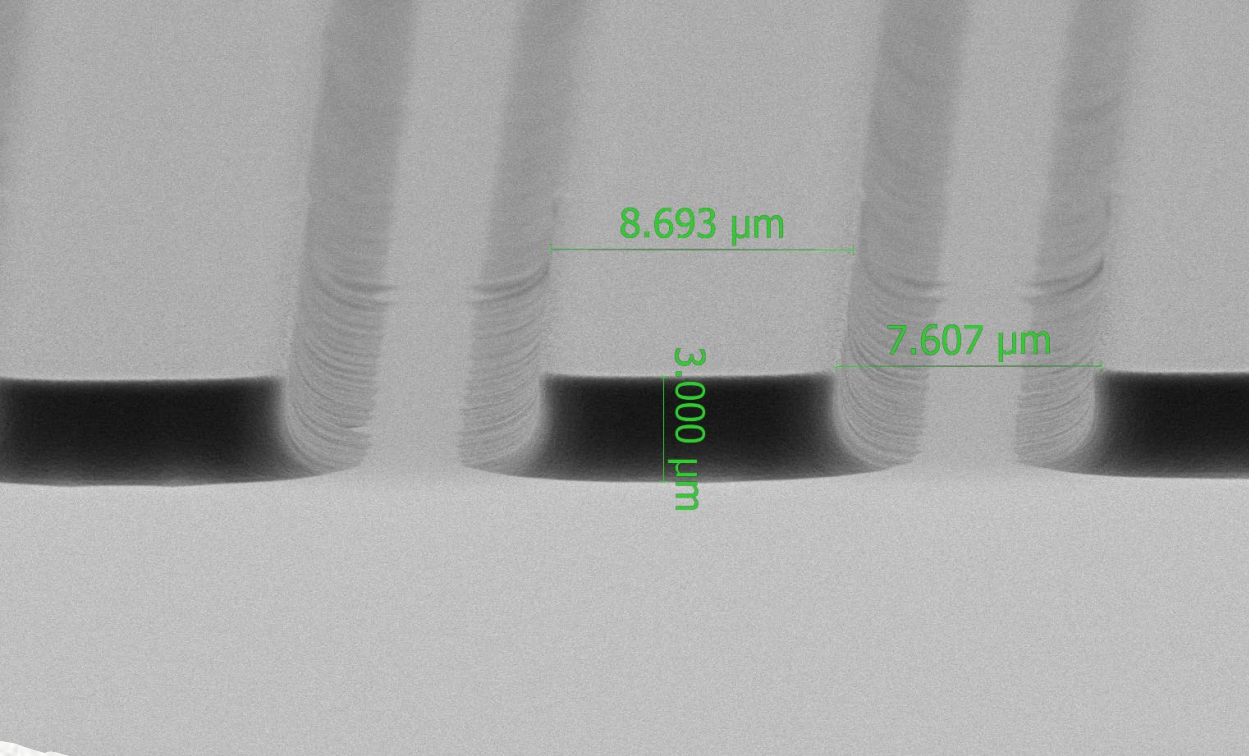


3/3/2023 WD mag spot det curr HV HEW

spot det curr HV HFW 10 μm

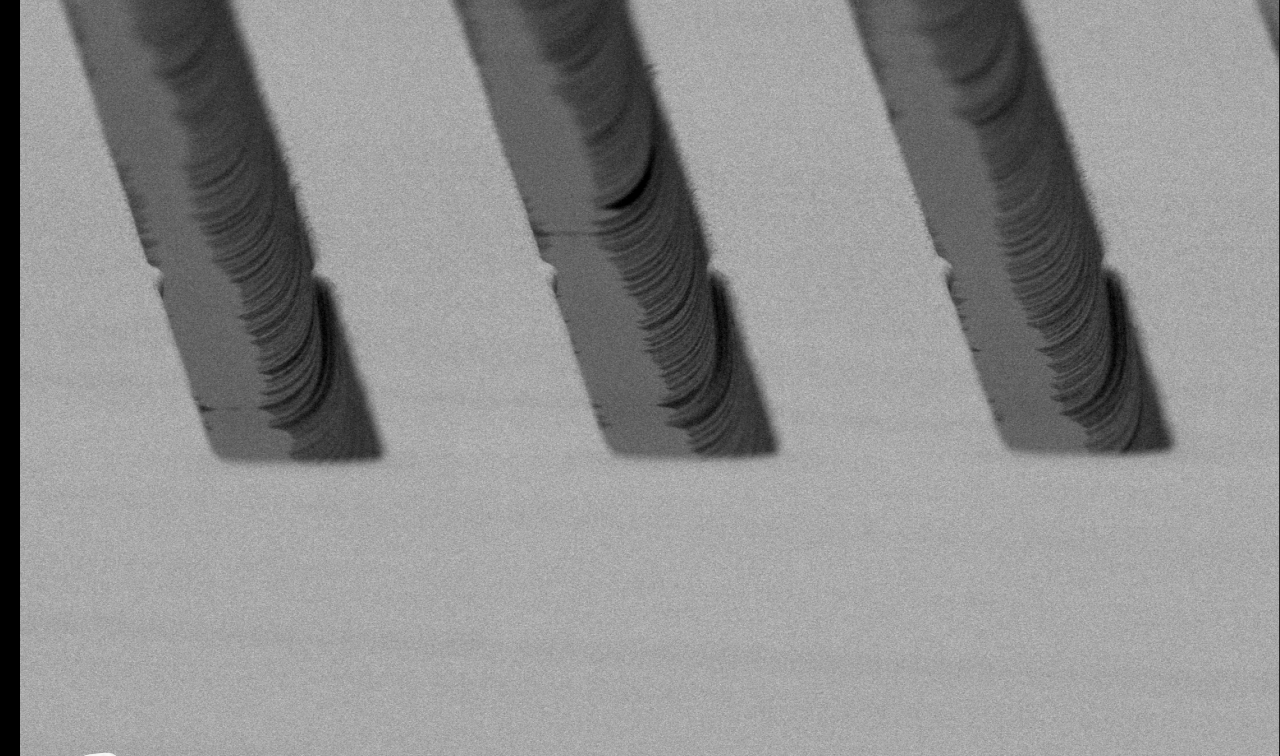
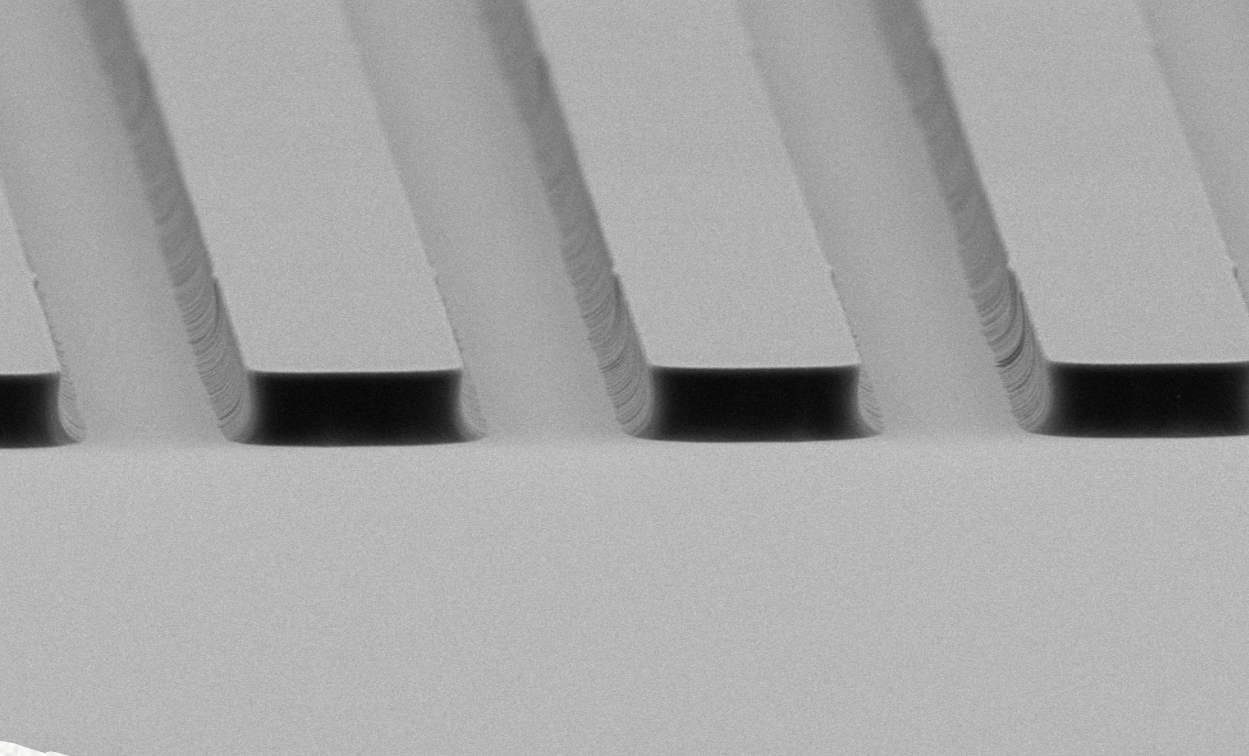
Resist: 1827 Hard Contact -Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
No Hard bake
Reactive Ion etch in O₂ 30 sec?

Flood E.: 60 sec
Develop: 4 min
Angle: 98.3
Imaged: March, 3 2023



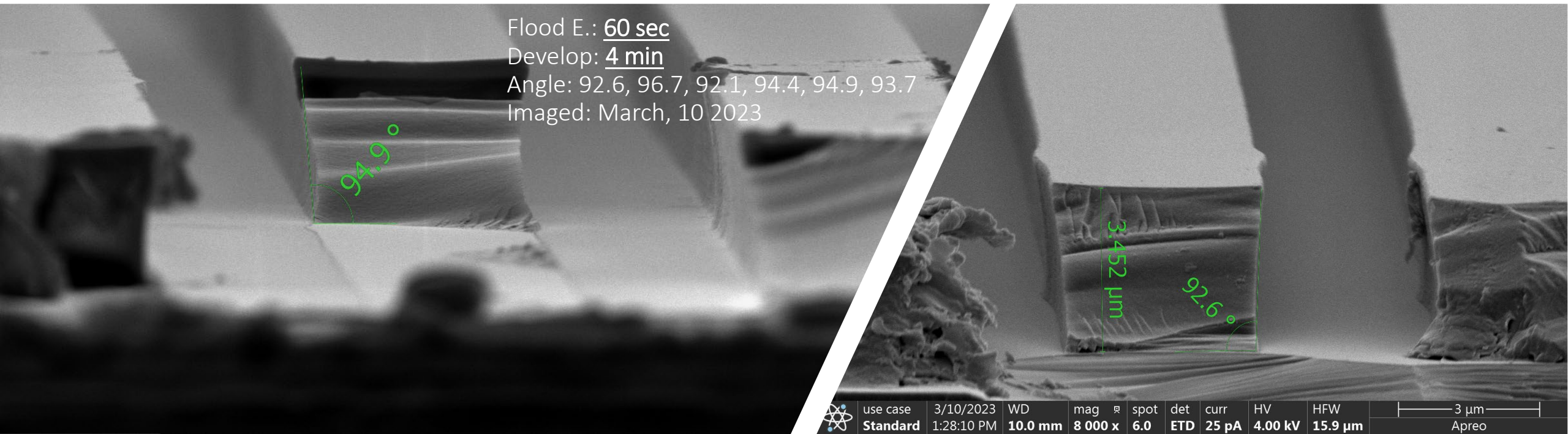
Resist: 1827 Hard Contact - Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: 90° Vacuum oven

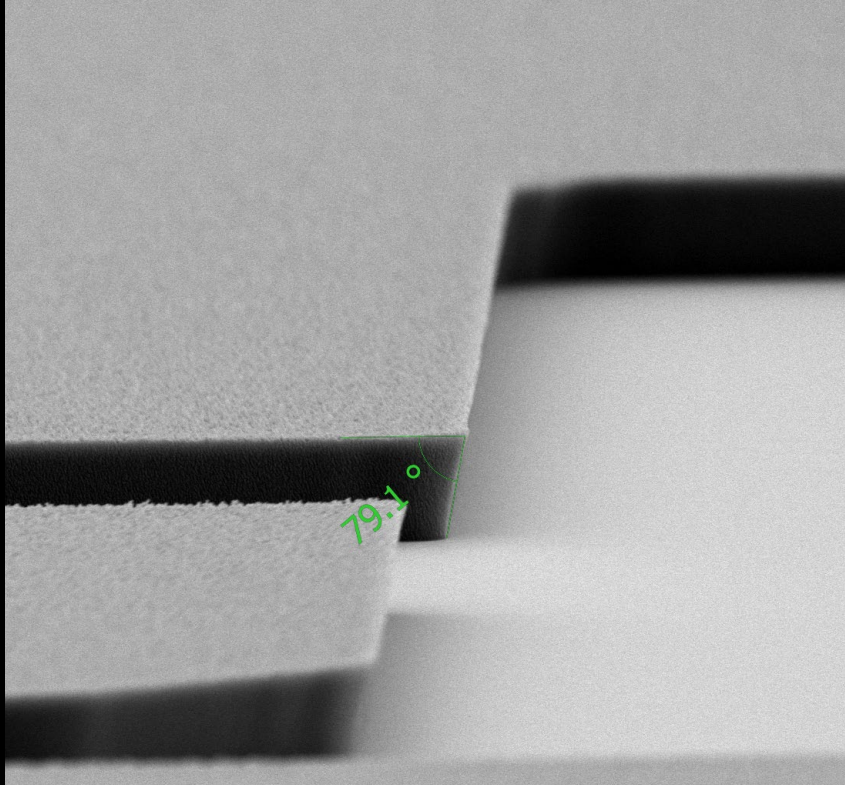
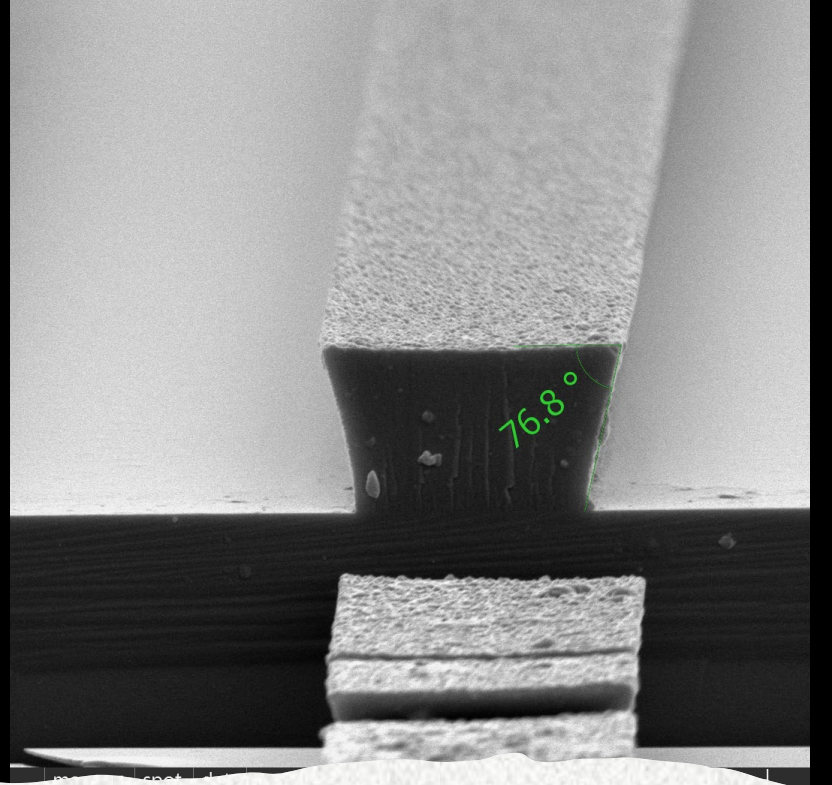
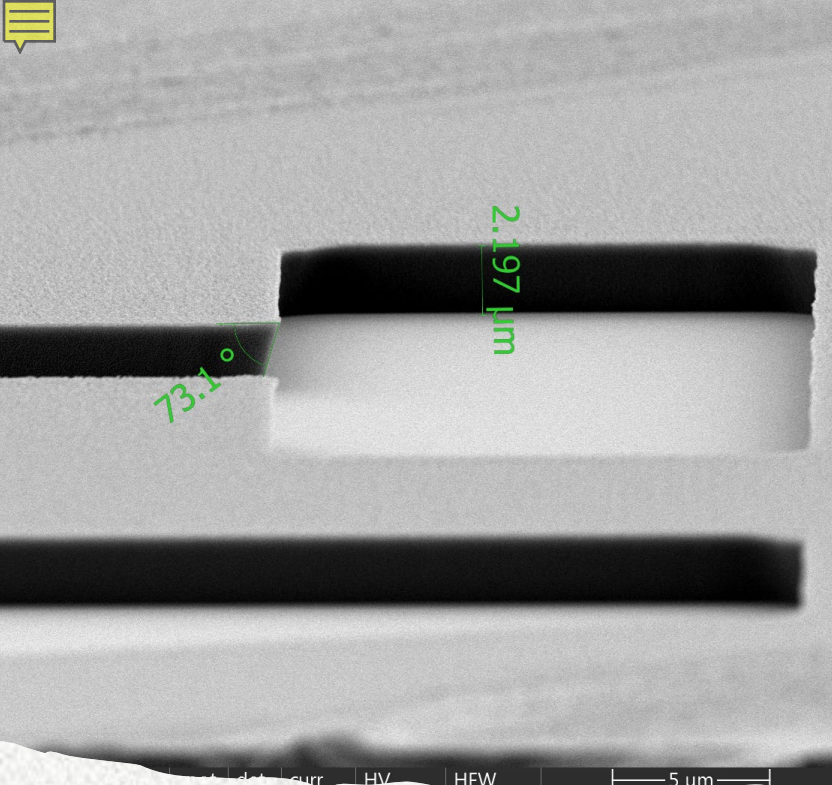
Flood E.: 90 sec
Develop: 3 min
Angle: N/A
Imaged: March, 3 2023



Resist: 1827 Hard Contact - Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

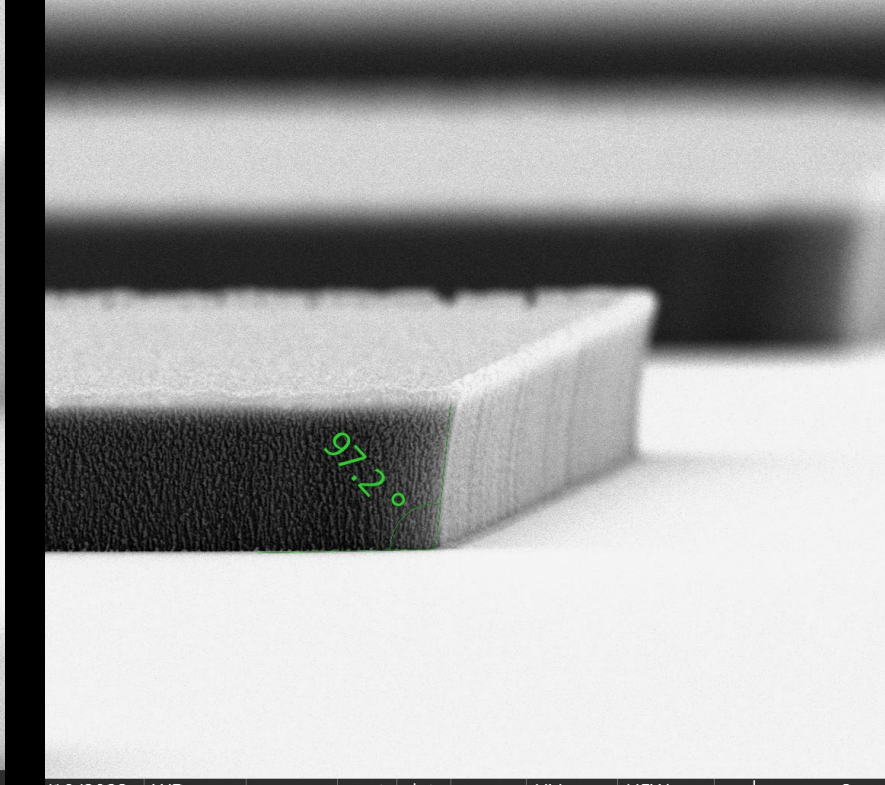
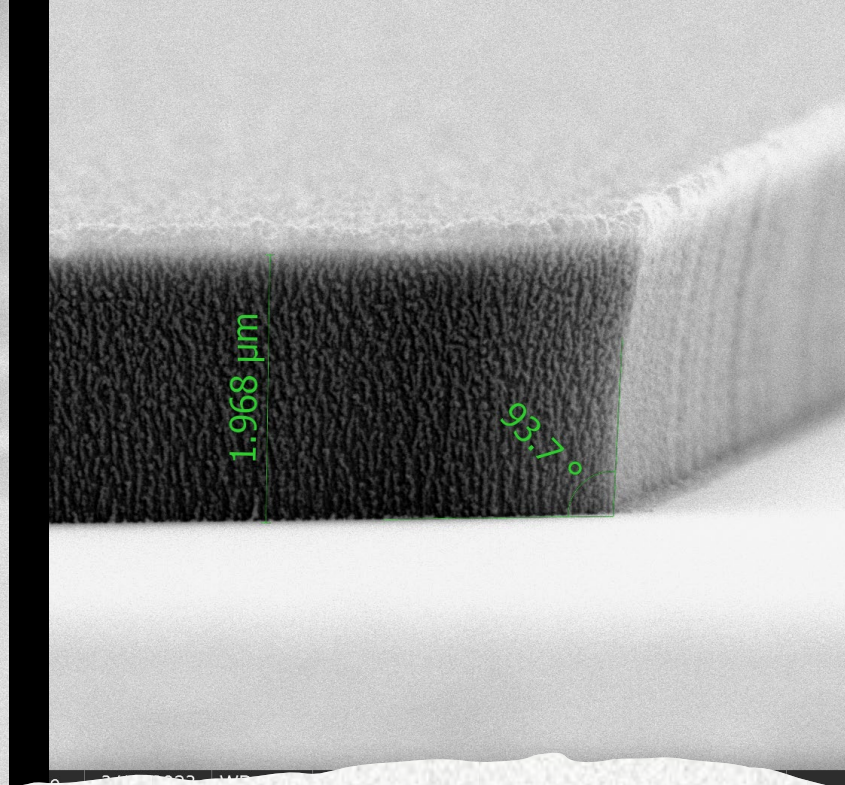
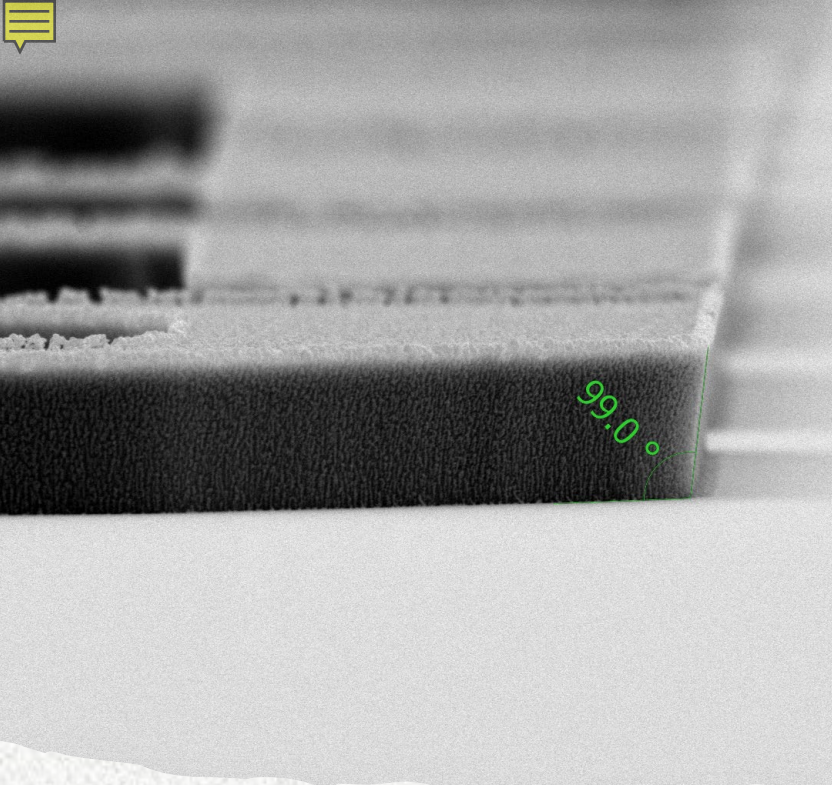
Flood E.: 90 sec
Develop: 3 min
Angle: N/A
Imaged: March, 3 2023





Resist: 1827 Hard Contact - Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

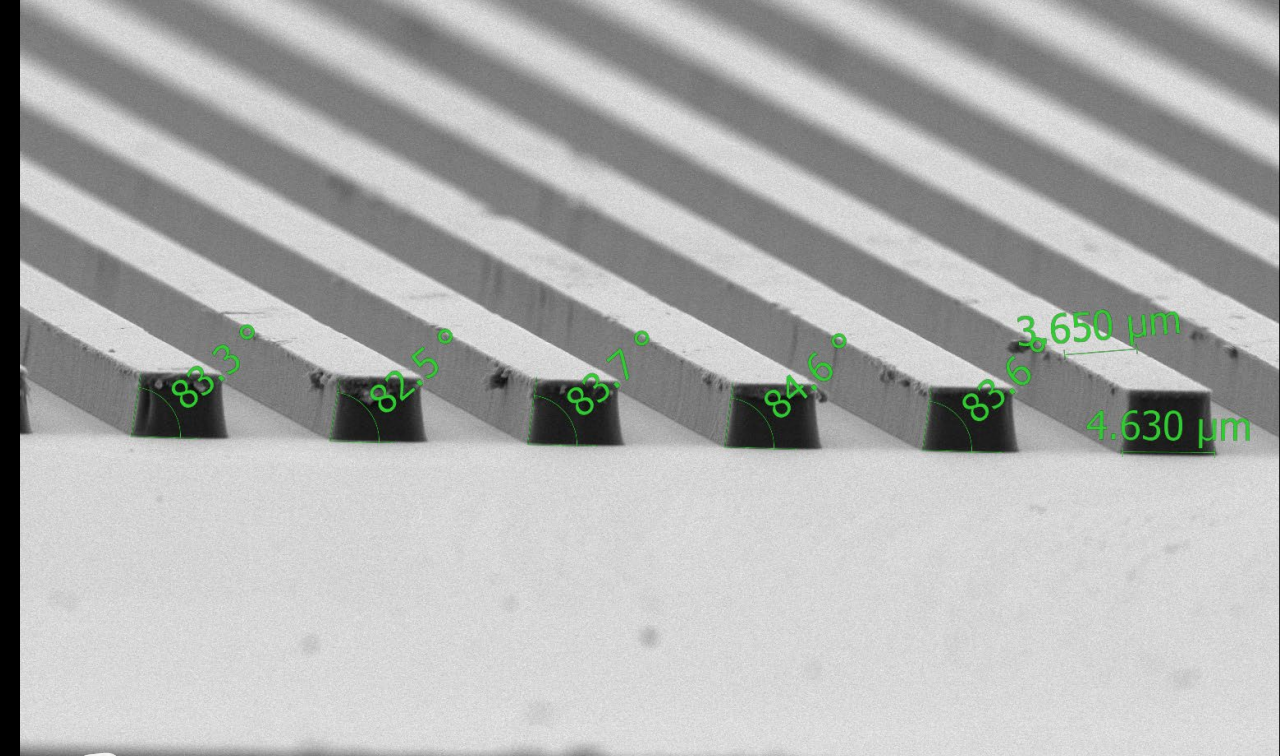
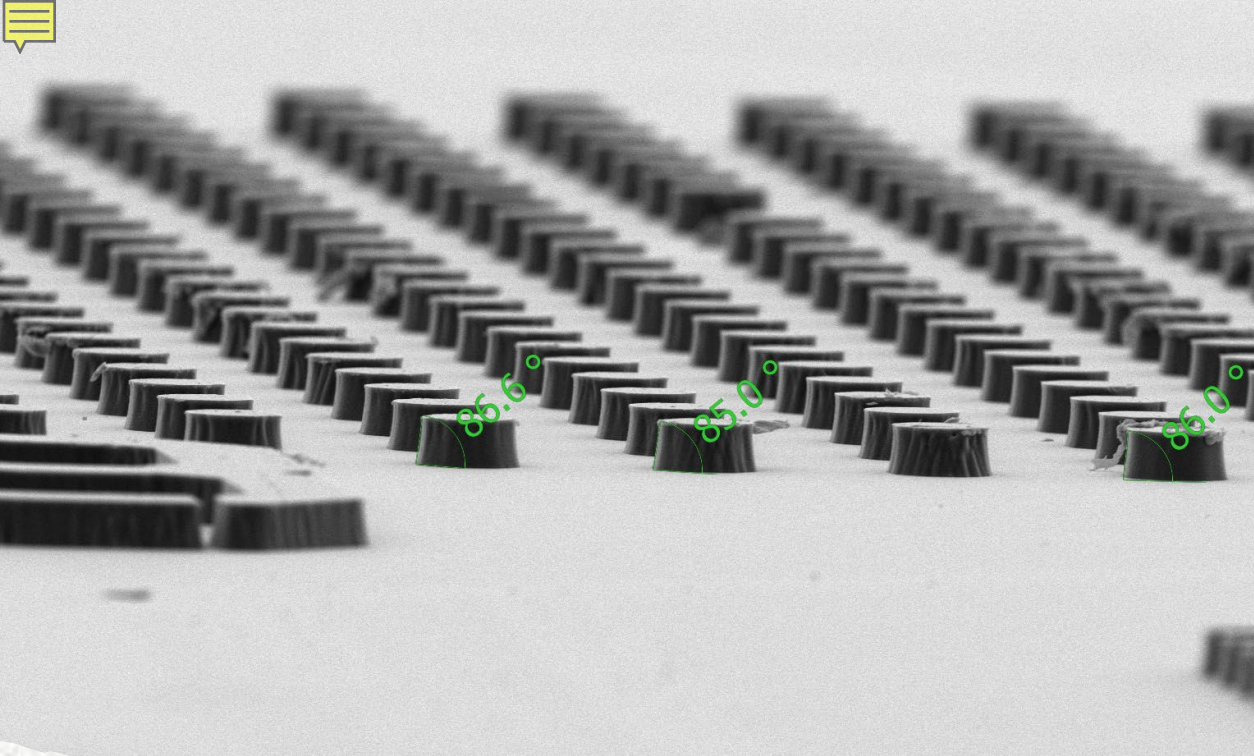
Flood E.: 60 sec
Develop: 4 min
Angle: 103.2, 100.9, 105.5, 106.9
Imaged: March, 9 2023
Plasma Ash: 1min



3/10/2023 WD mag 8 spot det curr HV HFW 3 micrometers Area

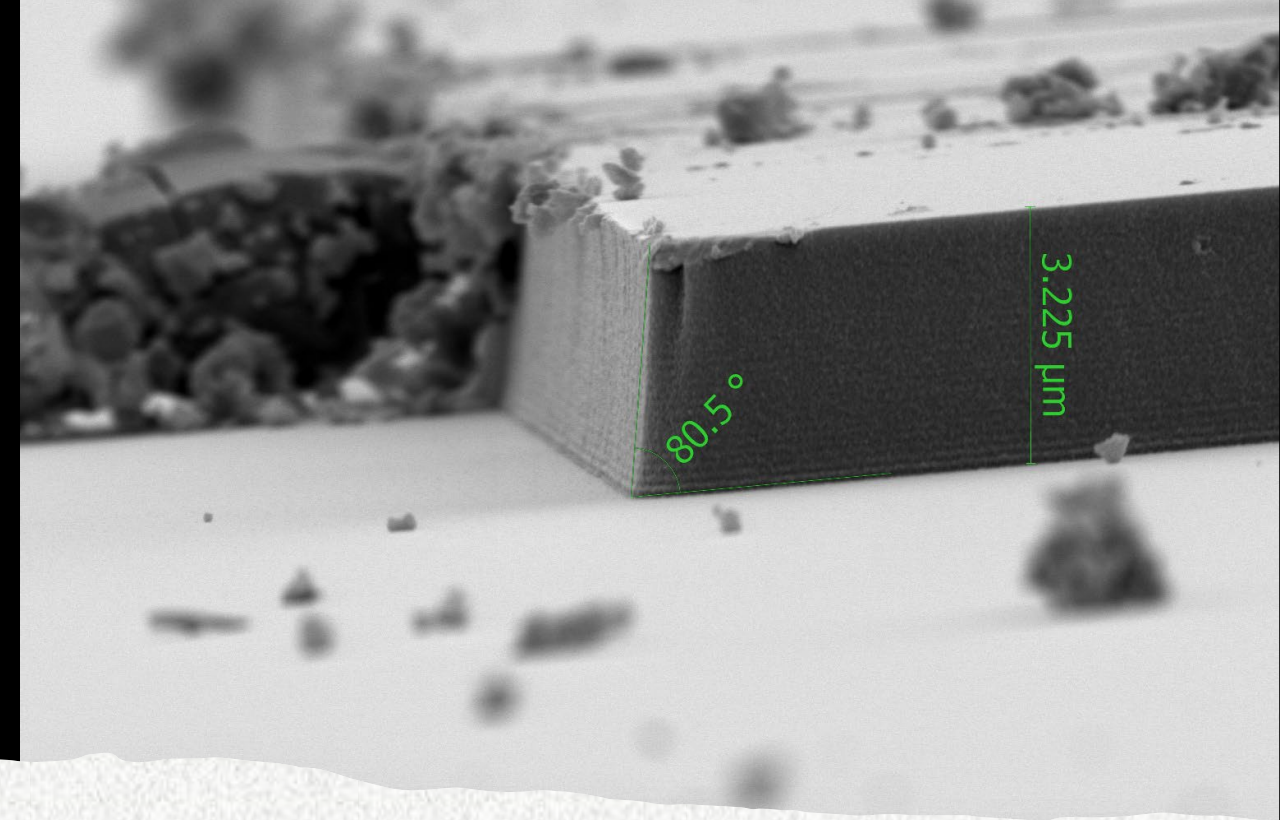
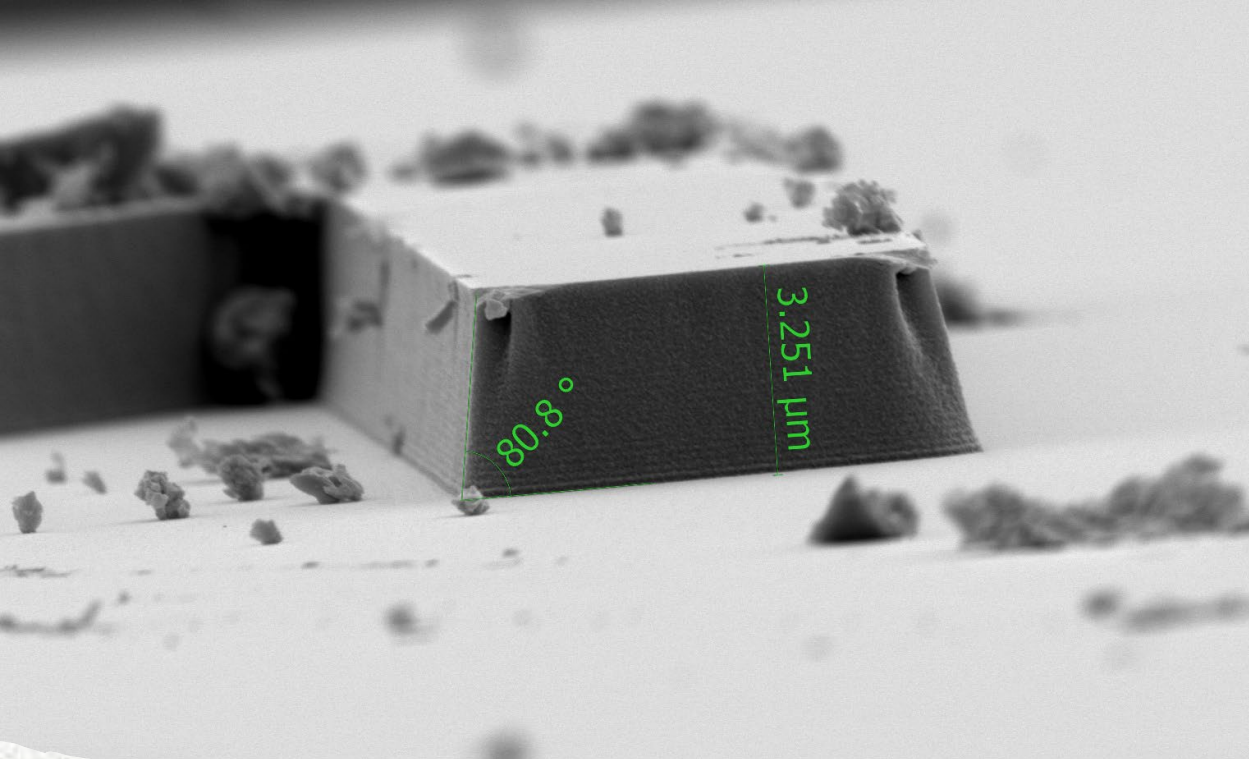
Resist: 1827 Hard Contact - Image Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

Flood E.: 60 sec
Develop: 4 min
Angle: 96.1, 93.7, 96.7, 93.7, 97.2, 99.0,
99.4, 97.1, 95.0, 95.7
Imaged: March, 10 2023
Plasma Ash: 1min 20 sec



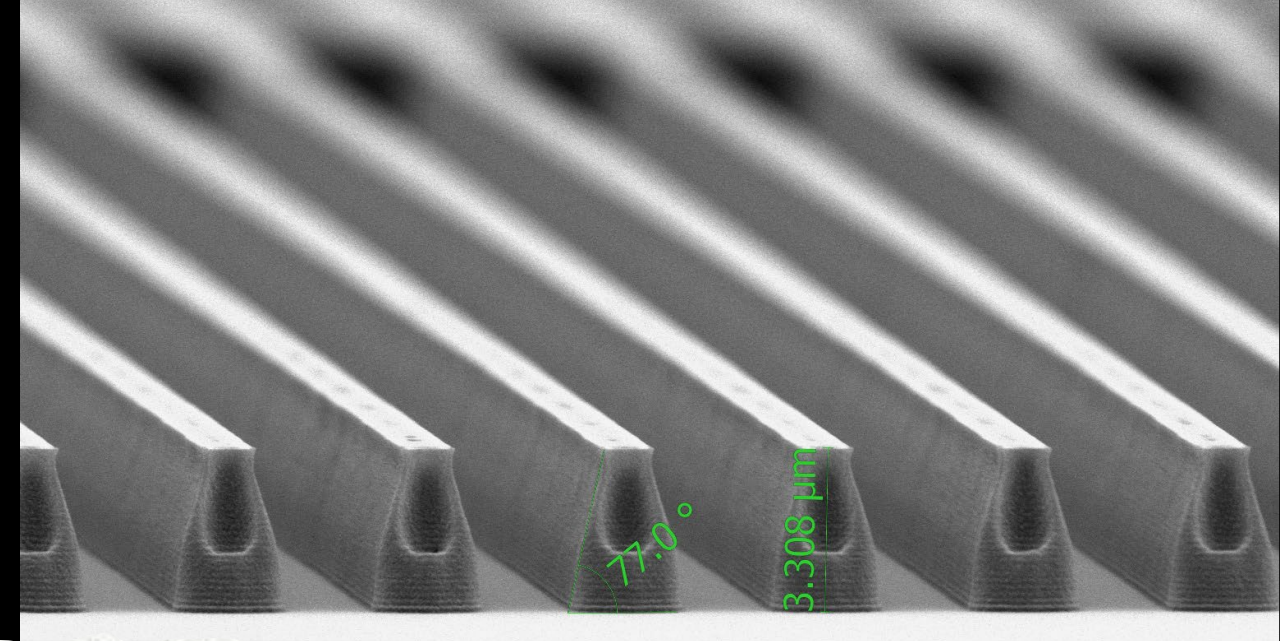
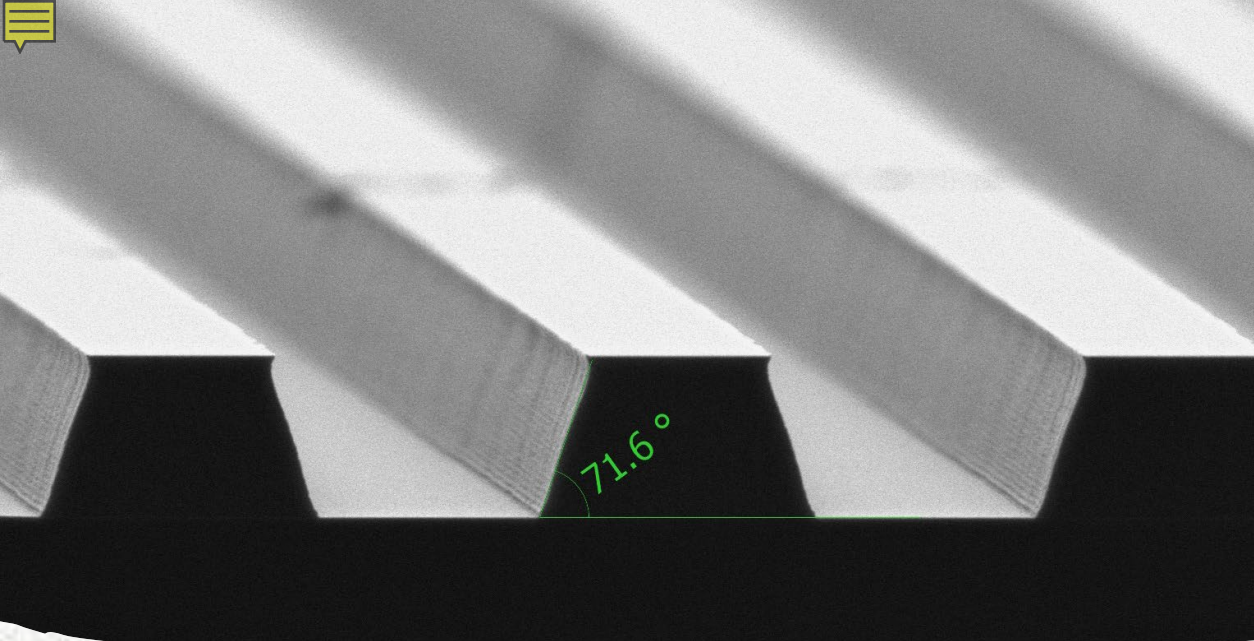
Resist: 1827 Vac Contact
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 18 sec
Hard bake: None

Develop: 2 min
_Angle: 86.6, 85.0, 86.0, 80.9, 79.7, 84.5,
88.5, 83.3, 82.5, 83.7, 84.6, 83.6
Imaged: March, 15 2023



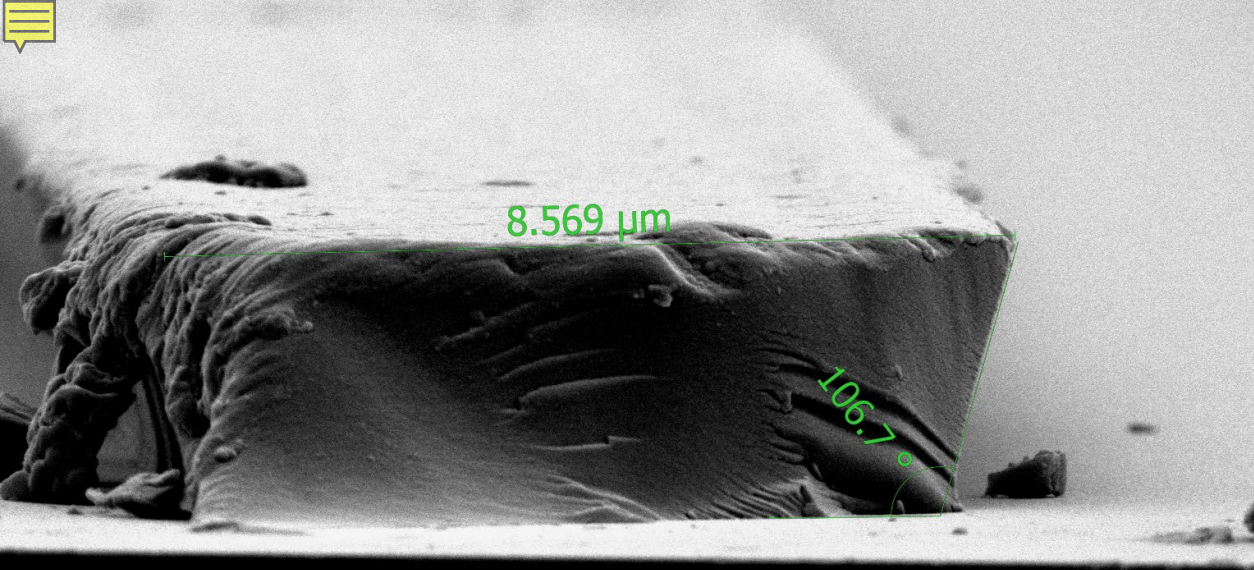
Resist: 1827 Vac Contact
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

Develop: 2 min
_Angle: 82.1, 80.4, 81.7, 80.5, 82.3, 80.8,
81.1
Imaged: March, 15 2023



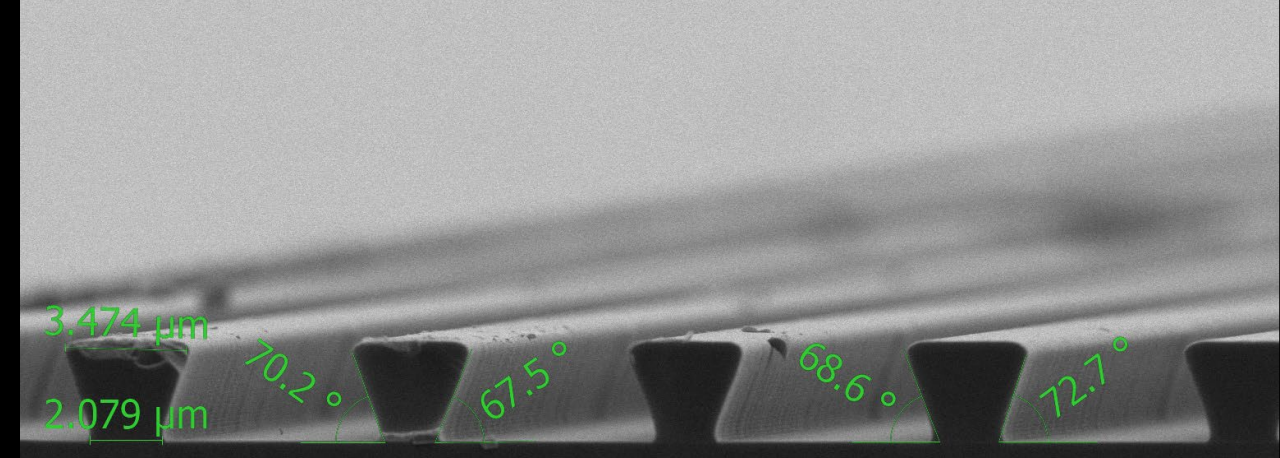
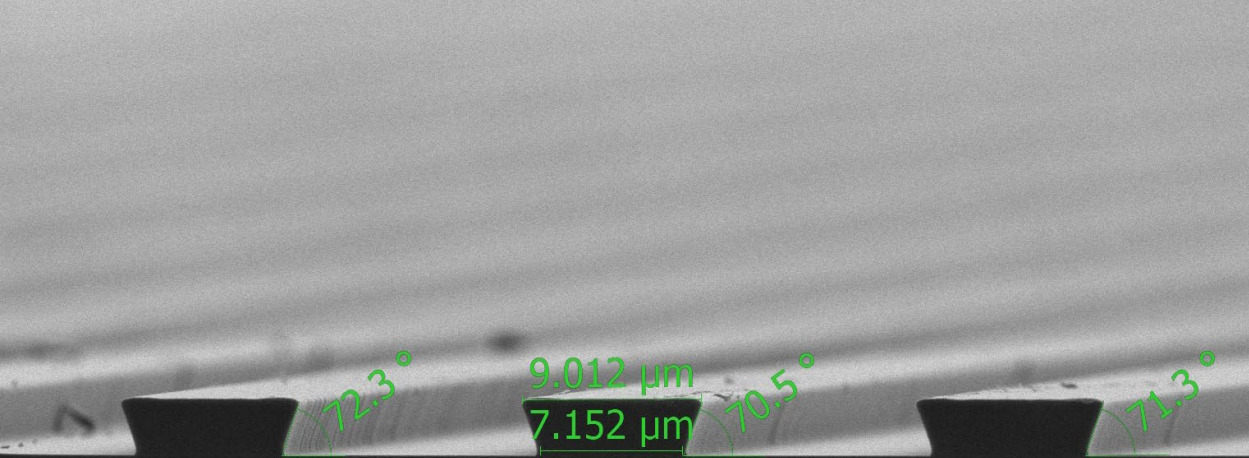
Resist: 1827 Vac Contact
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 22 sec
Hard bake: None

Develop: 1:30 min
_Angle: 71.6, 78.2, 77.0, 72.1, 74.8, 74.1
Imaged: March, 15 2023



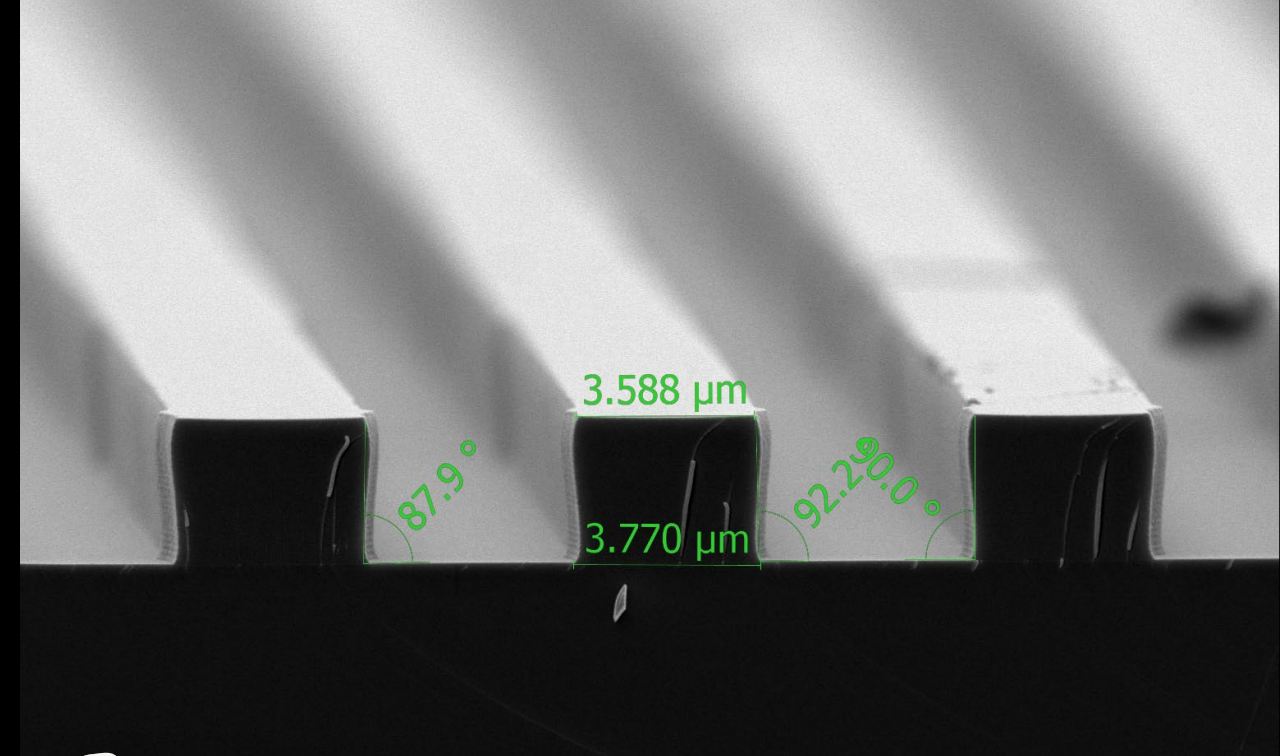
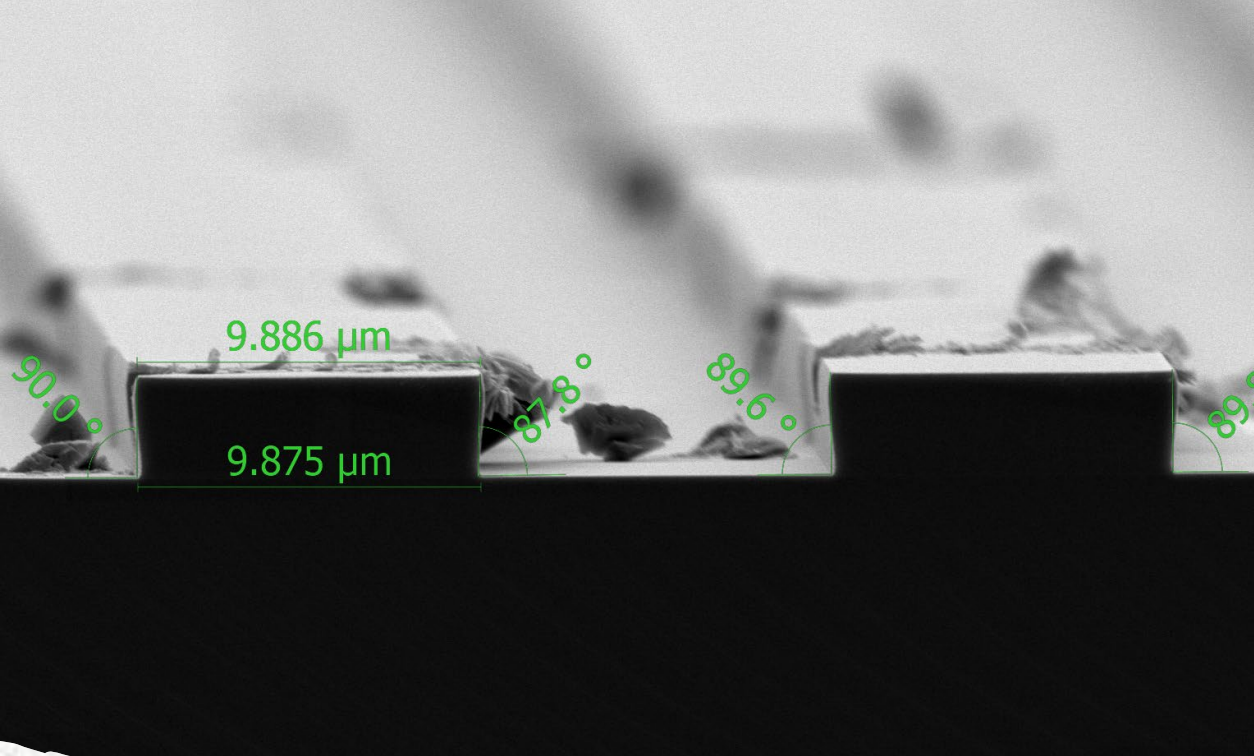
Resist: 1827 Hard Contact - Image
reversal to reproduce previous results
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

Flood E.: 60 sec
Develop: 4 min
Angle: 109.1, 109.0, 108.7, 106.7, 113.1,
110.3, 110.2
Imaged: March, 16 2023



Resist: 1827 Image reversal to reproduce previous results
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

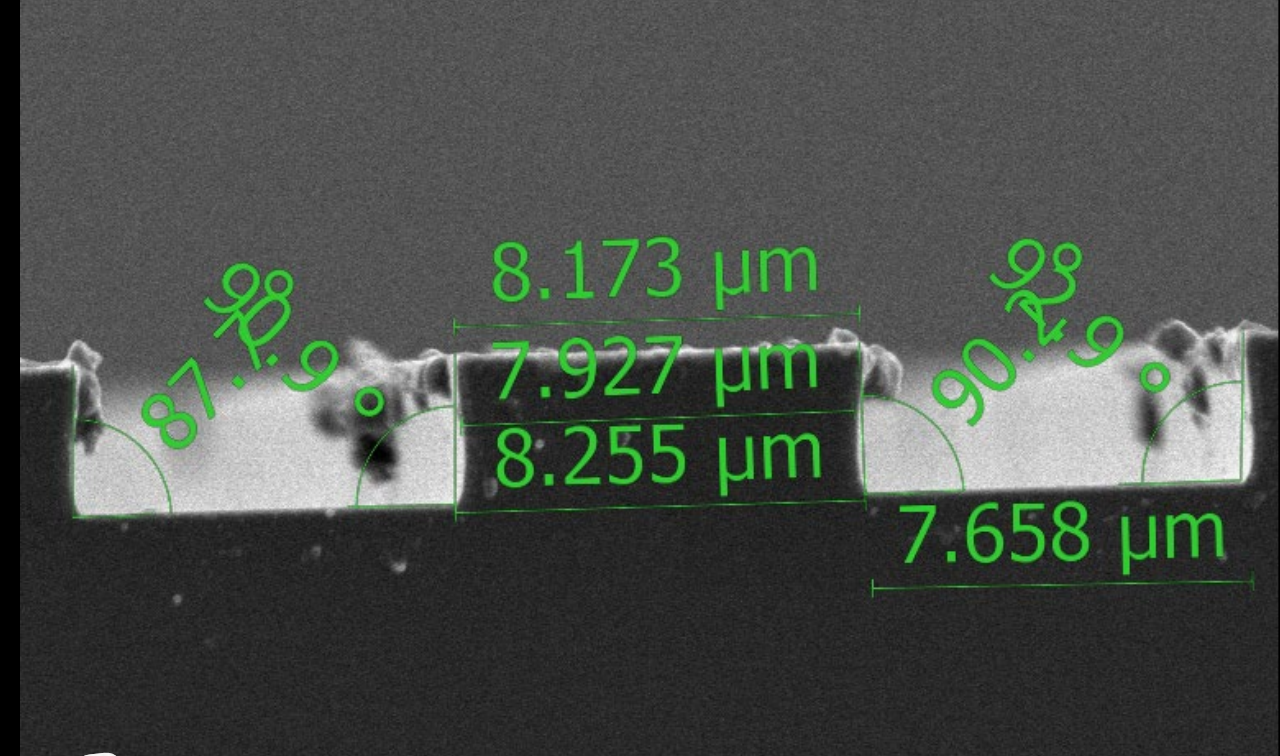
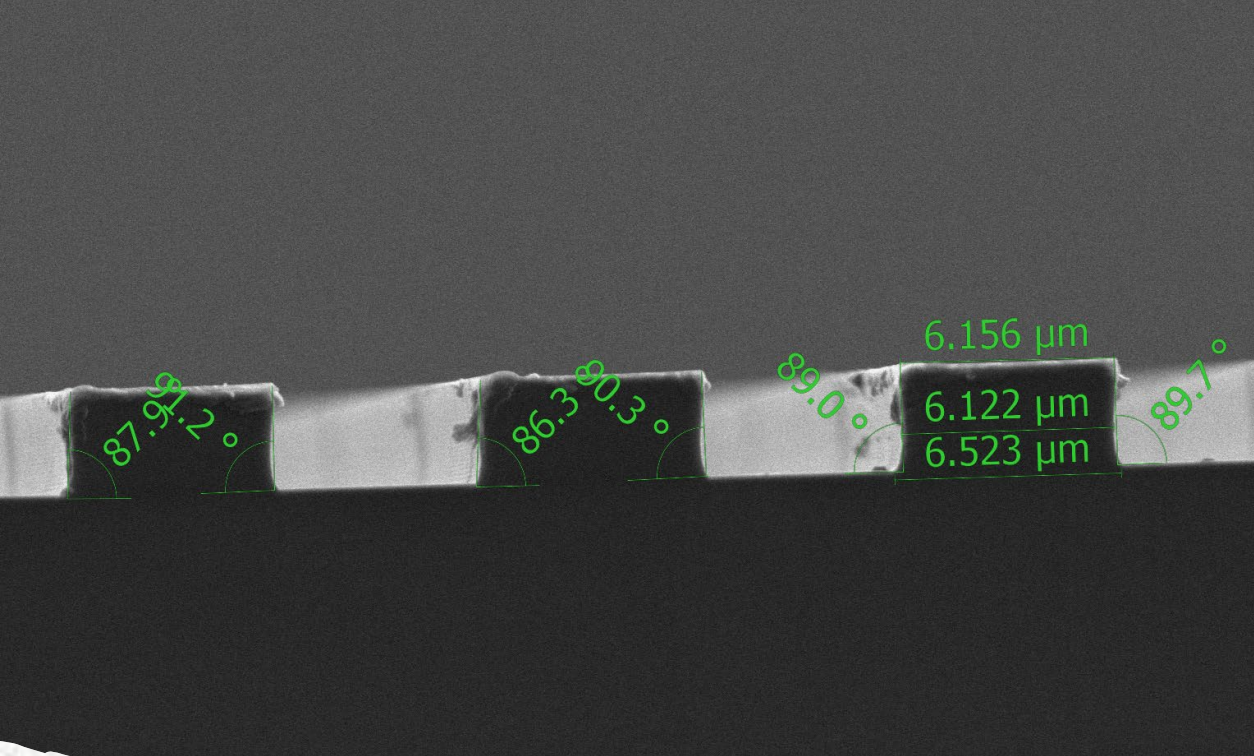
Flood E.: 60 sec
Develop: 5 min
Angle: 112.8, 109.5, 109.3, 109.8, 112.5, 111.4, 107.3, 110.4, 111.8, 111.8, 112.5, 112.3, 110.0, 108.7, 109.5, 109.7
Imaged: March, 16 2023



st det curr HV HFW 5 μm

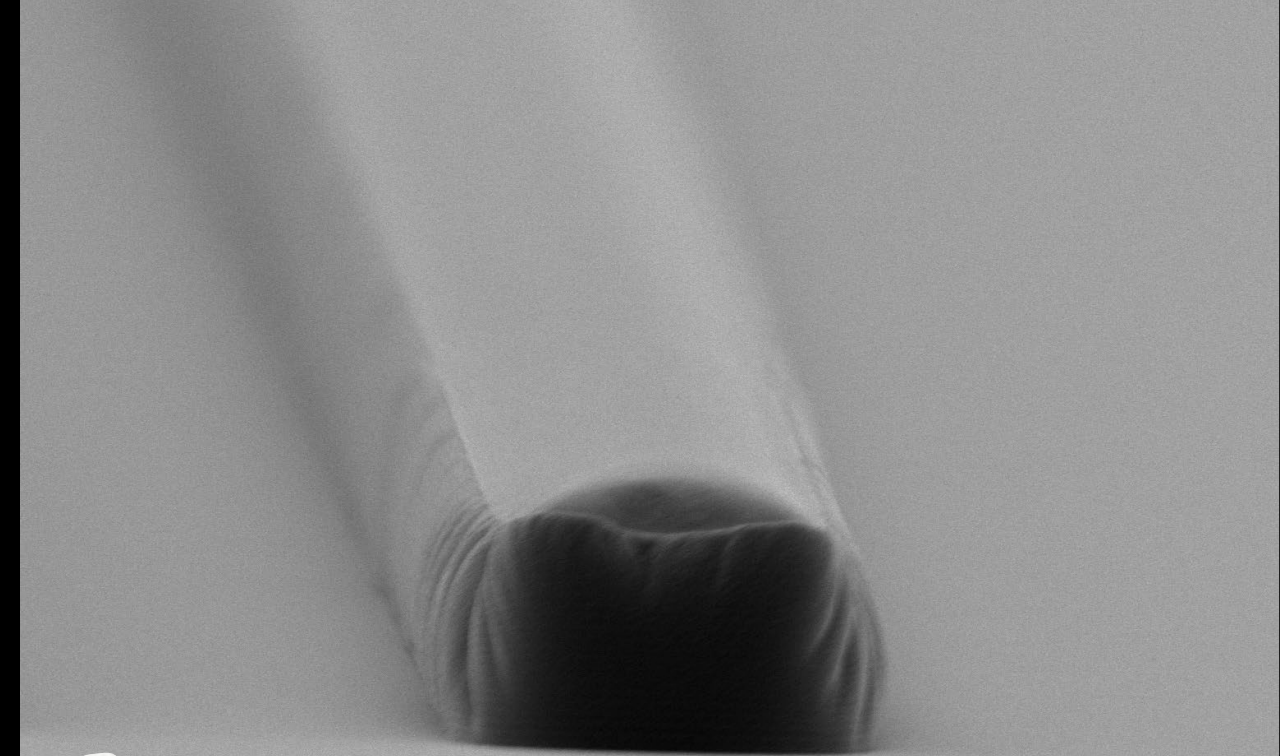
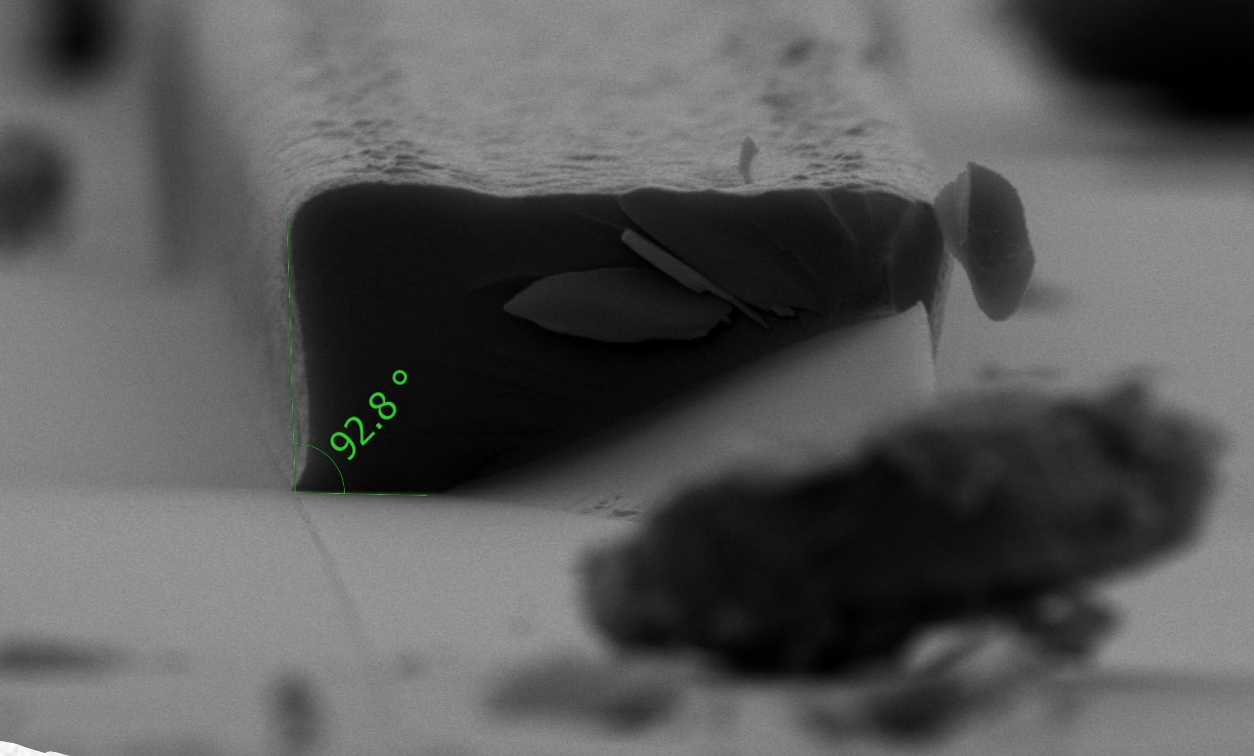
Resist: 1827 Vacuum Contact Image
Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: None

Flood E.: 60 sec
Develop: 1 min
Angle: 89.94+-1.01 (n=16)
Imaged: March, 16 2023



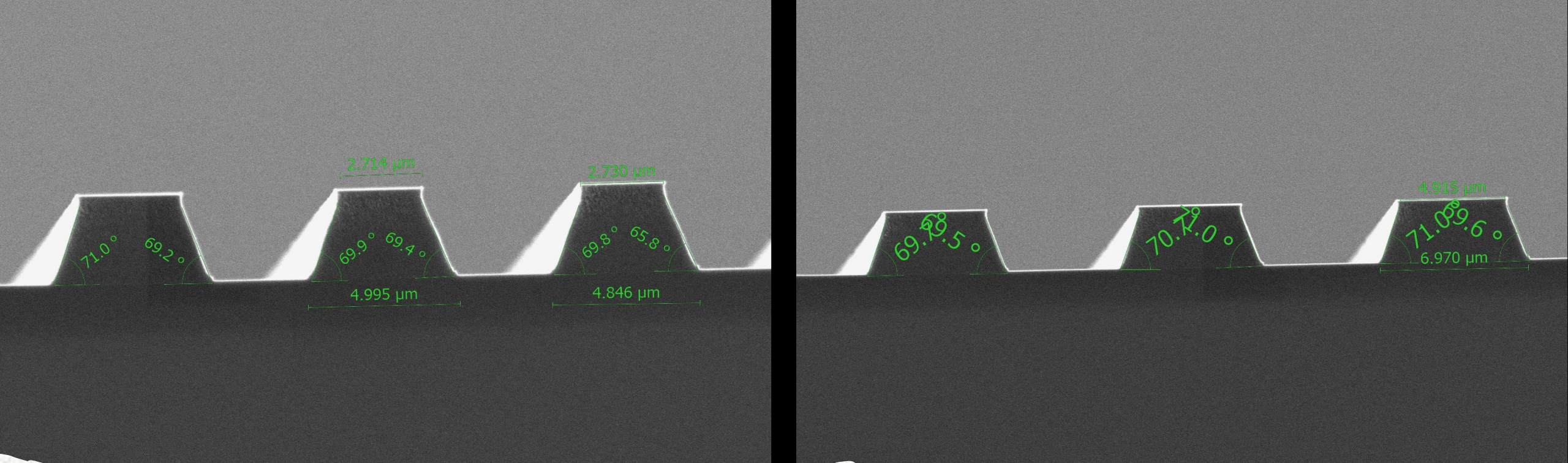
Resist: 1827 Vacuum Contact Image
Reversal
Soft bake: 2 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 20 sec
Hard bake: Image reversal oven 24 hrs
90C

Flood E.: 60 sec
Develop: 1 min
Angle: 89.56+-1.24 (n=17)
Imaged: March 16, 2023



Resist: 1827 Vacuum Contact Image
Reversal
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 20 sec
Hard bake: 12hr Vacuum Bake 100°C

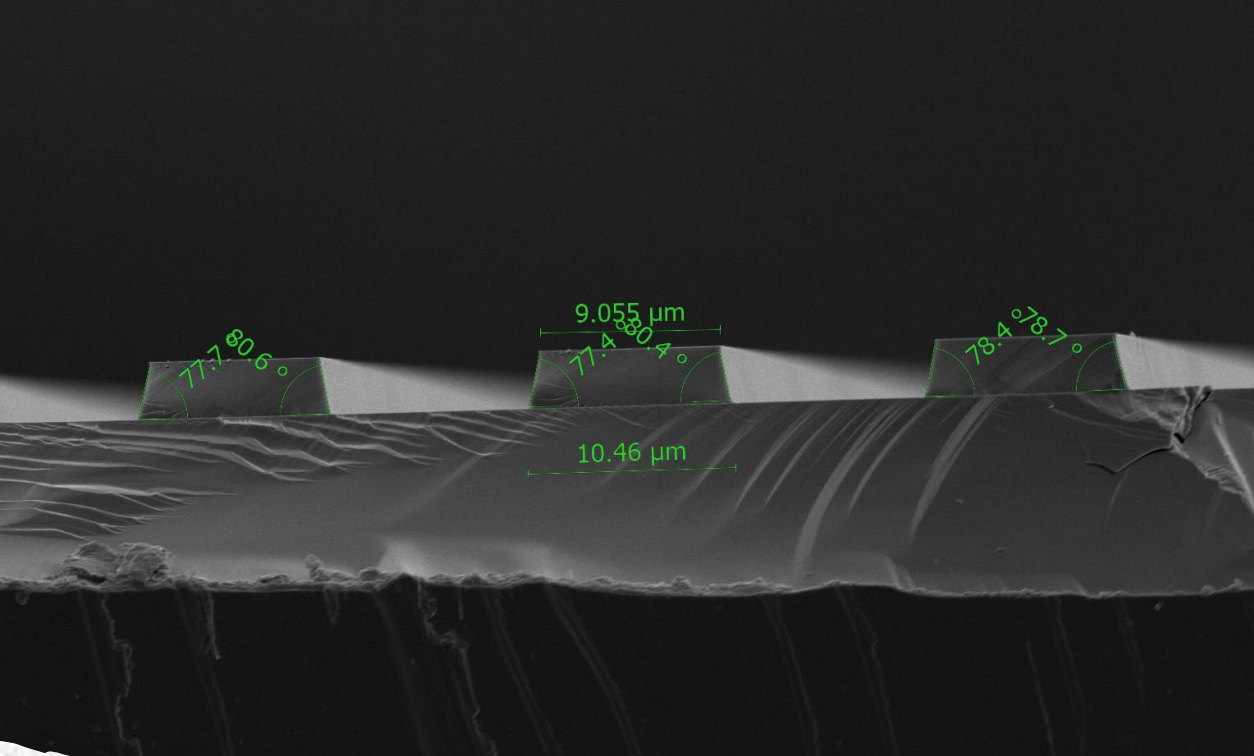
Flood E.: NA
Develop: 1 min
Angle: Some areas melted
Imaged: March, 23 2023



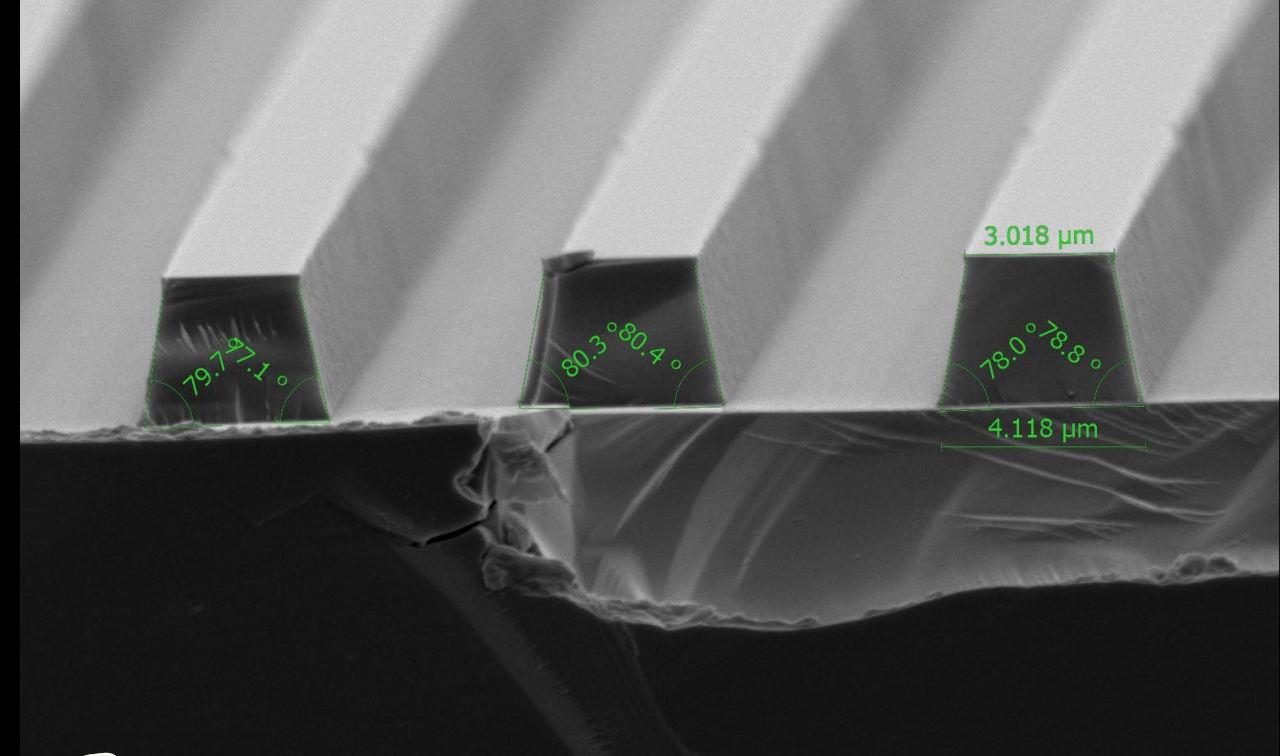
4 um Lines

Resist: 1827 Vacuum Contact Vapor
Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 14 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 69.7+-1.35 (n=12)
Imaged: March, 27 2023



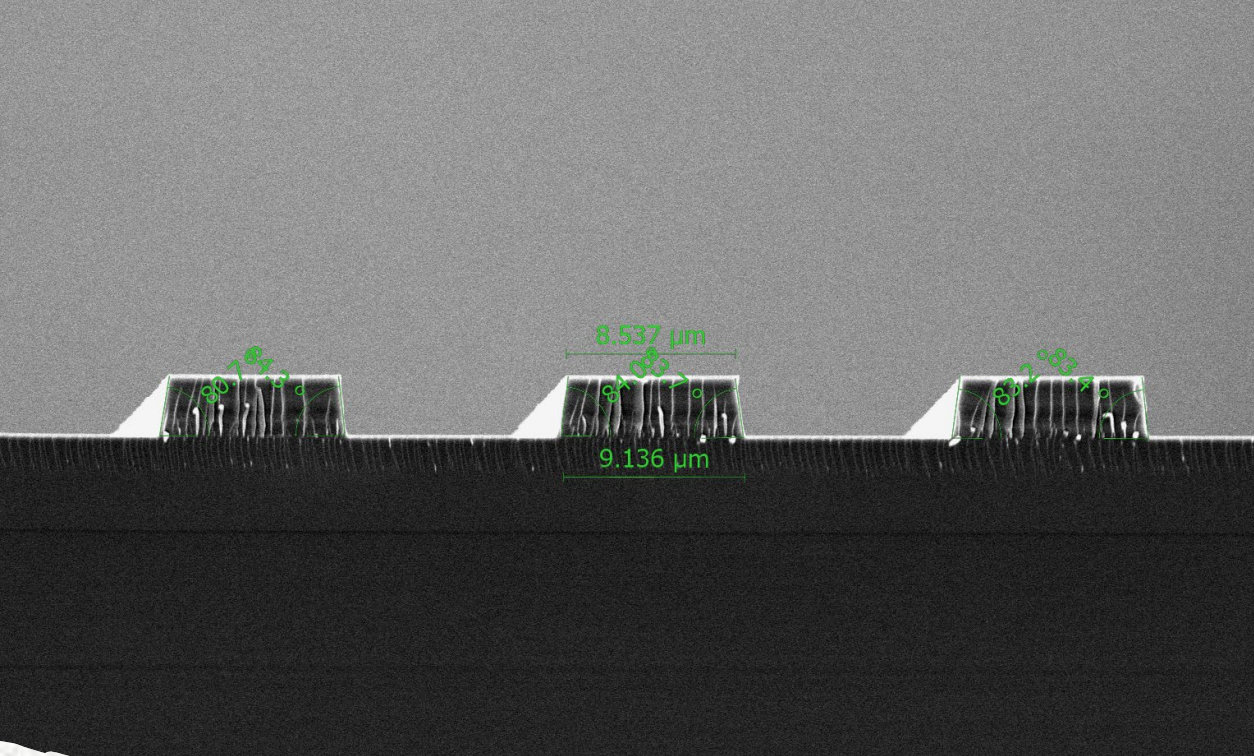
10 um Lines



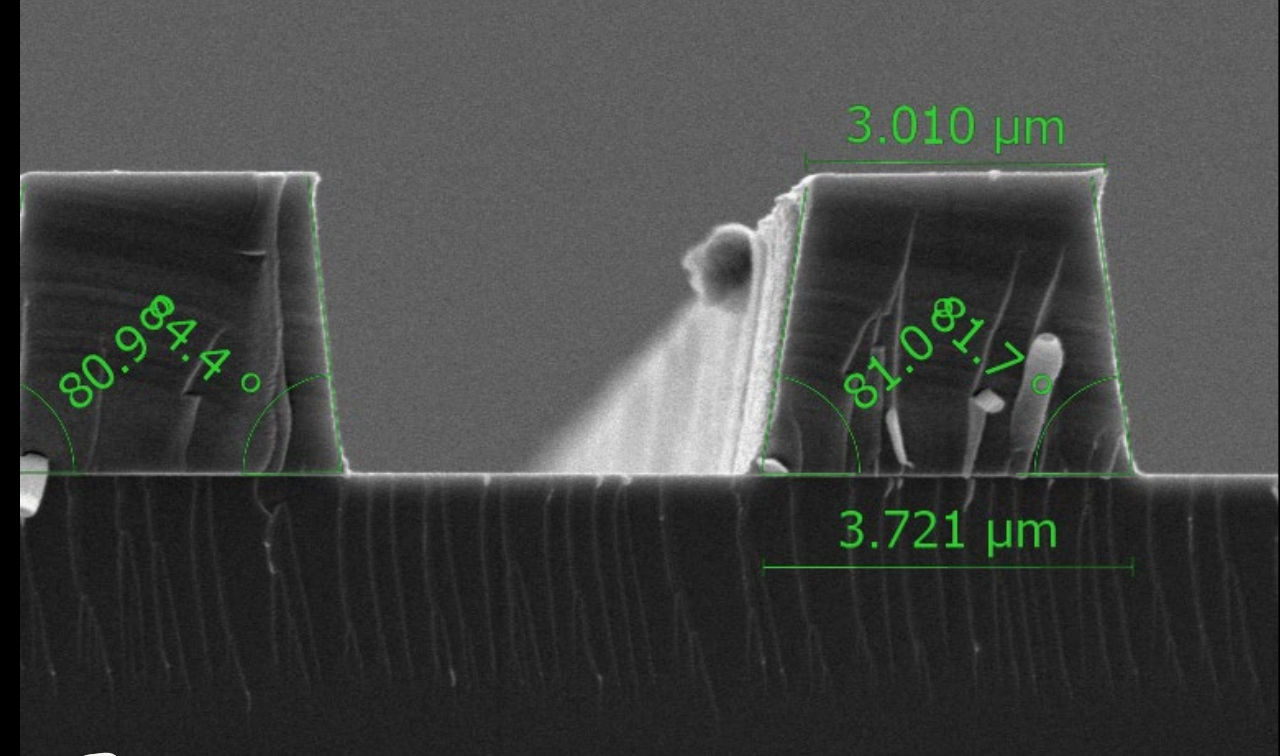
4 um Lines

Resist: 1827 Vacuum Contact Vapor
Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 16 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 79.44+-1.45 (n=18)
Imaged: March 27, 2023



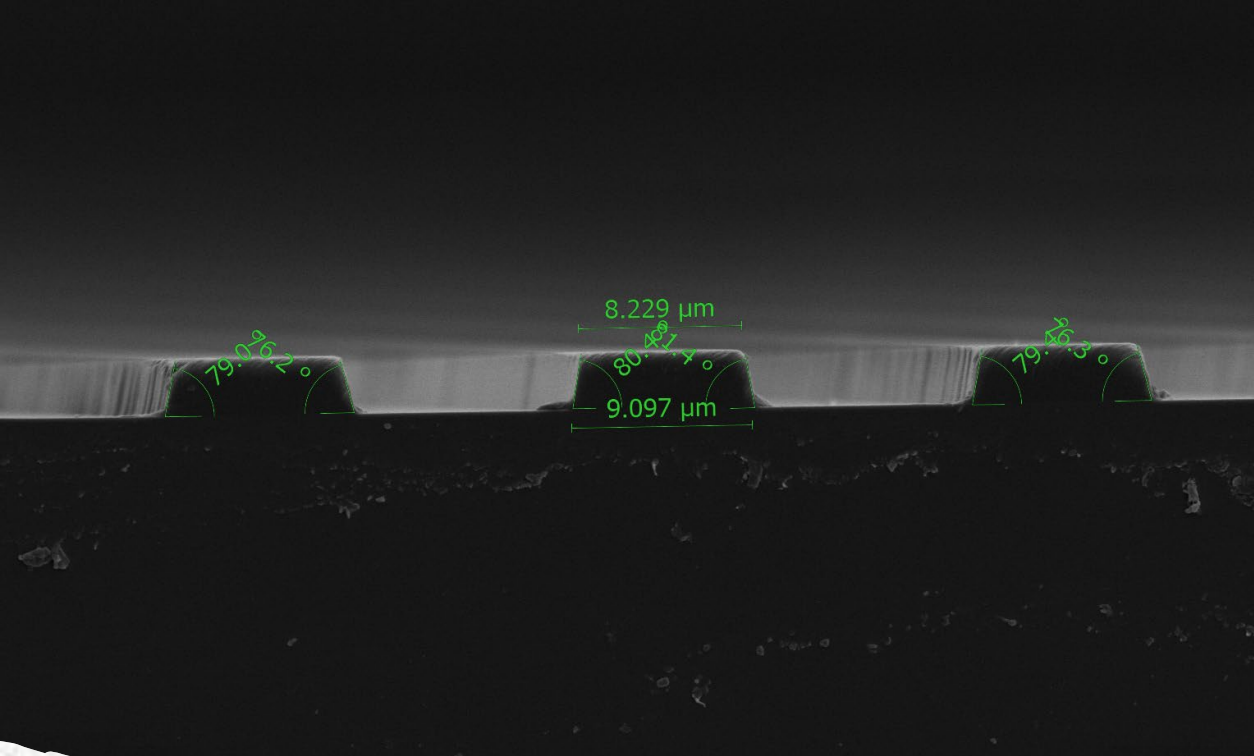
10 um Lines



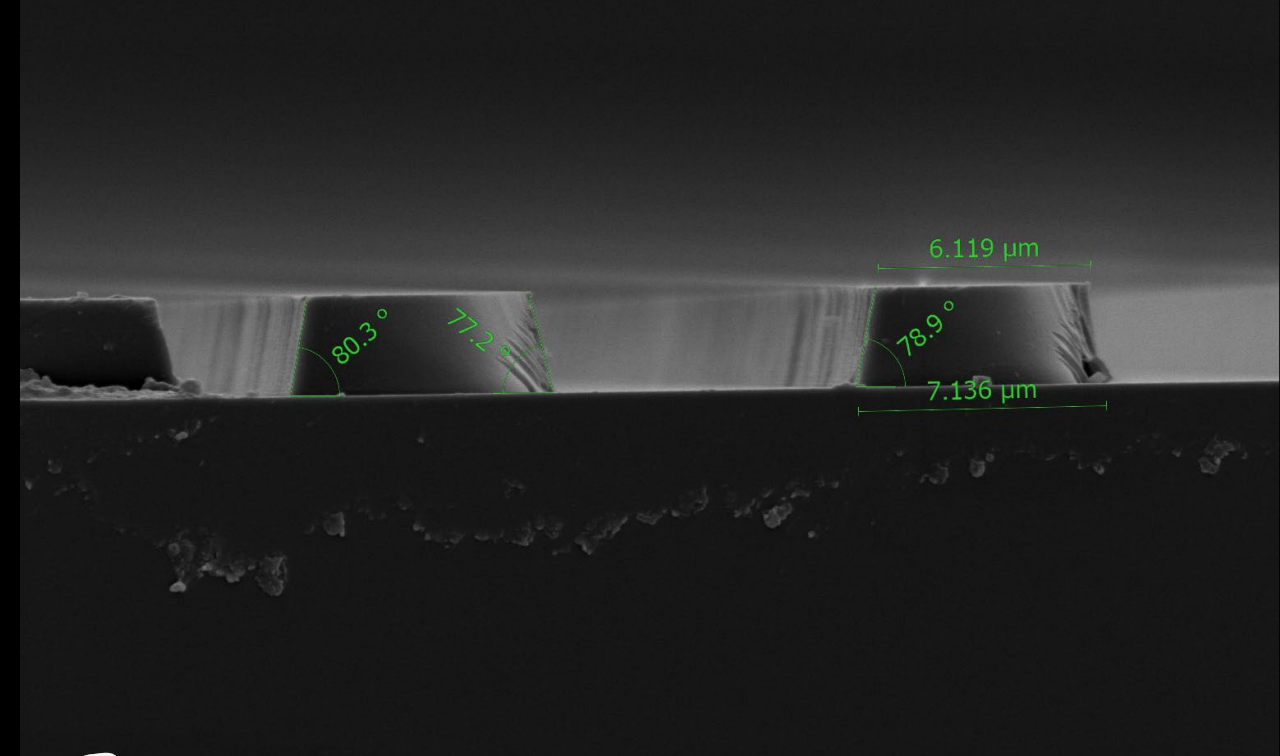
4 um Lines

Resist: 1827 Vacuum Contact Vapor
Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 18 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 83.22+-1.18 (n=6)
Imaged: March 27, 2023



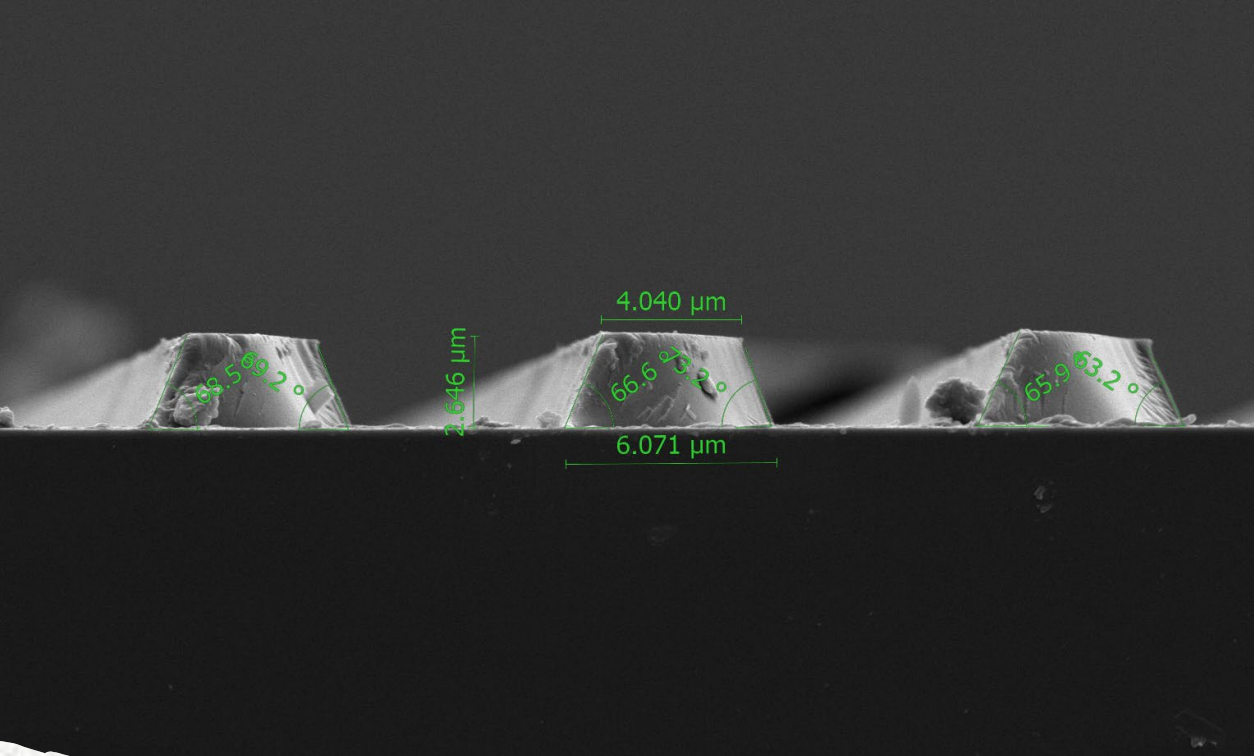
10 um Lines



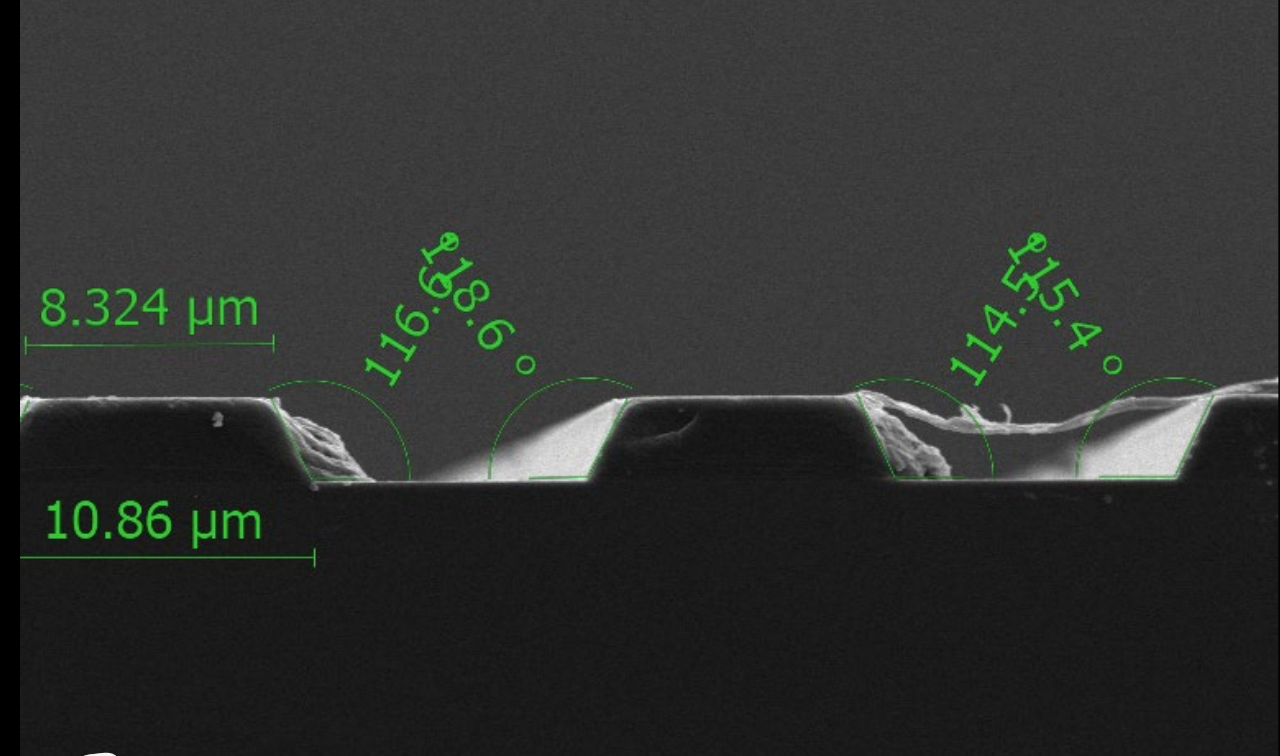
6 um Lines

Resist: 1827 Vacuum Contact Vapor Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 20 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 79.0±1.61 (n=11)
Imaged: March 27 2023



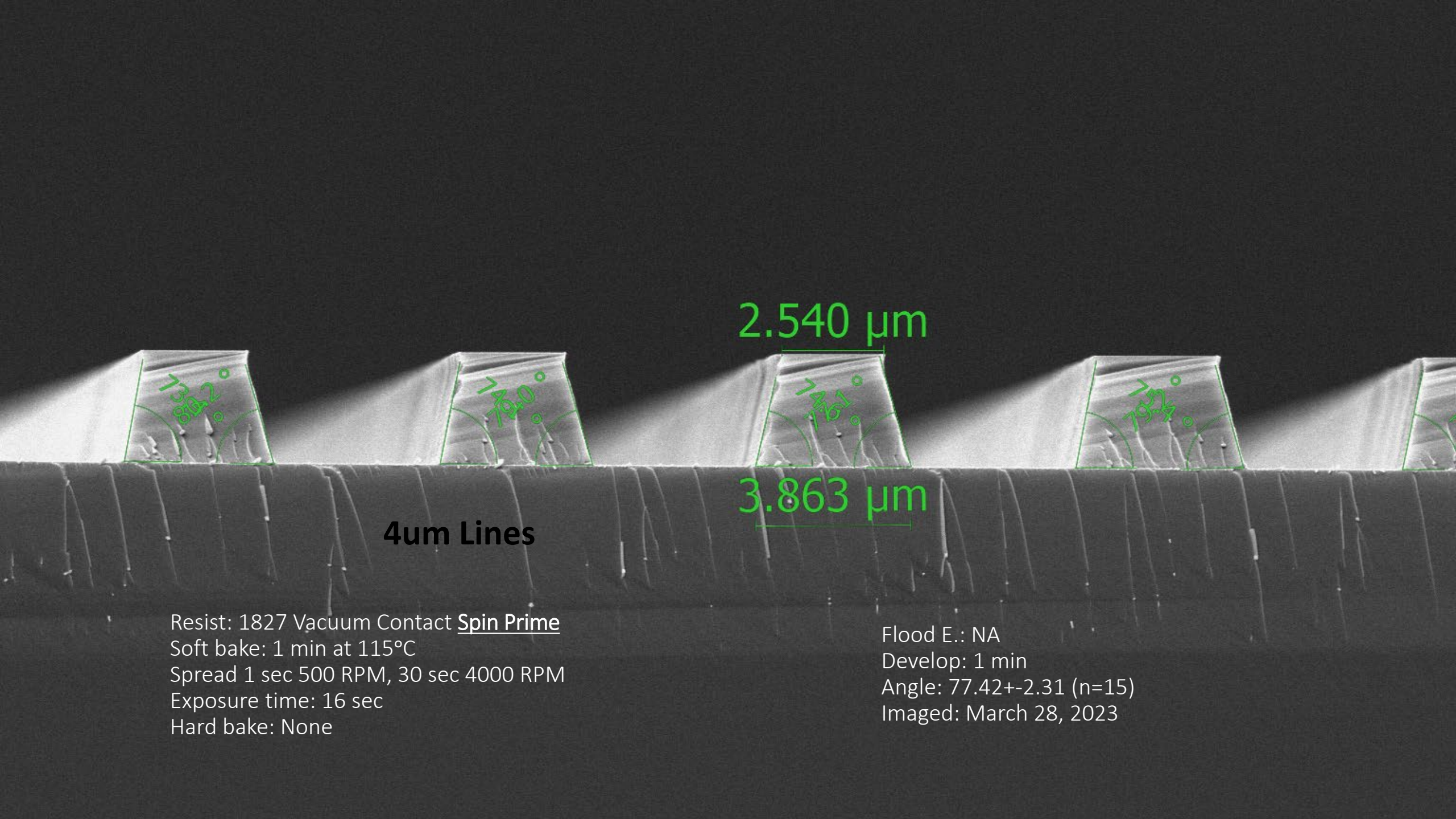
6 um Lines



10 um Lines

Resist: 1827 Vacuum Contact Spin Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 14 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 66.05+-2.99 (n=12)
Imaged: March 27, 2023



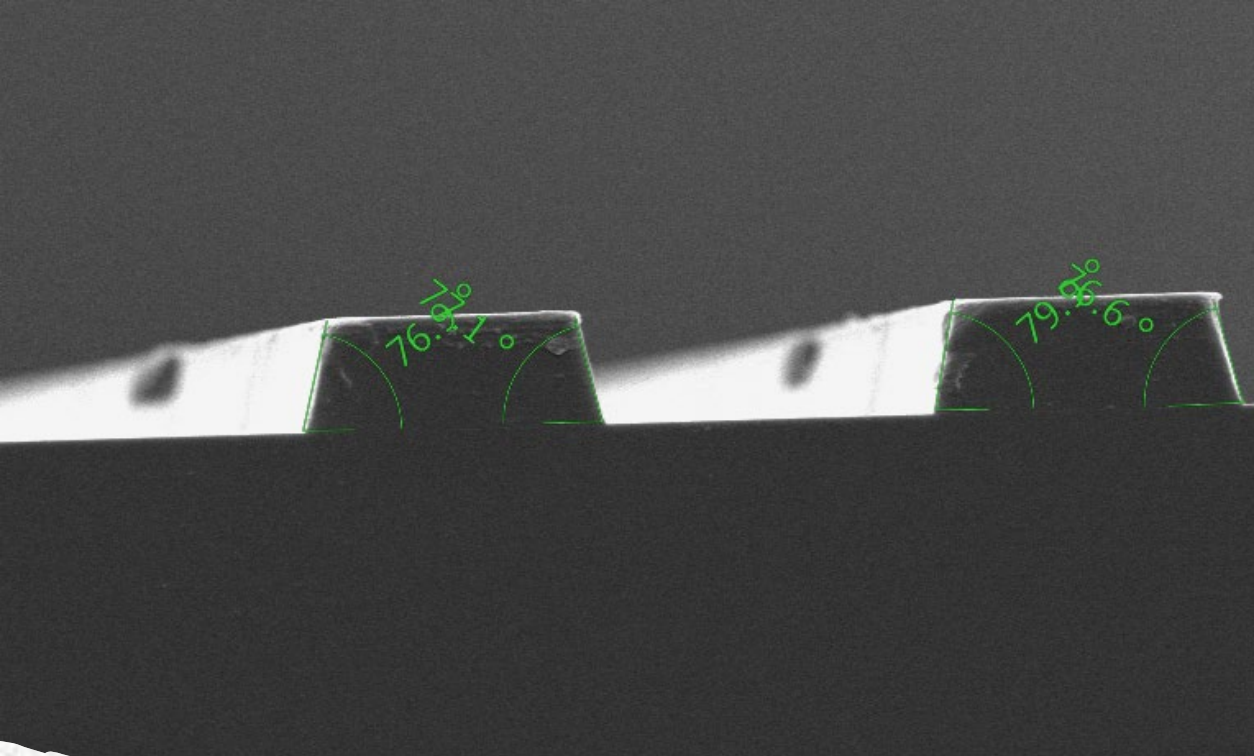
4um Lines

2.540 μm

3.863 μm

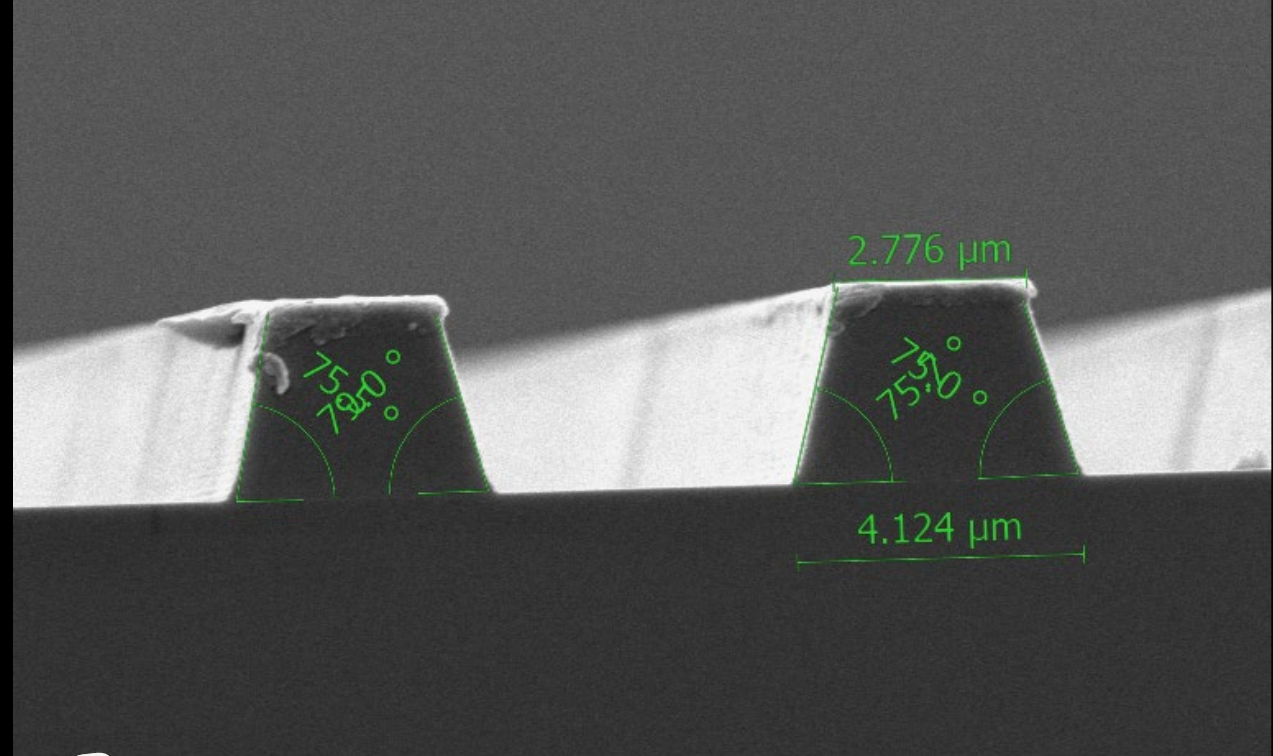
Resist: 1827 Vacuum Contact Spin Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 16 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 77.42+-2.31 (n=15)
Imaged: March 28, 2023



8um Lines

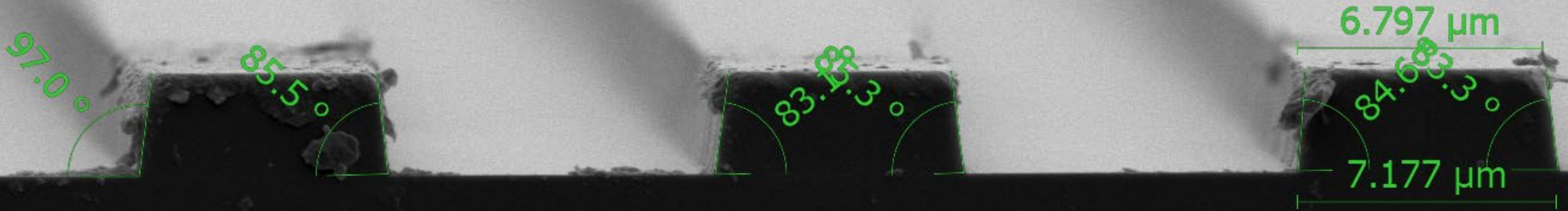
Resist: 1827 Vacuum Contact Spin Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 18 sec
Hard bake: None



4um Lines

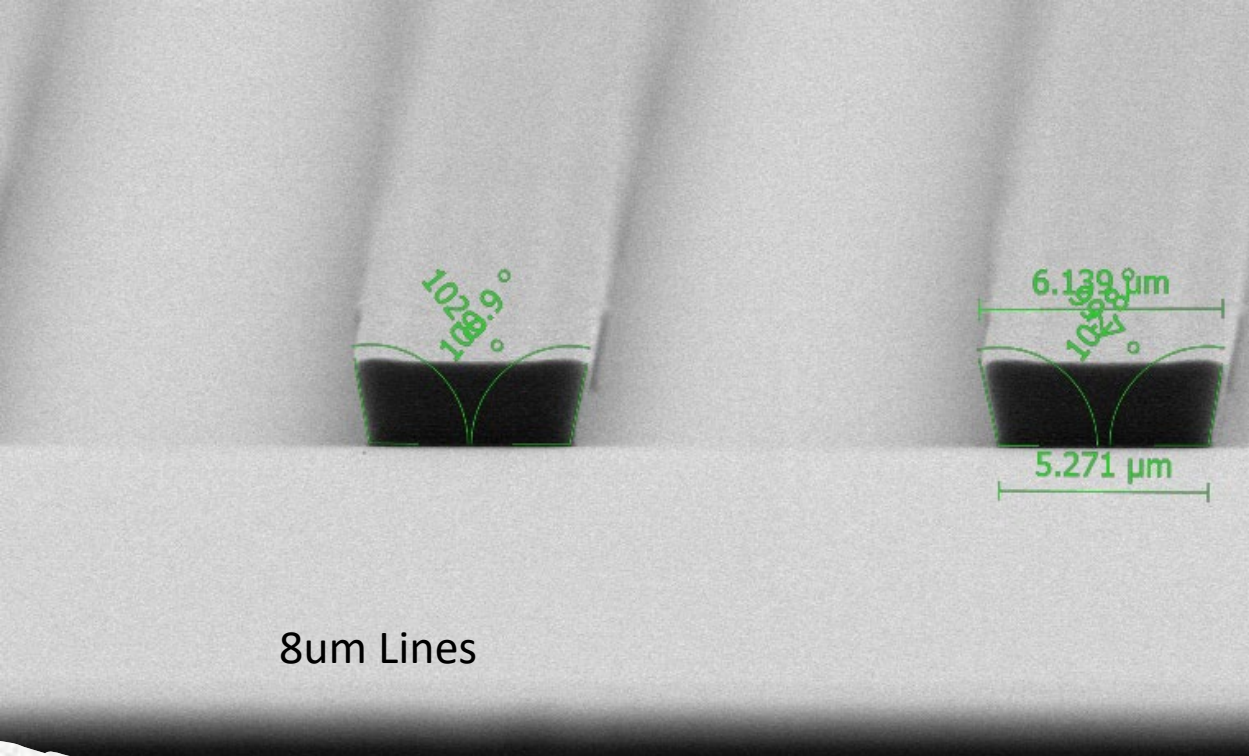
Flood E.: NA
Develop: 1 min
Angle: 77.31+-1.70 (n=16)
Imaged: March 28, 2023

6um Lines

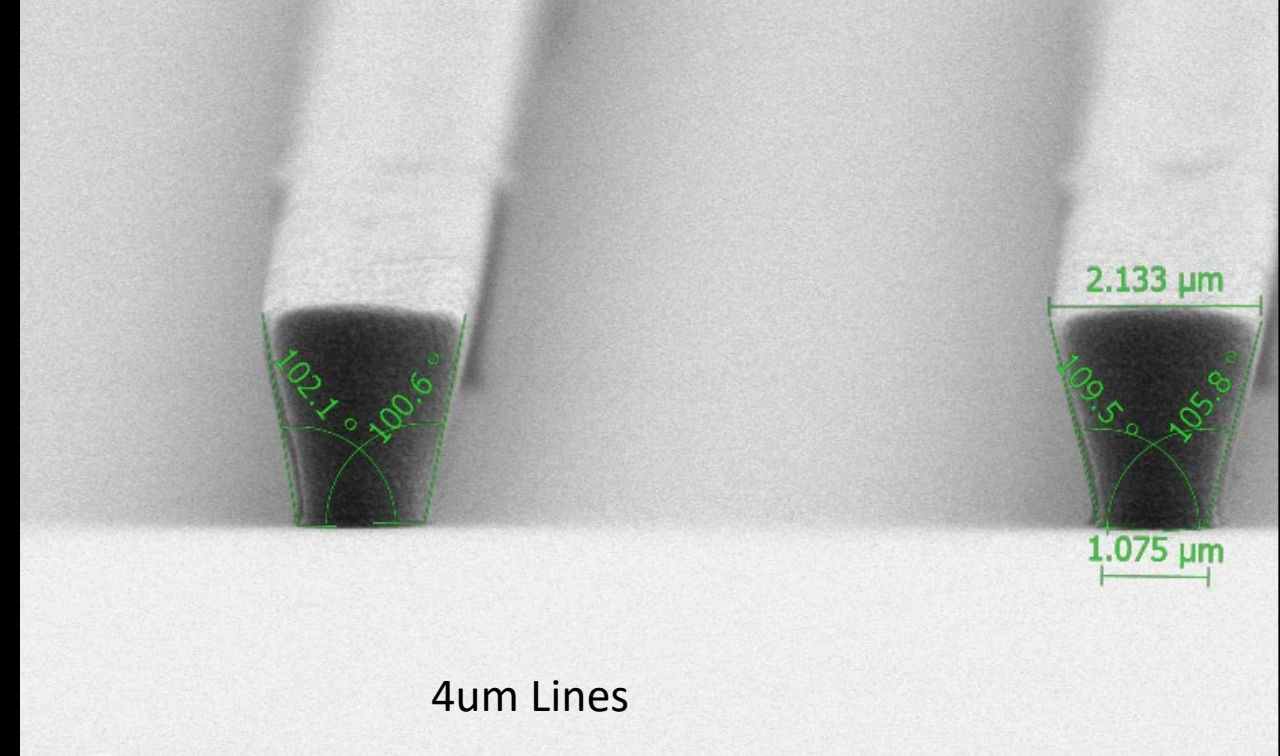


Resist: 1827 Vacuum Contact Spin Prime
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 20 sec
Hard bake: None

Flood E.: NA
Develop: 1 min
Angle: 84.0±1.07 (n=12)
Imaged: March, 27 2023



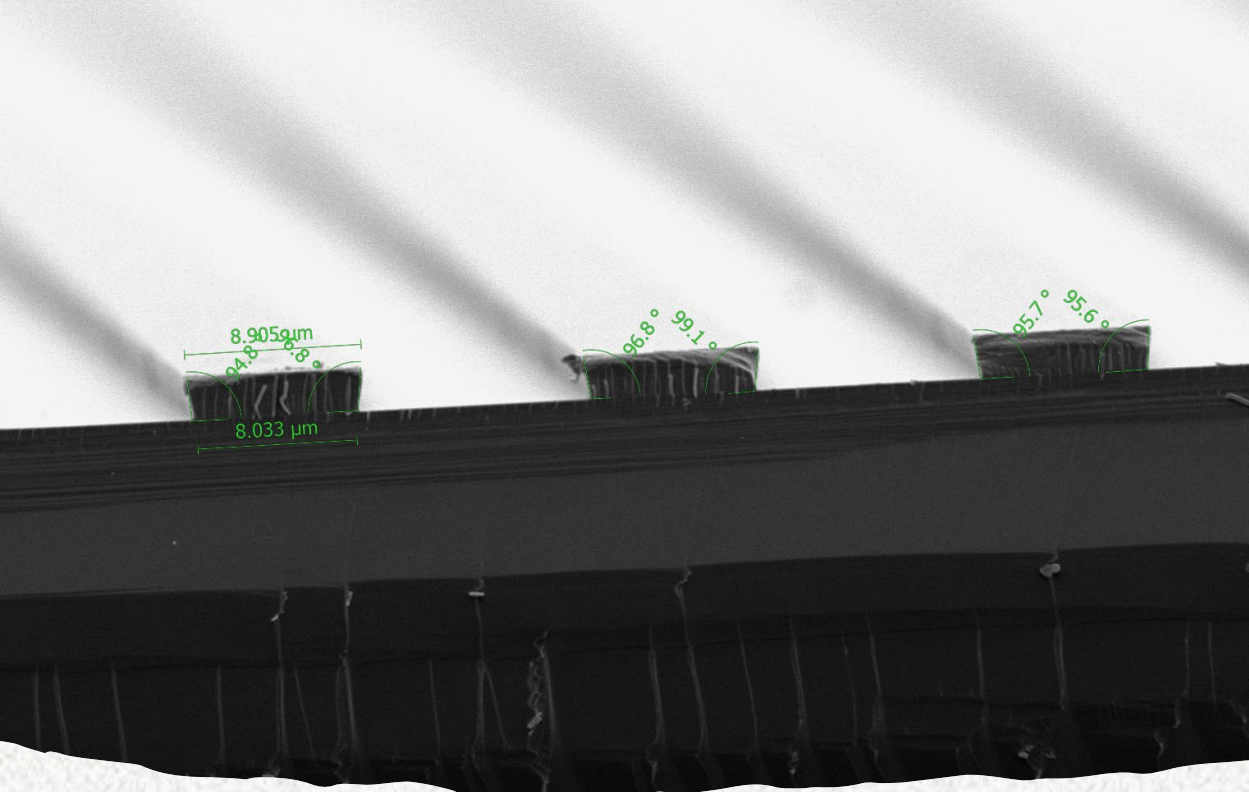
8um Lines



4um Lines

Resist: 1827 Vacuum Contact Vac Prime
Image Reversal
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 14 sec
Hard bake: None

Flood E.: 60 sec
Develop: 1 min ?
Angle: 101.87+-2.75 (n=14)
Imaged: March, 28 2023



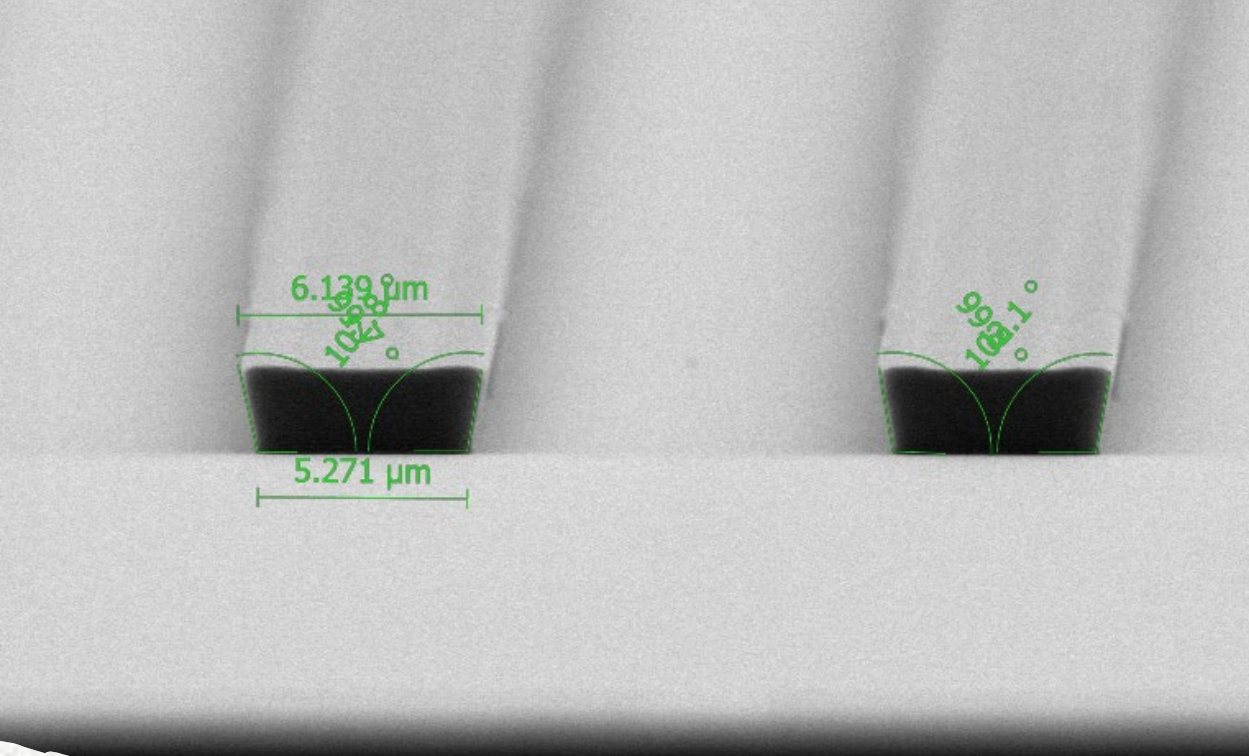
10 um Lines



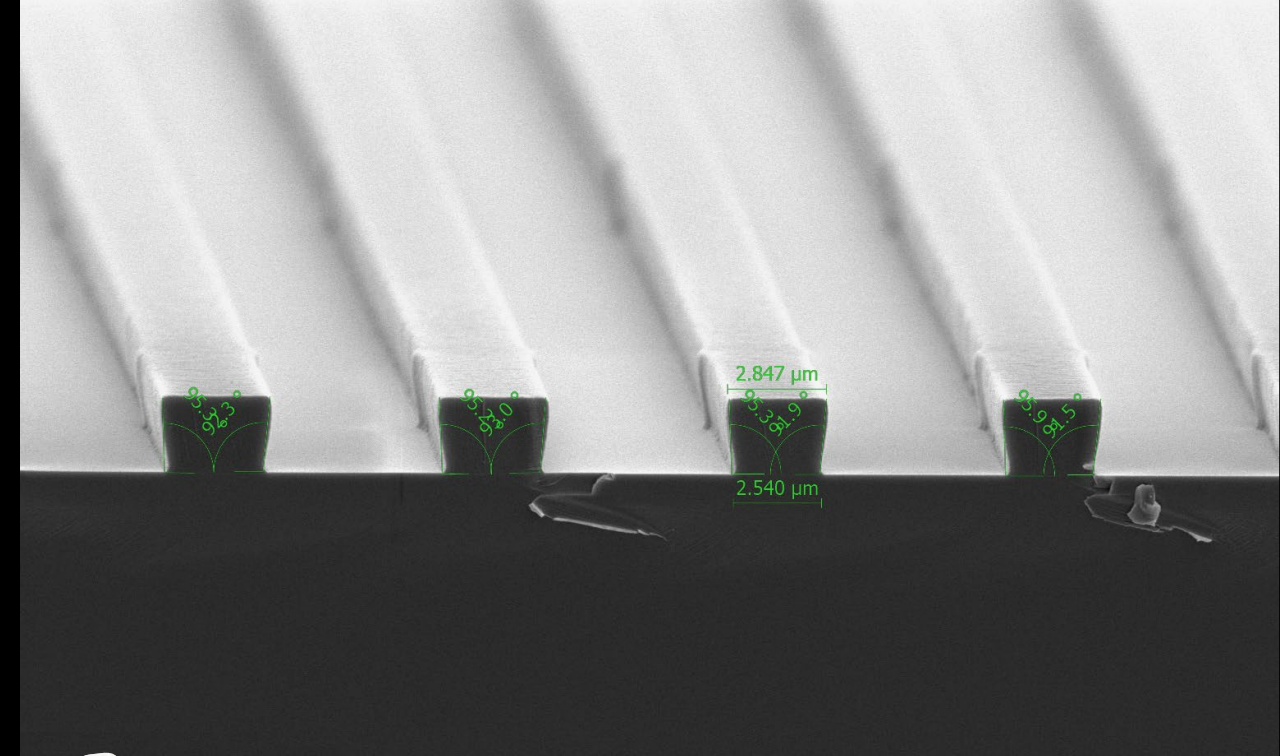
4um Lines

Resist: 1827 Vacuum Contact Vac Prime
Image Reversal
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 16 sec
Hard bake: None

Flood E.: 60 sec
Develop: 1 min ?
Angle: 96.79 ± 3.5 (n=20)
Imaged: March 28, 2023



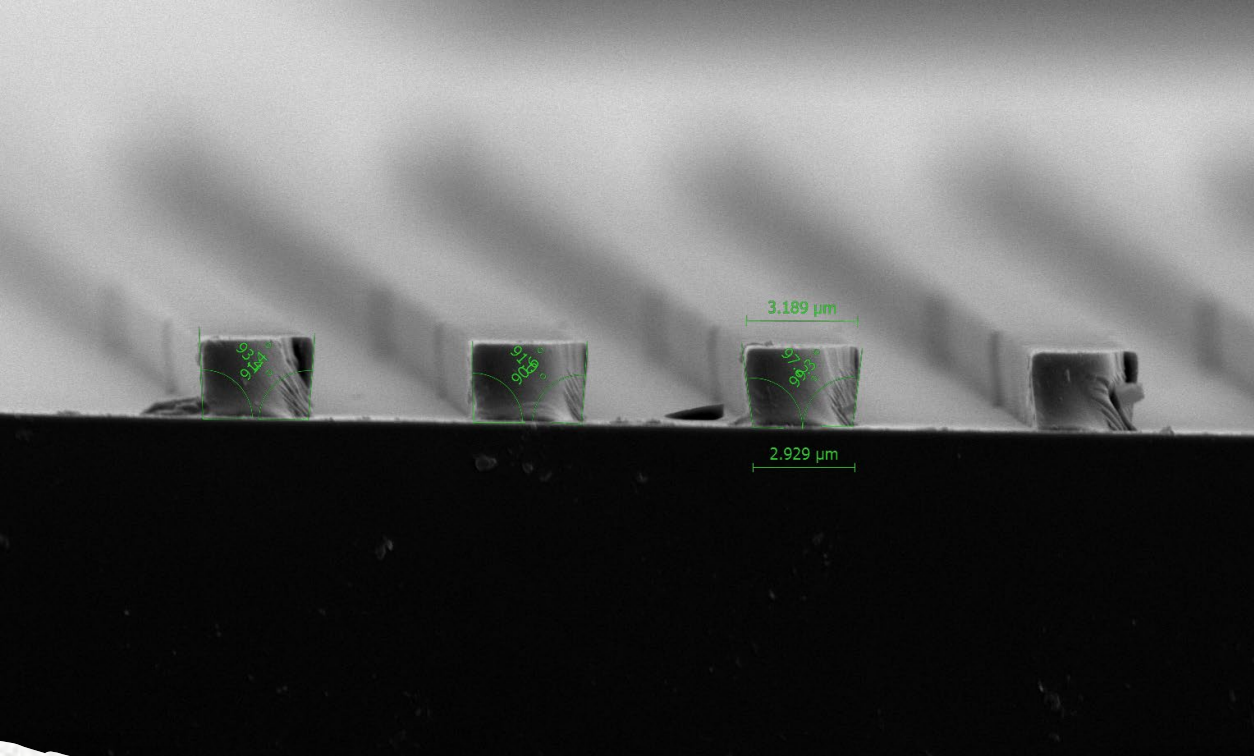
8um Lines



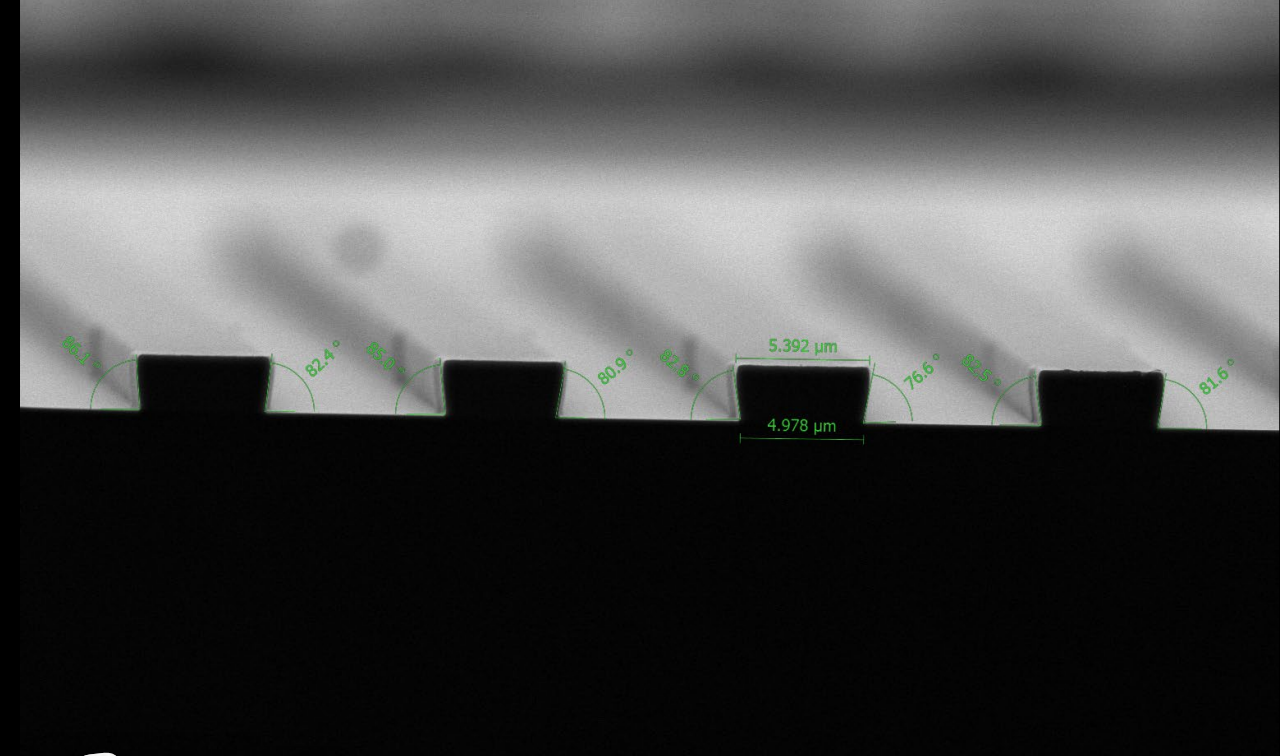
4um Lines

Resist: 1827 Vacuum Contact Vac Prime
Image Reversal
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 18 sec
Hard bake: None

Flood E.: 60 sec
Develop: 1 min ?
Angle: 95.63+-2.95 (n=16)
Imaged: March 28, 2023



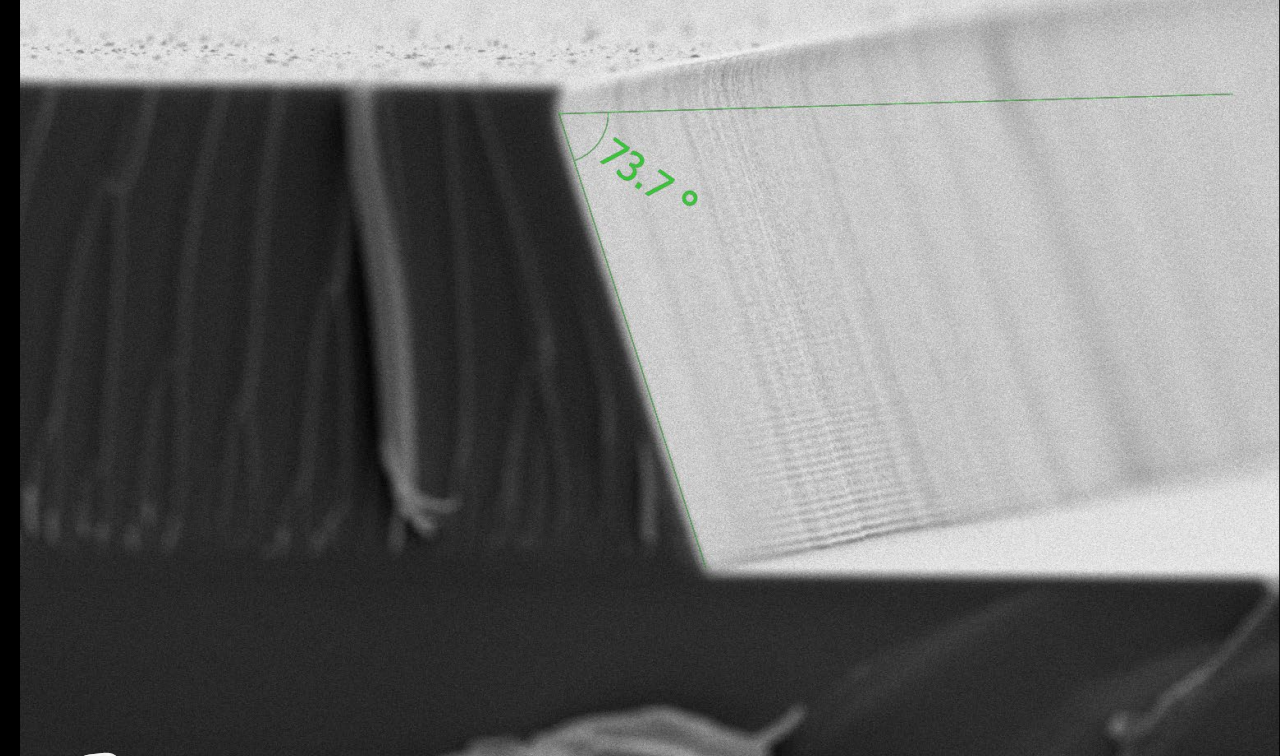
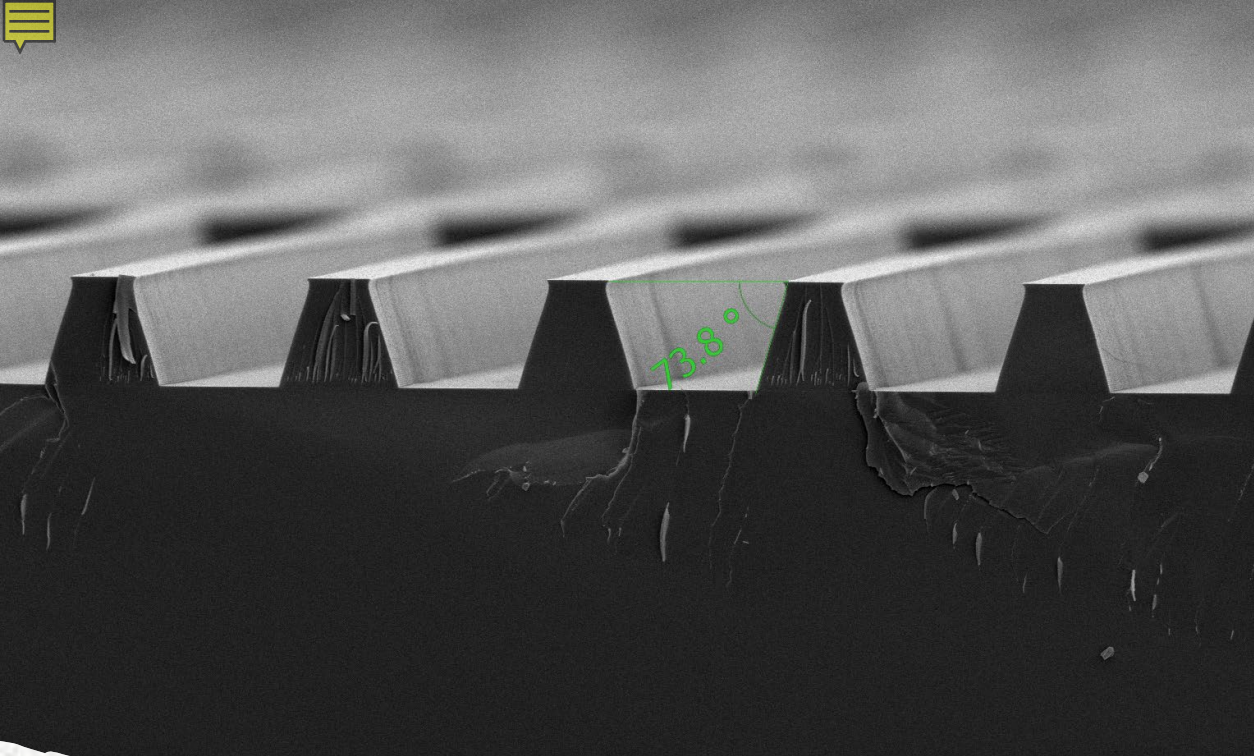
4um Lines



6um Lines

Resist: 1827 Vacuum Contact Vac Prime
Image Reversal
Soft bake: 1 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 20 sec
Hard bake: None

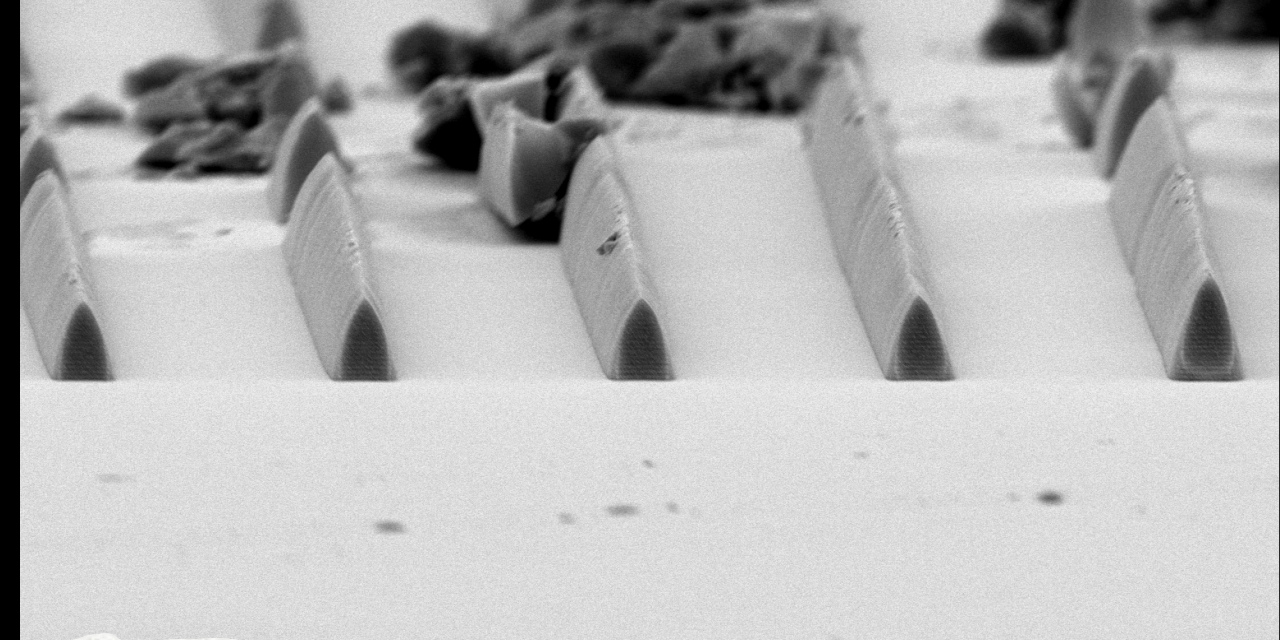
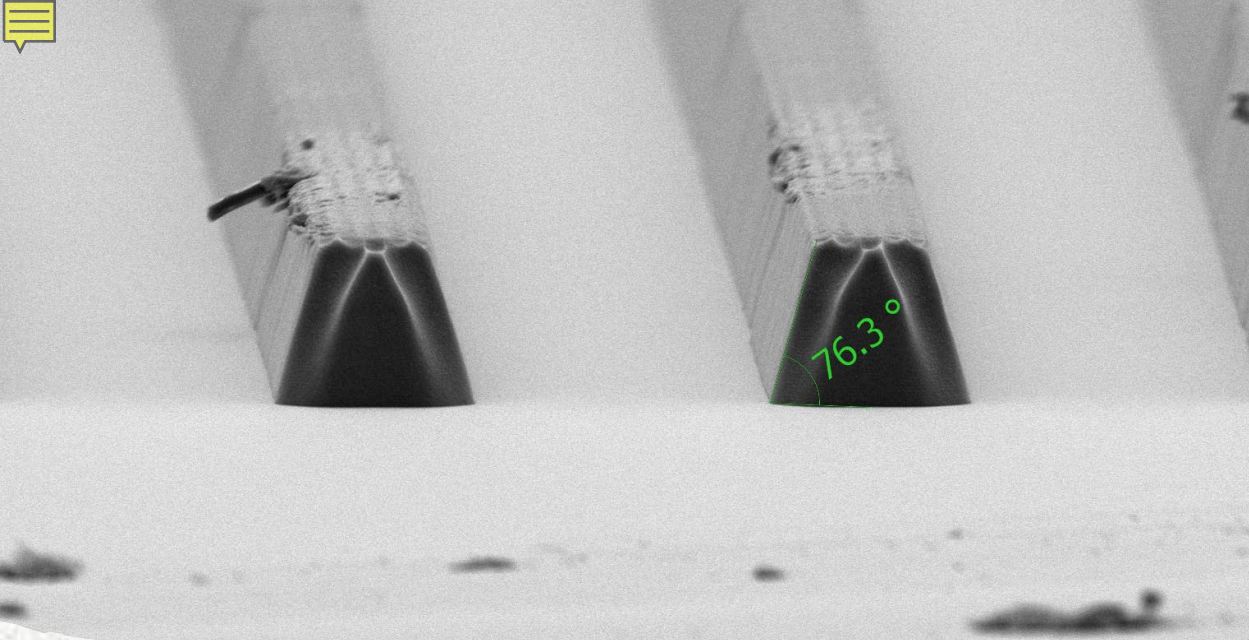
Flood E.: 60 sec
Develop: 1 min ?
Angle: 95.12+-3.17 (n=22)
Imaged: March 28, 2023



st det curr HV HFW 4 μm

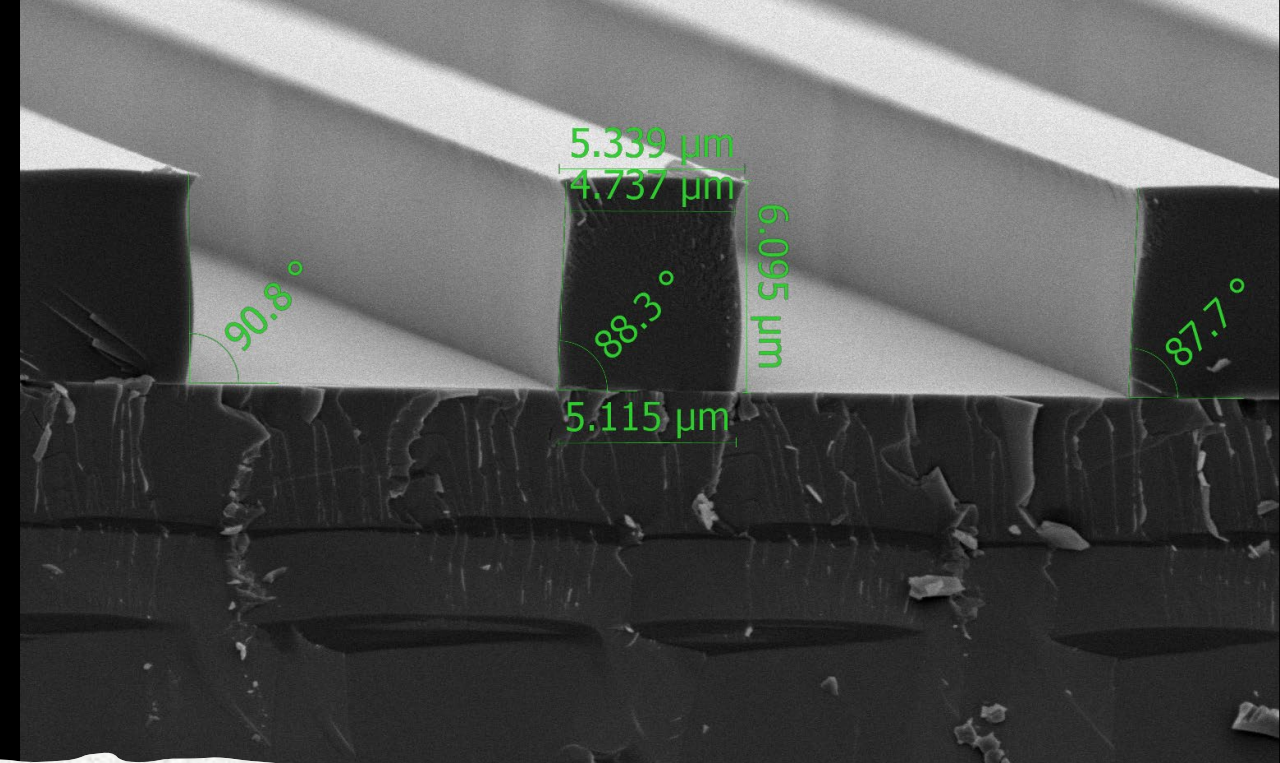
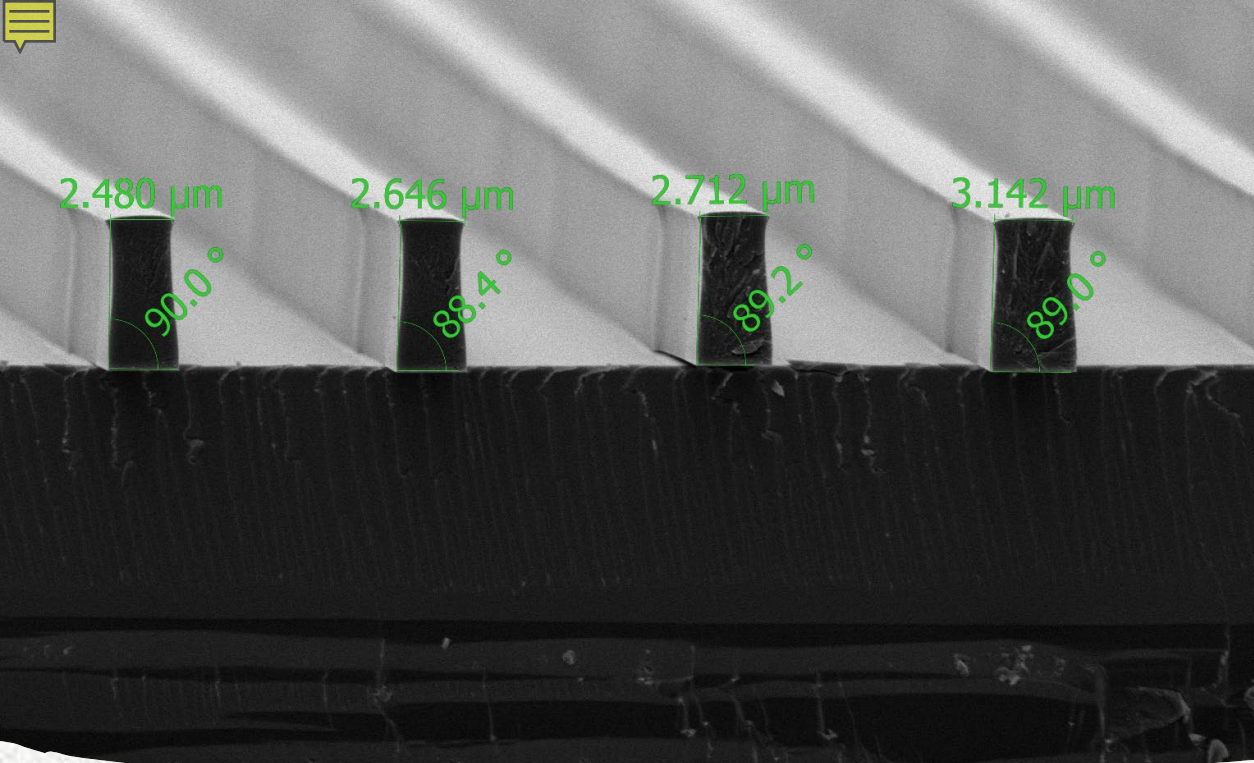
Resist: AZ4620 Hard Contact
Soft bake: 3 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 30 sec
Hard bake: None

Flood E.: NA
Develop: ?
Angle: 75.0,73.7,73.3,73.8, 76.3 Ave = 74.4
Imaged: March 13, 2023



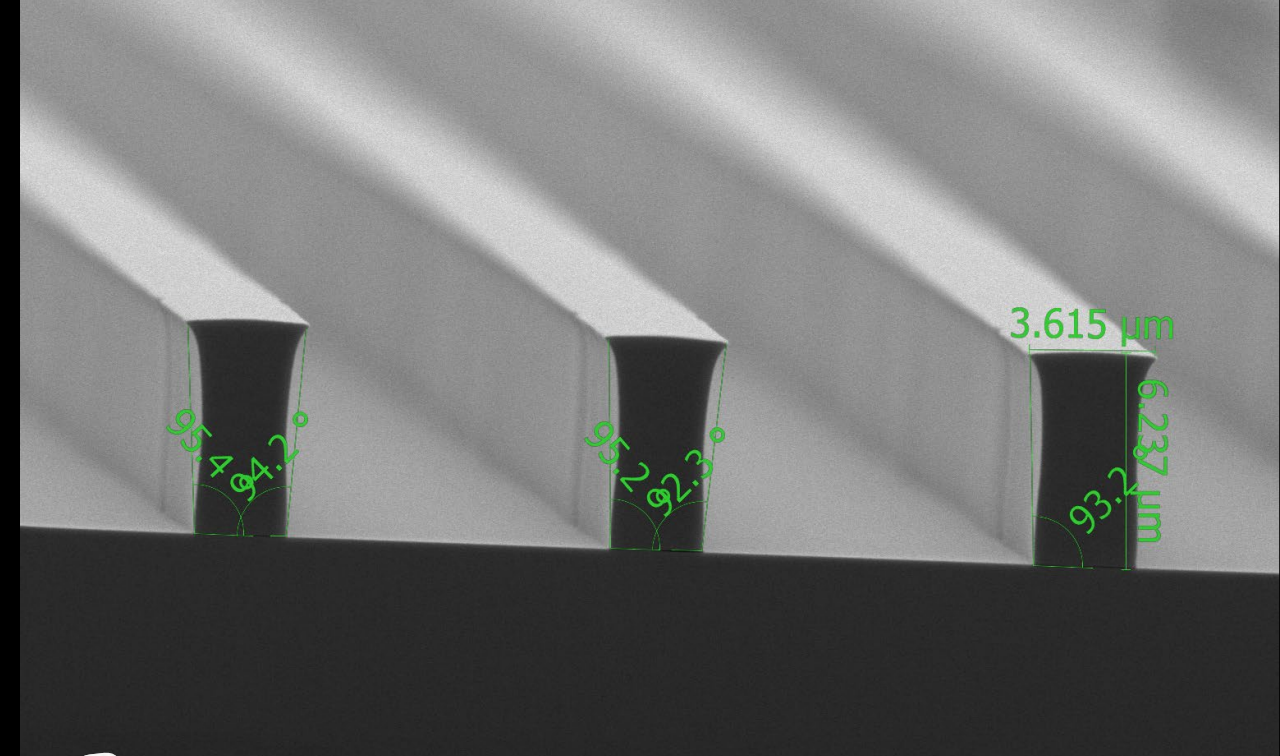
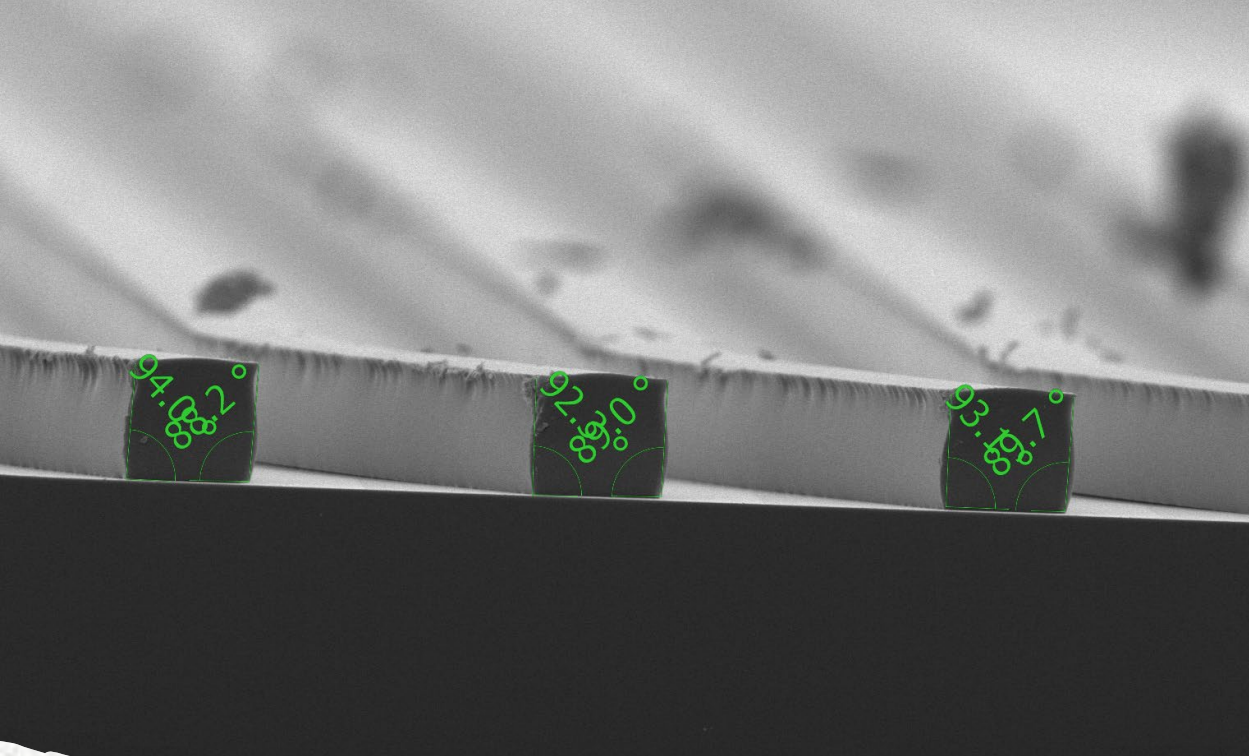
Resist: AZ4620 Hard Contact
Soft bake: 3 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 30 sec
Hard bake: None

Flood E.: NA
Develop: ?
Angle: 76.3
Imaged: March 13, 2023
Plasma Ash: 30 sec



Resist: AZ4620 Vacuum Contact
Soft bake: 3 min at 115°C
Spread 1 sec 500 RPM, 30 sec 3000 RPM
Exposure time: 30 sec
Hard bake: None

Flood E.: NA
Develop: 5 min
Angle: 90.0, 88.4, 89.2, 89.0, 87.7, 90.8,
90.8, 88.3, 87.7, 90.9, 91.2, 88.7
Imaged: March, 17 2023



Resist: AZ4620 Vacuum Contact
Soft bake: 3 min at 115°C
Spread 1 sec 500 RPM, 30 sec 4000 RPM
Exposure time: 30 sec
Hard bake: 12hr Vacuum Bake 100°C

Flood E.: NA
Develop: 5 min
Angle: 92.42 +- 2.34° (n=11)
Imaged: March, 23 2023

RESIST	LITHO TYPE	EXPOSURE TIME	FLOOD EXPOSURE TIME (SEC)	DEV TIME (MIN)	HARD BAKE (MIN)/(TEMP)	AVE. WALL ANGLE	SIGMA	NUMBER OF SAMPLES	COMMENTS
1827	Hard	20	NA	1-2	2/ 115C	NA	NA	NA	Curved Profile
1827	Hard	20	NA	1-2	NA	62.2	NA	1	
1827	Hard	20	NA	1-2	12 hrs/ 90C Vac	62.0	NA	1	Vacuum baked
1827	Hard	24	NA	1-2	NA	65	NA	1	
1827	Direct write	NA	NA	1-2	NA	63.5	NA	1	
1827	Hard	20	NA	1-2	NA	63.2	NA	1	Fresh resist from freezer
1827	Hard	20	30	2		80-106			Walls concave
1827	Hard	20	40	2		86-95			Walls concave
1827	Hard	20	40	3		105.5	0.5	2	Reentrant
1827	Hard	20	60	3		102.5	0.8	2	Reentrant
1827	Hard	20	60	4		95.33	3.4	7	Reentrant
1827	Hard	20	60	5		98.43	3.0	6	Reentrant
1827	Hard	20	60	1:40		91.3	3.8	3	Concave

Summary of Data

RESIST	LITHO TYPE	EXPOSURE TIME	FLOOD EXPOSURE TIME (SEC)	DEV TIME (MIN)	HARD BAKE (MIN)/(TEMP)	AVE. WALL ANGLE	SIGMA	NUMBER OF SAMPLES	COMMENTS
1827	Hard	20	60	4	NA	98.3	NA	1	Short O2 plasma etch
1827	Hard	20	90	3	Vacuum 90C 12 hrs	NA	NA		Walls very curved
1827	Hard	20	90	3	NA	NA	NA	1	Walls very curved
1827	Hard	20	60	4	NA	94.1	1.5	6	Reentrant
1827	Hard	20	60	4	NA	104.1	2.3	4	Reentrant, O2 plasma 1 min
1827	Hard	20	60	4	NA	96.4	1.8	10	Reentrant O2 plasma 1:20
1827	Vac	18	NA	2	NA	84.1	2.3	12	
1827	Vac	20	NA	2	NA	81.3	0.71	12	
1827	Vac	24	NA	1:30	NA	74.6	2.4	6	
1827	Hard	20	60	4	NA	109.6	1.9	7	Reentrant - REPRODUCING PREVIOUS Experiment
1827	Hard	20	60	4	NA	110.6	1.6	16	Reentrant - REPRODUCING PREVIOUS Experiment
1827	Vac	20	60	1	NA	89.9	1.1	16	Slight S shape to some walls
1827	Vac	20	60	1	NA	89.3	2.0	17	Slightly Concave

Summary of Data

RESIST	LITHO TYPE	EXPOSURE TIME	FLOOD EXPOSURE TIME (SEC)	DEV TIME (MIN)	HARD BAKE (MIN)/(TEMP)	AVE. WALL ANGLE	SIGMA	NUMBER OF SAMPLES	COMMENTS
AZ 4620	Hard	30	NA	?	NA	74.4	1.1	17	
AZ 4620	Hard	30	NA	?	NA	76.3		1	
AZ 4620	Vac	30	NA	?	NA	89.4	1.2	12	Somewhat S shaped
AZ 4620	Vac	30	NA	?	240hrs vac 100C	92.4	2.34	11	Upside down top hat
1827	Vac		14 NA		1 NA	69.716667	1.3452592	12	
1827	Vac		16 NA		1 NA	79.438889	1.4514892	18	
1827	Vasc		18 NA		1 NA	83.216667	1.182394	6	
1827	Vac		20 NA		1 NA	78.991667	1.6121716	11	
1827	Vac		14 NA		1 NA	66.05	2.9867764	12	Spin Prime
1827	Vac		16 NA		1 NA	77.42	2.3094588	15	Spin Prime
1827	Vasc		18 NA		1 NA	77.30625	1.6972289	16	Spin Prime
1827	Vac		20 NA		1 NA	84.016667	1.07458	12	Spin Prime
1827	Vac		14	60	1 NA	101.87143	2.7514746	14	
1827	Vac		16	60	1 NA	96.785	3.485581	20	
1827	Vac		18	60	1 NA	95.625	2.9812959	16	
1827	Vac		20	60	1 NA	95.118182	3.1668218	22	

Summary of Data

Conclusions/ Issues

- Best 1827 Conditions: Vacuum contact with image reversal.
Exp Time: 20 sec, 60 sec Flood Exposure, 1 min develop
- Above can be vacuum baked at 90C for 12 hours if needed
- Best AZ 4620 Conditions: Vacuum contact, Exp Time: 30 sec,
? min develop