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Fabrication and characterization of CNT/Ni/TiN/Si bridge structures.

Report 2014-03

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CONTENTS

1. Fabrication of CNT/Ni/TiN/Si bridge structures

1.1. SOI Batch #3A, Sample CTSoi-14N (Follow-up, complete)

CNT bridge fabrication results for SOI Batch #3A samples were shown in last report, except for the particularly promising sample TSoi-14N which was planned to be cleaned using a new microwave plasma ashing method prior to CNT growth. Although the MW plasma ashing wasn't successful in removing the remaining burnt/popped photoresist on the sample, aligned CNT were obtained for the first time on this sample's previously broken Bridge #3 (Figure 1). However, Bridges #1 and #2 also collapsed before the CNT growth making CTSoi-14N unsuitable for electrical/thermal characterization. Last MW stripping, lithography, and CNT growth process parameters are available in the follow-up tables of (Annex 1, Annex 1B), (Annex 1, Annex 1D), and (Annex 1, Annex 1G) respectively for this sample. Photomicrographs and SEM micrographs of the CNT bridge are added for those last fabrication steps in Annex 2.

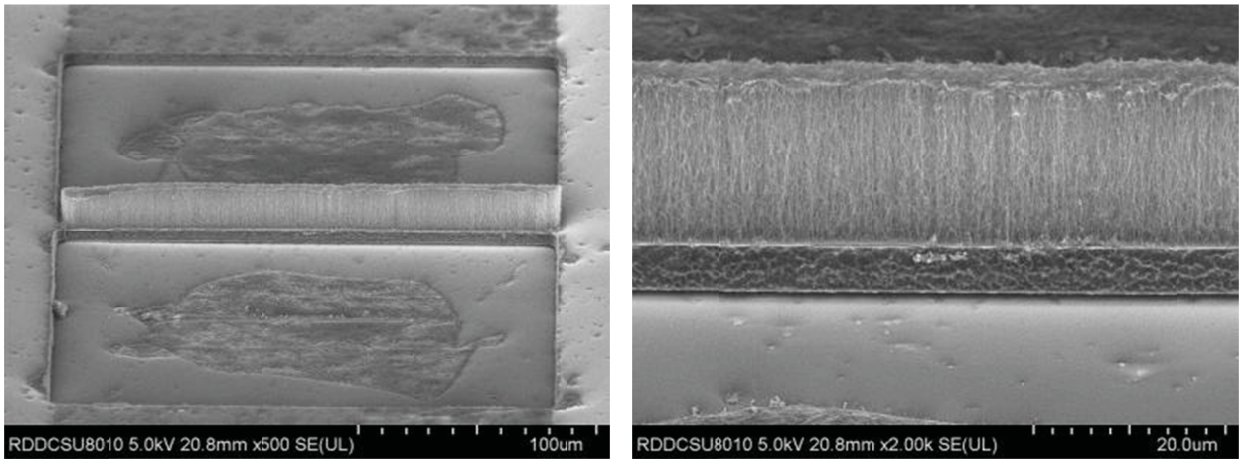

Figure 1 : SOI Batch #3A, Process flow #3A: SEM images of CTSoi-14N broken Bridge#3 with aligned CNTs

1.2. SOI Batch #3B, Process flow #3B (New, complete)

The CNT bridge fabrication for the five SOI Batch #3B samples (CTSoi-13bN, CTSoi-14bN, CTSoi-14cN, CTSoi-15N, and CTSoi-19N) was performed using the related process flow described in the second to last report. Precise process parameters and data are available in the follow-up tables of (Annex 1, Annex 1A) for deposition with the CVC sputter, (Annex 1, Annex 1B) for CNT growth with the PECVD, (Annex 1, Annex 1D) for lithography processes, (Annex 1, Annex 1E) for wet etching processes, (Annex 1, Annex 1F) for dry etching processes with the Tegal T901e RIE, and (Annex 1, Annex 1G) for resist ashing/stripping with the Plasma-Preen. Photomicrographs and SEM micrographs are provided at the various process flow steps for the samples in Annex 3, Annex 4 , Annex 5, Annex 6, and Annex 7. Many CNT bridges of this batch appear to be potentially good and are further analyzed in the characterization section.

1.3. SOI Batch #4A, Process flow #4A (New, started)

The process flow #4A was also described in the second to last report and 5 samples (TSoi-11, TSoi-11b, TSoi-12, TSoi-12b, and TSoi-18) are being processed accordingly. First already

available process data are also included in the follow-up tables of Annex 1 but since the fabrication is still ongoing, main results are only expected for next report. Preliminary tests already indicated that stiction between the early released Si bridge and the handle underneath might be one of the main challenges for this process flow.

1.4. SOI Batch #5A, Process flow #5A (New, started)

This batch of samples has been started lately using the new SOI prime wafers that have been received with device nominal thickness of 3±0.5 µm and a BOX nominal thickness of 1 µm ±0.5%. The CNT bridge fabrication is however currently on hold as the precise process flow to use will be determined from ongoing first characterization and analyses of previous batch results.

2. Characterization of potentially good CNT bridges

Volume (thickness and growth area) and mass measurements are being performed on some selected CNT samples to help estimate their CNT density. Densities of ~2-3% are reported in the literature for SWCNT films 10 µm thick but could vary a lot depending on sample preparation conditions [1]. Thermal conductivity measurements are also to be performed once the experimental setup is ready. Room temperature thermal conductivity values in the extremely wide range of ~0.7-6600 W/m K are reported for individual and bulk single wall and multiwall CNTs [2], [3].

2.1. Thickness measurement (CNT and Si bridge)

The CNT layer thickness was estimated using various tools:

- Veeco optical profiler appears unsuitable for this kind of measurements due to the high difference of reflectivity between the CNT layer and the surrounding layers (TiN electrodes and Si Handle). The low reflectivity of the CNT layer makes the bridge appear as a hole in the whole structure (Figure 2).

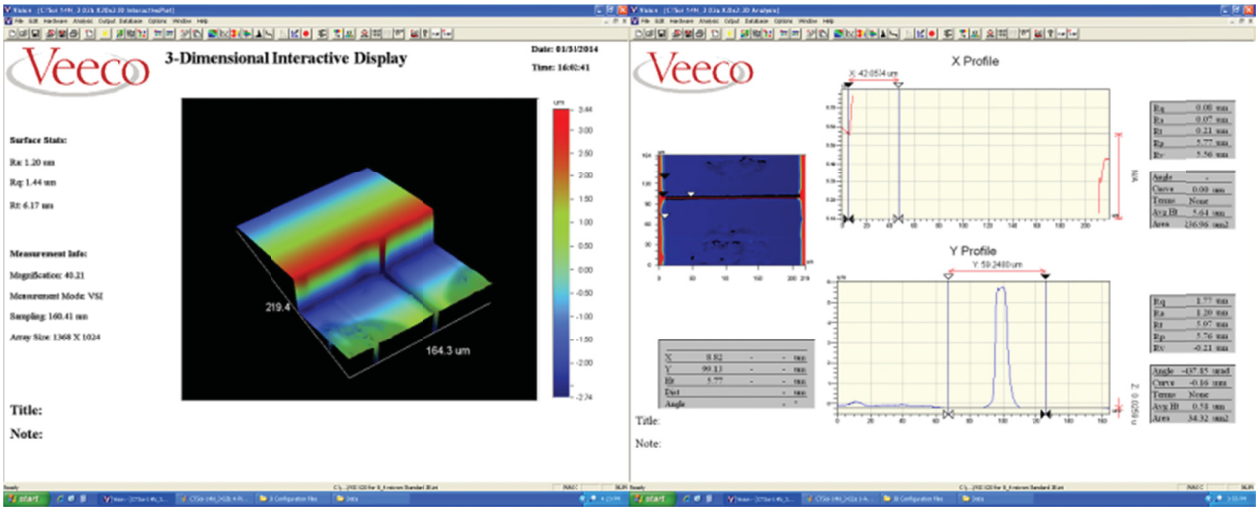

Figure 2 : Veeco Optical profiler measurement of CNT layer thickness for sample CTSoi-14N Bridge#3

- Nikon Eclipse LV150 optical microscope was used to measure the stage displacement required (in the vertical Z-direction) to focus respectively on the top surface (Tip) and bottom (TiN layer) of the CNT film. Since the Z-displacement knob graduation is in arbitrary units, the system has to be calibrated for the conversion of this graduation unit into standard length units. A first calibration was done using an available Veeco Step Height Standard (SHS) which was known to have a height of 8.374 µm. The challenge was however to know exactly when the focus was on the top of the step and in the trench. Calculated conversion factors are shown in Table 1 and hence estimated thicknesses for the samples' CNT layers are shown in the second to last column of Table 2.

Table 1 : Veeco SHS based Z-displacement conversion factor for the Nikon LV150 optical microscope stage

Sample name	Date	Nikon Eclipse LV150 microscope Objective	Stage moving Up or Down	Trench Level (grad) = Knob Graduation Unit	Step Level (grad) = Knob Graduation Unit	Step Height (grad) = Knob Graduation Unit	Conversion factor (µm/grad) - From SHS known 8.374 µm height	Comments
Veeco (SHS)	14/02/17	**X50**	**Down**	77	47	30	0.279	This estimation of the Z-displacement conversion factor for the Nikon Eclipse LV150 stage is done using an 8.374µm-high Veeco Step Height Standard (SHS).
		X50	**Up**	77	45	32	0.262	idem
		X100	**Down**	81	52	29	**0.289**	idem
		X100	**Up**	82.5	51	31.5	**0.266**	idem

- A second calibration of the Nikon Eclipse LV150 optical microscope stage Z-displacement was done for each sample by measuring an additional reference distance that could also be easily measured using the Dektak 150 stylus profiler. The depth of the trench (TiN + Device layer + BOX) around each bridge was therefore measured using both methods and a conversion factor was calculated for each bridge. The challenge was also to know exactly when the focus was on the handle, the TiN surface and the CNT tip. Calculated conversion factors and estimated CNT thicknesses are shown in Table 2.
- SEM measurements of the CNT layer thickness were also performed on the samples by tilting them as much as possible (65-70°). Raw measurements indicated on SEM images in Annex 2, Annex 3, Annex 4, Annex 5, Annex 6, and Annex 7 are to be corrected afterward for the tilting angle as the SEM automatic tilt-compensation was shown to distort images only in an in-plane direction, leading to false CNT thickness measurements when used. Corrected average CNT thicknesses are shown in Table 2. Definite tip delimitation for aligned CNT samples (CTSoi-14N) leads to more reliable measurements than the unclear delimitation of the top surface of all other analyzed samples which CNTs are spaghetti-like.

Veeco SHS based estimations are seen to be completely out of range with Dektak and SEM based estimations. In fact tilt-corrected SEM measurements are thought to be more reliable as they are less operator-related.

The thicknesses of the Si bridges (device layers) are also estimated using the Dektak 150 and SEM measurements as shown in Table 3.

2.2. CNT growth area measurement

Theoretical dimensions of the Ni masks (6 µm X 54 µm; 6 µm X 104 µm; 6 µm X 204 µm) could be used to estimate CNT surface coverage on the bridges. However, more precise and direct measurements were performed using a useful surface measurement feature found in NIS-Elements image analysis software. Those measurements of CNT growth areas allow for taking into account fabrication-related defects as indicated in the optical images of Annex 2, Annex 3, Annex 4, Annex 5, Annex 6, and Annex 7.

For electrical/thermal characterization purposes, it should be noted that the effective CNT surface coverage might be slightly smaller than measured in some particular cases depending on the fabrication process flow used. Especially, when the TiN electrode layer is patterned and etched before Ni deposition and lift-off, Ni might also be deposited directly on the Si in TiN defect areas leading to CNT/Ni/Si growth which should not be accounted for in electrical signal from CNT/Ni/TiN/Si areas. CNT surface coverage data are available in Table 3.

2.3. Mass measurement of CNT film

The CNT film mass measurement was performed using a ***Sartorius Supermicro*** 4 microbalance which was found in the Chemistry Laboratory of DRDC WS Section. This microbalance has a specified readability (resolution) of 0.1 µg. For practical operating reasons, the total sample (CNT + substrate) size and mass should not exceed approximately 2 cm X 2 cm and 400 mg respectively. The CNT weight is estimated by comparing the weight of the substrate before and after removing the CNT film.

The first measurement performed on a CNT test sample (CS093-3N) yield 77.6 µg for CNTs covering an area of ~1 cm^2. If such CNTs were on the Ni/TiN/Si bridges, they would have weighed between 0.25 ng and 0.95 ng respectively for the shortest and longest bridge. Those values are at least two orders lower than the resolution of the microbalance and that means there's no point trying to measure directly CNT mass on real CNT bridge samples. Witness samples will therefore be used to estimate the CNT mass on the bridges. Moisture could affect seriously measurements with the microbalance and therefore special care should be taken with the CNT layers which are highly porous.

Table 2 : CNT thickness estimation using Nikon LV150 optical microscope (with Dektak and SHS based Z-displacement conversion factors) and SEM

Sample name	Bridge identification #	Nikon Eclipse LV150 microscope Objective	Stage moving Up or Down	Z-stage Knob graduation - Focus on Si handle : 1st	Z-stage Knob graduation - Focus on Si handle : 2nd	Z-stage Knob graduation - Focus on Si handle : Average	Z-stage Knob graduation - Focus on TiN surface : 1st	Z-stage Knob graduation - Focus on TiN surface : 2nd	Z-stage Knob graduation - Focus on TiN surface : Average	Z-stage Knob graduation - Focus on CNT surface : 1st	Z-stage Knob graduation - Focus on CNT surface : 2nd	Z-stage Knob graduation - Focus on CNT surface : Average	Si Handle to TiN surface distance (grad) = Knob Graduation Unit	Si Handle to TiN surface distance (µm) - Dektak measurement	Conversion factor (µm/grad) - From Dektak measurement of Si-TiN distance	CNT thickness = TiN to CNT surface distance (grad) = Knob Graduation Unit	CNT thickness (µm) - From Dektak-based conversion factor	CNT thickness (µm) - From measured Veeco SHS standard conversion factor	CNT thickness (µm) - From SEM measurements
↓ BATCH #3A																			
CTSoi-13N	1	X100	Down	69	68	68.5	66	65	65.5	62	61	61.5	3	2.205	0.735	4	2.940	1.155	2.282
		X100	Up	68.5	68.5	68.5	65.5	66	65.75	62	63	62.5	2.75	2.205	0.802	3.25	2.606	0.864	2.282
CTSoi-14N	3	X100	Down	88.5	87	87.75	83	82	82.5	64	61	62.5	5.25	5.788	1.102	20	22.050	5.775	**17.923**
		X100	Up	87	88.5	87.75	82	83	82.5	61.5	64	62.75	5.25	5.788	1.102	19.75	21.774	5.250	**17.923**
↓ BATCH #3B																			
CTSoi-13bN	2	X100	Down	76	74.5	75.25	72.5	71	71.75	69.25	68.75	69	3.5	3.103	0.887	2.75	2.438	0.794	0.845
		X100	Up	76	77	76.5	72	73.5	72.75	69	71	70	3.75	3.103	0.827	2.75	2.276	0.731	0.845
CTSoi-14bN	1	X100	Down	89.5	88.5	89	84.5	83.5	84	81.5	79.5	80.5	5	5.476	1.095	3.5	3.833	1.011	1.266
		X100	Up	89	90.5	89.75	83	84.5	83.75	80	81.5	80.75	6	5.476	0.913	3	2.738	0.798	1.266
CTSoi-14bN	2	X100	Down	88.5	87.5	88	83.5	82.5	83	80.75	80	80.375	5	4.049	0.810	2.625	2.126	0.758	1.386
		X100	Up	86	87.5	86.75	83	84	83.5	81.5	82.5	82	3.25	4.049	1.246	1.5	1.869	0.399	1.386
CTSoi-14cN	1	X100	Down	94	92	93	89	88	88.5	87	86	86.5	4.5	4.076	0.906	2	1.812	0.578	1.125
		X100	Up	93	94.5	93.75	89	90	89.5	86.5	87.5	87	4.25	4.076	0.959	2.5	2.398	0.665	1.125
CTSoi-14cN	2	X100	Down	97	96	96.5	92.5	91.5	92	90	89.5	89.75	4.5	4.256	0.946	2.25	2.128	0.650	1.221
		X100	Up	96.5	97.5	97	92	93.5	92.75	89.5	90.5	90	4.25	4.256	1.001	2.75	2.754	0.731	1.221
CTSoi-14cN	3	X100	Down	102.5	101.5	102	98.5	97.5	98	96	95	95.5	4	3.949	0.987	2.5	2.468	0.722	1.291
		X100	Up	101.5	102.5	102	98	99	98.5	96	96.5	96.25	3.5	3.949	1.128	2.25	2.539	0.598	1.291
CTSoi-15N	2	X100	Down	84	82.5	83.25	77.5	76.5	77	75	71	73	6.25	6.916	1.107	4	4.426	1.155	0.898
		X100	Up	83.5	85	84.25	76.5	77.5	77	72	75	73.5	7.25	6.916	0.954	3.5	3.339	0.930	0.898
CTSoi-19N	2	X100	Down	99.5	98	98.75	97.5	96.5	97	95	93.5	94.25	1.75	2.919	1.668	2.75	4.587	0.794	1.583
		X100	Up	99	100	99.5	96.5	97.5	97	94	95	94.5	2.5	2.919	1.168	2.5	2.919	0.665	1.583

Table 3 : Characteristics of potentially good CNT bridge samples

Sample name	Bridge identification #	Si Handle to TiN surface distance (µm) - Dektak	TiN layer thickness (µm) - From Dektak	Buried Oxide -BOX- thickness (µm) - SOI wafer substrate	Si bridge thickness (µm) - From Dektak estimation	Si bridge thickness (µm) - From SEM measurements	CNT thickness (µm) - From SEM measurements	CNT surface (µm x µm) - From LV150 estimation	CNT Volume (µm x µm x µm) - From LV150 and SEM	TiN Resistance (kΩ) / Conductivity test across the bridge with 2 probes	Witness Samples Names (for density estimation)	Comments
↓ BATCH #2											↓ BATCH #2	
CTSoi-02N	2	7.575	0.068	1	6.507	7.829	0.799	449	359	1	CS145N (CNT, Ni)	Very thin and low density CNT layer on a lot thicker Si bridge. The bridge can however be used for thermal/electrical testing
↓ BATCH#3A											↓ BATCH #3A	
CTSoi-13N	1	2.205	0.119	1	1.086	0.916	2.282	297	678	0.555	CS158N (CNT, Ni) - S160 (TiN)	Effective CNT surface might be slightly smaller than calculated since some CNTs are grown on a small Ni/Si area instead of the main Ni/TiN/Si area of the bridge (due to this process flow) - Good bridge with thin Si and thicker CNT layer.
CTSoi-14N	3	5.788	0.108	1	4.68	5.032	**17.923**	1836	32906	20?	CS163N (CNT) - S161N (Ni, TiN)	Aligned CNTs on however broken bridge
		5.788					**17.923**	1202	21543	← Tip		
↓ BATCH #3B											↓ BATCH #3B	
CTSoi-13bN	2	3.103	0.113	1	1.99	1.810	0.845	528	446	0.849	CS160N (CNT, Ni, TiN)	Although the TiN layer exhibits a low resistance across the bridge, its continuity at one end of the bridge seems fragile! The bridge can be used for thermal/electrical pre-testing
CTSoi-14bN	1	5.476	0.108	1	4.368	4.660	1.266	305	386	0.5	CS160N (CNT, Ni) - S161 (TiN)	Dense CNT layer but thinner than the Si bridge. Sample can be used for thermal/electrical testing
CTSoi-14bN	2	4.049	0.108	1	2.941	2.795	1.386	579	803	1.174	CS160N (CNT, Ni) - S161 (TiN)	This Si bridge touches the handle on ≥1/3 of its length. The CNT/Ni/TiN is sometimes detached from the Si, forming bumps at few locations on the bridge. The bridge can be used for thermal/electrical pre-testing
CTSoi-14cN	1	4.076	0.108	1	2.968	3.088	1.125	233	262	0.42	CS162bN (CNT, Ni) - S161 (TiN)	Dense, nonuniform CNT layer but thinner than the Si bridge. Sample can be used for thermal/electrical testing
CTSoi-14cN	2	4.256	0.108	1	3.148	3.294	1.221	541	661	0.585	CS162bN (CNT, Ni) - S161 (TiN)	Dense, nonuniform CNT layer but thinner than the Si bridge. Sample can be used for thermal/electrical testing
CTSoi-14cN	3	3.949	0.108	1	2.841	2.919	1.291	1020	1316	0.895	CS162bN (CNT, Ni) - S161 (TiN)	This Si bridge touches the handle on ≥1/2 of its length. Holes in TiN layer lead to nonuniform CNT layer. The bridge can be used for thermal/electrical pre-testing
CTSoi-15N	2	6.916	0.1	1	5.816	6.731	0.898	263	236	0.65	CS162bN (CNT, Ni, TiN)	The CNT grows in sparsely distributed spots. Although the TiN layer exhibits a low resistance across the bridge, its continuity at one end of the bridge seems fragile! The CNT/Ni/TiN is detached from the Si and forms a large bump at one end of the bridge. The bridge can be used for thermal/electrical pre-testing
CTSoi-19N	2	2.919	0.1	1	1.819	1.647	1.583	560	886	0.343	CS162bN (CNT, Ni, TiN)	This Si bridge touches the handle on ≥1/2 of its length. Dense CNT layer almost as thick as the Si bridge. The bridge can be used for thermal/electrical pre-testing

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Annex 1: Samples characteristics and follow-up tables (#10)

Nomenclature for samples in the following tables:

Si-0X : Si substrate with identification number 0X (**SN0X** for old samples).
Soi-0X : SOI (Silicon on insulator substrate with identification number 0X).
ALN01 : Bare Al_2O_3 substrate, number 01.

Ti-0X: Si substrate with Ti coating, number 0X.
Bolo9Ti: Ti coating, on a special substrate (Bolo9 is the name of a device prototype used as substrate).
SX01 : Si substrate with a thermally grown oxide layer at 1000 °C in O_2, number 01.
S012 : Si substrate with TiN coating, number 012.
TSoi-02 : SOI substrate with TiN coating, number 02.
AL07 : Al_2O_3 substrate with TiN coating, number 07.
SiN-0Y : Si_3N_4 film with identification number 0Y deposited on an identified substrate.
SiO-0Z : SiO_2 film with identification number 0Z deposited on an identified substrate.
VO2-XX : VO_x film with identification number XX deposited on an identified substrate.
YBCO-YY : Y-Ba-Cu-O film with identification number YY deposited on an identified substrate.
Bolo5-YBCO: Y-Ba-Cu-O coating, on a special substrate (Bolo5 is the name of a device prototype used as substrate).

SX18N : SX18 with Ni coating.
S100N : S100 with Ni coating.
SN11N : SN11 (Si substrate) with Ni coating, (usually for Ni calibration).
ALN02N : ALN02 with Ni coating.
TSoi-02N : TSoi-02 with Ni coating or being patterned (lithography) prior to the Ni coating for lift-off.

CS100N : CNT grown on S100N
CALN28N : CNT grown on ALN28N.

Ti-18_pe: Plasma etching of sample Ti-18 using the Plasmionique SPT330 sputter.

Annex 1A: *Sputter deposition with the "CVC New-Sputter"*

Sample name	Date	New-Sputter (NS) Plasmionique sputter (SPT)	Gun Number	Gun/Target diameter (")	Mode: DC or RF (Contactor/Generator 1 or 2)	Target	Target→Substrate Distance (cm)	Substrate (If in rotation)	Toggle Half-Angle (±X°)	Toggle Velocity	Base Pressure - Pfeiffer - Cold Cathode (Torr)	Base Pressure - Varian - Ion Gauge (Torr)	Real Temperature (°C)	Temperature Setpoint (°C)	Sputtering Power (W)	Reflected Power (W)	Presputtering Time (min)	Sputtering Time (min)	DC Bias in RF mode or Voltage in DC mode (V)	Current in DC mode (A)	N2 adjusted flow (sccm)	O2 flow (sccm)	Ar flow (sccm)	Deposition Total Pressure - MKS - Baratron (mTorr)	Deposition Total Pressure - Varian - CDG (mTorr)	Deposition Total Pressure - Varian - ConvecTorr (mTorr)	Deposition Total Pressure - Pfeiffer - Pirani (mTorr)	Thickness (nm) Dektak	Thickness (nm) Ellipsometry	Comments
TSoi-13bN	13/11/04	**NS**	8	4	**RF-1**	**Ni**	10	TSoi-13b	**45**	3	2.9E-07	3.7E-07			101	5	20	0	**-738**		0	0	10	5.73	13	10	6.87			3h10 pumping
								_							101	4	5	3.5	**-825**		0	0	30	0.76	1.7	1.6	2.12		***3.89***	
TSoi-14bN		**NS**	8	4	**RF-1**	**Ni**	10	TSoi-14b	**45**	3	2.9E-07	3.7E-07			101	5	20	0	**-738**		0	0	10	5.73	13	10	6.87			3h10 pumping
								_							101	4	5	3.5	**-825**		0	0	30	0.76	1.7	1.6	2.12		***3.89***	
S160N		**NS**	8	4	**RF-1**	**Ni**	10	S160	**45**	3	2.9E-07	3.7E-07			101	5	20	0	**-738**		0	0	10	5.73	13	10	6.87			3h10 pumping
								_							101	4	5	3.5	**-825**		0	0	30	0.76	1.7	1.6	2.12		***3.89***	
TSoi-14cN	13/11/05	**NS**	8	4	**RF-1**	**Ni**	10	TSoi-14c	**45**	3	1.8E-07				101	6	20	0	**-737**		0	0	10	5.74	13	10	6.9			Overnight pumping
								_							101	4	5	3.5	**-831**		0	0	30	0.75	1.7	1.6	2.08		***3.89***	
TSoi-15N		**NS**	8	4	**RF-1**	**Ni**	10	TSoi-15	**45**	3	1.8E-07				101	6	20	0	**-737**		0	0	10	5.74	13	10	6.9			Overnight pumping
								_							101	4	5	3.5	**-831**		0	0	30	0.75	1.7	1.6	2.08		***3.89***	
TSoi-19N		**NS**	8	4	**RF-1**	**Ni**	10	TSoi-19	**45**	3	1.8E-07				101	6	20	0	**-737**		0	0	10	5.74	13	10	6.9			Overnight pumping
								_							101	4	5	3.5	**-831**		0	0	30	0.75	1.7	1.6	2.08		***3.89***	
S162bN		**NS**	8	4	**RF-1**	**Ni**	10	S162'	**45**	3	1.8E-07				101	6	20	0	**-737**		0	0	10	5.74	13	10	6.9			Overnight pumping
								_							101	4	5	3.5	**-831**		0	0	30	0.75	1.7	1.6	2.08		***3.89***	
TiN test	13/11/25	**NS**	1	2	**DC-1**	**TiN**	10	holder	10	3	3.2E-07	4.1E-07			100	0	30	0	**484**	**0.206**	48.3	0	0	1.19	2.6	3.8	2.21	**120**		1h50 pumping

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Sample name	Date	New-Sputter (NS) Plasmionique sputter (SPT)	Gun Number	Gun/Target diameter (")	Mode: DC or RF (Contactor/Generator 1 or 2)	Target	Target→Substrate Distance (cm)	Substrate (If in rotation)	Toggle Half-Angle (±X°)	Toggle Velocity	Base Pressure - Pfeiffer - Cold Cathode (Torr)	Base Pressure - Varian - Ion Gauge (Torr)	Real Temperature (°C)	Temperature Setpoint (°C)	Sputtering Power (W)	Reflected Power (W)	Presputtering Time (min)	Sputtering Time (min)	DC Bias in RF mode or Voltage in DC mode (V)	Current in DC mode (A)	N2 adjusted flow (sccm)	O2 flow (sccm)	Ar flow (sccm)	Deposition Total Pressure - MKS - Baratron (mTorr)	Deposition Total Pressure - Varian - CDG (mTorr)	Deposition Total Pressure - Varian - ConvecTorr (mTorr)	Deposition Total Pressure - Pfeiffer - Pirani (mTorr)	Thickness (nm) Dektak	Thickness (nm) Ellipsometry	Comments
TSoi-30 to TSoi-39	13/11/27	**NS**	**1**	**2**	**DC-1**	**TiN**	10	Soi-30	10	3	2.3E-07	3.2E-07		**?**	100	0	15	40	**494**	**0.201**	48.3	0	0	1.18	2.6	3.8	2.31	***100***		4h00 pumping; New 4" SOI substrate; DHF preclean; For samples TSoi-30 to TSoi-39. Heating (500 deg initially) lost at 20 min due to bad cable connection. Temperature down to 150 deg at the end. Not to be used for devices
TSoi-20 to TSoi-29	13/11/28	**NS**	**1**	**2**	**DC-1**	**TiN**	10	Soi-20	10	3	1.7E-07			**500**	100	0	15	40	**494**	**0.201**	48.3	0	0	1.17	2.5	3.7	2.28	***100***		Overnight pumping; New 4" SOI substrate; DHF preclean; For samples TSoi-20 to TSoi-29. Heating OK. Good sample with goldish color. Use for devices as SOI Batch#5
Ni Clean	13/12/06	**NS**	**8**	**4**	**RF-1**	**Ni**	10	Holder	**45**	3	7.8E-07				101	5	30	0	**-735**		0	0	10	5.74	13	10	6.84			Overnight pumping

Annex 1B: *CNT growth with the PECVD system*

Samples	Date		Base Pressure - Pfeiffer Gauge (Torr)	Distance substrate - µwaves entrance window	Substrate	Substrate holder (PECVD)			MW Power (W)	Deposition Time (min)	Deposition Temperature (°C)	Deposition Pressure (mTorr)	Deposition Gas N2 (%)	Deposition Gas Ar (%)	Deposition Gas H2 (%)	Deposition Gas CH4 (%)	Deposition Gas C2H2 (%)	Thickness (nm)	Comments (*Number in italic = estimation based on previous measurements*)
CTSoi-13bN	13/11/26		4.0E-07	27	TSoi-13bN	BN			900	20	700	6000			80	20			
CS160N			4.0E-07	27	S160N	BN			900	20	700	6000			80	20			
CTSoi-14bN			4.0E-07	27	TSoi-14bN	BN			900	20	700	6000			80	20			
CTSoi-14cN			4.0E-07	27	TSoi-14cN	BN			900	20	700	6000			80	20			
CTSoi-15N			4.0E-07	27	TSoi-15N	BN			900	20	700	6000			80	20			
CTSoi-19N			4.0E-07	27	TSoi-19N	BN			900	20	700	6000			80	20			
CS162bN			4.0E-07	27	S162bN	BN			900	20	700	6000			80	20			
	13/12/09																		**PECVD : Heater Power supply fusible burnt and changed for temporary fusible. Mechanical pumps fusible burnt and changed too. Water leak from the cryopump compressor.**
CTSoi-14N	14/01/28		2.1E-07	27	TSoi-14N	BN			900	30	700	6000			80	20		**16700**	Aligned CNTs from SEM observation

Annex 1C: *Sputter deposition with the "Plasmionique SPT330" system*

No data available for this period.

Annex 1D: *Lithography processes*

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, …	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CH1:constant intensity I-line=365nm; CH2: CP Power (W) or CT Intensity (mW/cm2)	Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, …)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target+Mask+Resist (Plasma/High temperature treated PR) prior to post-strip		Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, …)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, …)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, …); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
MASK-2	13/10/29																				Acetone	55	1200					IPA; N2			New Photomask received on 2013-10-18, with enlarged Si bridge to compensate for undercut due to isotropic plasma etch. RRD version. Cleaning.
MASK-3																					Acetone	50	1200					IPA; N2			Idem. RRU version. Cleaning.
MASK-1																					Acetone	54	1200					IPA; N2			First uncentered mask. RRU version. Cleaning.
TSoi-13bN		200	HMDS	900	4000																									1st Negative tone PR

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask O2 Plasma Clean(Plasma/Rgt temperature treated PR) prior to next step		Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
																																	litho for Ni lift-off.
			ma-N1410	500	3000																												
			ma-N1410	500	3000	160	120	CI 1	9	60	ma-D533S	RT	180									Acetone	RT	1200				IPA; N2	RIE		Double coat. Bad alignment. Strip + restart
MASK-2																						Acetone	RT	600				IPA; N2			Photomask Cleaning.
TSoi-13bN	13/10/30	200	HMDS	900	4000																												2nd Negative tone PR litho for Ni lift-off.
			ma-N1410	500	3000																												
			ma-N1410	500	3000	160	120	CI 1	9	60	ma-D533S	RT	180									Acetone	RT	300				IPA; N2	RIE		Double coat. Bad alignment. Strip + restart
TSoi-13bN		200	HMDS	900	4000																												3rd Negative tone PR litho for Ni lift-off.
			ma-N1410	500	3000	160	120	CI 1	9	50	ma-D533S	RT	180									Acetone	RT	300				IPA; N2	RIE		Single coat. Bad alignment

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity Line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask +O2 Plasma Clean(Plasma/High temperature treated PR) prior to		Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
																																	. Strip + restart
TSoi-13bN		**200**	HMDS	**900**	**4000**																												4th Negative tone PR litho for Ni lift-off.
			ma-N1410	**500**	**3000**																												
			ma-N1410	**500**	**3000**	**160**	**120**	**CI 1**	**9**	**60**	ma-D533S	**RT**	**180**																			Double coat. Fairly good alignment . Restart?
											ma-D533S	**RT**	**180**																			
								CI 1	**9**	**180**					-							Acetone	**RT**	**300**				IPA ; N2	RIE		
TSoi-13bN	13/11/01	**200**	HMDS	**900**	**4000**																												5th Negative tone PR litho for Ni lift-off.
			ma-N1410	**500**	**3000**																												
			ma-N1410	**500**	**3000**	**160**	**120**	**CI 1**	**9**	**60**	ma-D533S	**RT**	**180**																			Double coat. Quite good alignment

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask +O2 Plasma Clean(Plasma/Rgt temperature treated PR) prior to coat, etc.	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
																																.
											ma-D533S	RT	180																			
								CI 1	9	180					100																	
	13/11/04														-	RIE		CVC														
	13/11/05														-					No		PG	70	3600	Acetone	RT	300	IPA; DI; N2 dry			Wet strips
	13/11/06														-					RIE		PG	70	1800	Acetone	RT	300	IPA; DI; N2 dry	RIE		RIE + Wet + RIE strips
TSoi-14bN	13/10/31	**200**	HMDS	**900**	**4000**																											1st Negative tone PR litho for Ni lift-off.
			ma-N1410	**500**	**3000**																											
			ma-N1410	**500**	**3000**	160	120	CI 1	9	60	ma-D533S	RT	180																			Double coat. Good alignment.
											ma-D533S	RT	180																			

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask O2 Plasma Clean(Plasma/Rgt temperature treated PR) prior to next step	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
	13/11/01							CI 1	9	180					100																
	13/11/04														-	RIE		CVC													
	13/11/05														-					No		PG	70	3600	Acetone	RT	300	IPA; DI; N2 dry			Wet strips
	13/11/06														-					RIE		PG	70	1800	Acetone	RT	300	IPA; DI; N2 dry	RIE		RIE + Wet + RIE strips
TSoi-14cN	13/10/31	**200**	HMDS	**900**	**4000**																										1st Negative tone PR litho for Ni lift-off.
			ma-N1410	**500**	**3000**																										
			ma-N1410	**500**	**3000**	**160**	**120**	**CI 1**	**9**	**60**	ma-D533S	**RT**	**180**																	Double coat. Good alignment.
											ma-D533S	**RT**	**180**																	
	13/11/01							CI 1	9	180					100																
	13/11/04														-	RIE															

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask O2 Plasma Clean(Plasma/Rgt temperature treated PR) prior to post strip		Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
	13/11/05														-			CVC		No		PG	70	3600	Acetone	RT	300	IPA; DI; N2 dry			Wet strips
	13/11/06														-					RIE		PG	70	1800	Acetone	RT	300	IPA; DI; N2 dry	RIE		RIE + Wet + RIE strips
TSoi-15N	13/11/01	**200**	HMDS	**900**	**4000**																												1st Negative tone PR litho for Ni lift-off.
			ma-N1410	**500**	**3000**																												
			ma-N1410	**500**	**3000**	**160**	**120**	**CI 1**		**9**	**60**	ma-D533S	**RT**	**180**																			Double coat. Good alignment.
												ma-D533S	**RT**	**180**																			
								CI 1		**9**	**180**					***100***																	
	13/11/04														-	RIE																	
	13/11/05														-			CVC		No		PG	70	3600	Acetone	RT	300	IPA; DI; N2 dry			Wet strips

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask O2 Plasma Clean(Plasma/Rgt temperature treated PR) prior to coat strip	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
	13/11/06														-					RIE		PG	70	1800	Acetone	RT	300	IPA; DI; N2 dry	RIE		RIE + Wet + RIE strips
TSoi-19N	13/11/01	200	HMDS	900	4000																											1st Negative tone PR litho for Ni lift-off.
			ma-N1410	500	3000																											
			ma-N1410	500	3000	160	120	CI 1	9	60	ma-D533S	RT	180																		Double coat. Good alignment.
											ma-D533S	RT	180																		
								CI 1	9	180					100																
	13/11/04														-	RIE															
	13/11/05														-				CVC		No		PG	70	3600	Acetone	RT	300	IPA; DI; N2 dry			Wet strips
	13/11/06														-						RIE		PG	70	1800	Acetone	RT	300	IPA; DI; N2 dry	RIE		RIE + Wet + RIE strips

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask	O2 Plasma Clean (Plasma/Rgt temperature treated PR) prior to next step	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
TSoi-13bN	13/11/07	**200**	S1822	**500**	**3500**	**115**	**180**	**CP**	**196**	**20**	MF-319	**RT**	**50**		**115**		**2597**	RIE + Wet		RIE		1165	**70**	**600**				DI, N2	No		Litho for Ni/TiN/Si bridge release with Si and SiO2 etches
	13/11/13																**2591**	RIE + Wet		RIE		1165	**70**	**600**				DI, N2	No	**3103**	At bridge #2; idem + Si etch (RIE) + SiO2 etch (BHF)
																	2605	RIE + Wet		RIE		1165	**70**	**600**				DI, N2	No		At bridge #3; idem + Strip (RIE + Wet + RIE)
TSoi-14bN	13/11/07	**200**	S1822	**500**	**3500**	**115**	**180**	**CP**	**196**	**20**	MF-319	**RT**	**50**								Acetone							IPA; DI; N2 dry			Litho for Ni/TiN/Si bridge release with Si and SiO2 etches
TSoi-14bN		**200**	S1822	**500**	**3500**	**115**	**180**	**CP**	**195**	**21**	MF-319	**RT**	**50**								Acetone							IPA; DI; N2 dry			2nd litho because 1st litho was bad
TSoi-14bN	13/11/08	**200**	S1822	**500**	**3500**	**115**	**180**	**CP**	**196**	**20**	MF-319	**RT**	**50**		**115**		**2863**	RIE + Wet		RIE		1165	**70**	**600**				IPA; DI; N2 dry	RIE	**5476**	3rd litho because 2nd litho was bad

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; Cl1:constant intensity I_line=365nm; Cl2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask	O2 Plasma Clean (Plasma/Rgt temperature treated PR) prior to next step	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
	13/11/13																2837	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE	4049	At bridge #2; idem + Si etch (RIE) + SiO2 etch (BHF)
	13/11/25																2711	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE		At bridge #3; idem + Strip (RIE + Wet + RIE)
TSoi-14cN	13/11/08	200	S1822	500	3500	115	180	CP	196	20	MF-319	RT	50		115		2578	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE	4076	Litho for Ni/TiN/Si bridge release with Si and SiO2 etches
	13/11/13																2593	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE	4256	At bridge #2; idem + Si etch (RIE) + SiO2 etch (BHF)
	13/11/25																2628	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE	3949	At bridge #3; idem + Strip (RIE + Wet + RIE)
TSoi-15N	13/11/08	200	S1822	500	3500	115	180	CP	196	20	MF-319	RT	50		115		2585	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE		Litho for Ni/TiN/Si bridge release with Si and SiO2

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)		Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask	O2 Plasma Clean(Plasma/High temperature treated PR) prior	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
																																etches
	13/11/13																2587	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE	6916	At bridge #2; idem + Si etch (RIE) + SiO2 etch (BHF)
	13/11/25																2610	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE		At bridge #3; idem + Strip (RIE + Wet + RIE)
TSoi-19N	13/11/08	200	S1822	500	3500	115	180	CP	196	20	MF-319	RT	50		115		2598	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE		Litho for Ni/TiN/Si bridge release with Si and SiO2 etches
	13/11/13																2602	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE	2919	At bridge #2; idem + Si etch (RIE) + SiO2 etch (BHF)
	13/11/25																2597	RIE + Wet		RIE		1165	70	600				IPA ; DI; N2 dry	RIE		At bridge #3; idem + Strip (RIE + Wet + RIE)
MASK-2																						Acetone	RT	600				IPA ; N2			Photomask Cleaning.

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)	Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask	O2 Plasma Clean(Plasma/High temperature treated PR) prior to wet strip	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
TSoi-11	13/12/02	200	S1813	500	4000	115	180	CP	196	12.5	MF-319	RT	50	1301	115			RIE		RIE		1165	70	600				Bake	RIE		SOI Batch #4A. Litho for TiN etch on already patterned Si Bridges
	13/12/03													1308				RIE		RIE		1165	70	600				Bake	RIE		At bridge #2; idem
	13/12/04													1305						RIE		1165	70	600				Bake	RIE		At bridge #3; idem
TSoi-11b	13/12/02	200	S1813	500	4000	115	180	CP	196	12.5	MF-319	RT	50	1301	115			RIE		RIE		1165	70	600				Bake	RIE		SOI Batch #4A. Litho for TiN etch on already patterned Si Bridges
	13/12/03													1308				RIE		RIE		1165	70	600				Bake	RIE		At bridge #2; idem
	13/12/04													1305						RIE		1165	70	600				Bake	RIE		At bridge #3; idem
TSoi-12	13/12/02	200	S1813	500	4000	115	180	CP	196	12.5	MF-319	RT	50	1301	115			RIE		RIE		1165	70	600				Bake	RIE		SOI Batch #4A. Litho for TiN etch on already patterned Si

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; Cl1:constant intensity I_line=365nm; Cl2: CP Power (W) or CI Intensity (mW/cm2)	Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask	O2 Plasma Clean/Plasma/Rigi temperature treated PR) prior to wet strip	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
																														Bridges
	13/12/03												1308				RIE		RIE		1165	70	600				Bake	RIE		At bridge #2; idem. The only viable bridge #2 is broken, probably due to stiction forces with the handle during the wet strip
	13/12/04												1305						RIE		1165	70	600				Bake	RIE		At bridge #3; idem
MASK-2																					Acetone	RT	600				IPA; N2			Photomask Cleaning.
TSoi-12b	13/12/03	**200**	S1813	**500**	**4000**	**115**	**180**	**CP**	**196**	**12.5**	MF-319	**RT**	**50**	1301	**115**			RIE		RIE		1165	70	600				Bake	RIE		SOI Batch #4A. Litho for TiN etch on already patterned Si Bridges
	13/12/03												1308				RIE		RIE		1165	70	600				Bake	RIE		At bridge #2; idem
	13/12/04												1305						RIE		1165	70	600				Bake	RIE		At bridge #3; idem

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, ...	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I_line=365nm; CI2: CP Power (W) or CI Intensity (mW/cm2)	Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, ...)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or Oven Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target +Mask	O2 Plasma Clean(Plasma/Rgt temperature treated PR) prior to next step	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, ...)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, ...); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
TSoi-18	13/12/03	**200**	S1813	**500**	**4000**	**115**	**180**	**CP**	**196**	**12.5**	MF-319	**RT**	**50**	*1301*	**115**			RIE		RIE		1165	**70**	**600**				Bake	RIE		SOI Batch #4A. Litho for TiN etch on already patterned Si Bridges
	13/12/03													*1308*				RIE		RIE		1165	**70**	**600**				Bake	RIE		At bridge #2; idem
	13/12/04													*1305*						RIE		1165	**70**	**600**				Bake	RIE		At bridge #3; idem
TSoi-14N	13/12/06													-						MW-6x		1165	**70**	**600**	Acetone	**RT**	**300**	IPA; DI; N2 dry; bake			Microwave plasma strip: 6 runs of 20min each. No effect observed. 1165 strip has no effect. Scrubbing in acetone leads to the collapse of the 2 viable bridges #1 and #2. End

Sample name	Date	Dry/Dehydration bake : Hotplate Temperature (°C)	Resist, Primer / Adhesion Promoter, Polyimide, …	Spin Speed #1 (rpm)	Spin Speed #2 (rpm)	Softbake : Hotplate Temperature (°C)	Softbake Time Duration (s)	input power; CI1:constant intensity I-line=365nm; CI2:	CP Power (W) or CI Intensity (mW/cm2)	Exposure Time Duration (s)	Developer (Microposit MF-319 /321, NaOH, TMAH, …)	Bath Temperature (°C) - For MF-319, 15-20°C is best	Immersion or Soak Time (s)	Dektak measured step after development (nm)	Postbake : Hotplate or *Oven* Temperature (°C)	Short O2 Plasma De-scum (cleans thin resist left by dev.)	Dektak measured step after Postbake (nm)	Coating for Lift-off - Wet/Dry Etch of exposed target layer	Dektak measured step after Etch (nm) +Target -Mask	O2 Plasma Clean (Plasma/High temperature treated PR) prior to wet strip	Initial Strip: Acetone rinse + IPA rinse before acetone dries + Blow dry (Yes/No)	Remover Clean #1 (Microposit 1165, …)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Remover Clean #2 (Microposit 1165, …)	Bath Temperature (°C) -1165 at 80°C for 130-180°C bakes	Immersion or Soak Time (s)	Final solvent rinse (IPA, …); DI H2O rinse; N2 blow dry	O2 Plasma Clean after wet strip	Dektak measured step after Stripping (nm) Target only	Comments
																															of sample? CNT growth performed anyway leads to Aligned CNT on the broken Bridge #3!!!

Annex 1E: *Wet etching/cleaning processes*

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
TSoi-13bN	13/11/18	0	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	0	DI; N2			3170	3785	3415	Step measured after Si etch
		1	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	300	DI; N2	115	60				Visual inspection
		2	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	300	DI; N2	115	60				
		3	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		4	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		5	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		6	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				idem; Handle Si visible and clean in the trenches around all bridges.
		7	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		8	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	600	DI; N2	115	60				
		9	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		10	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	120				Witness Bridges #3 released
	13/11/19	11	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		12	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		13	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		14	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		15	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		16	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	60				
		17	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	60				
		18	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	60				
		19	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	60				
		20	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**420**	DI; N2	115	120				
		21	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**420**	DI; N2	115	120				Witness Bridges #1 released
	13/11/20	**22**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	60				
		23	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		24	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120	**458**	**482**	**318**	Witness Bridges #2 released - End of etch? To be confirmed with dektak measurements across the bridges
	13/11/22	**25**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		26	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120	**372**	**434**		
		27	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		28	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		29	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**340**	DI; N2	115	120				
		30	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**340**	DI; N2	115	120	**346**	**346**	**180**	
TSoi-14bN	13/11/18	**0**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**0**	DI; N2			5609	4496	2057	Step measured after Si etch
		1	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**300**	DI; N2	115	60				Visual inspection
		2	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**300**	DI; N2	115	60				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		3	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		4	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				Bridge #3 washed out. Normal since there was no Si underneath
		5	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		6	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				Handle Si visible and clean in the trenches around all bridges.
		7	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	60				
		8	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	540	DI; N2	115	60				
		9	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		10	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	120				
	13/11/19	11	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		12	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		13	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		14	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		15	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		16	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	600	DI; N2	115	120				Witness Bridges #2 released
		17	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		18	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	60				
		19	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	360	DI; N2	115	60				
		20	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	420	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		21	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**420**	DI; N2	115	120	**445**	**19**	**NA**	Witness Bridges #1 and #2 released - End of etch? To be confirmed with dektak measurements across the bridges
	13/11/22	**22**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		23	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120	**382**			
		24	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		25	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		26	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**340**	DI; N2	115	120				
		27	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**340**	DI; N2	115	120	**381**			
		28	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120	**348**	**26**	**NA**	
TSoi-14cN	13/11/20	**0**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**0**	DI; N2			4380	4592	4432	Step measured after Si etch
		1	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**300**	DI; N2	115	60				Visual inspection
		2	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**600**	DI; N2	115	60				
		3	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**480**	DI; N2	115	120				Dektak measurements across the bridges deteriorate the edges of the PR protecting them. Perform measurements only when required
		4	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**480**	DI; N2	115	120				Handle Si visible and clean in the trenches around all bridges.
		5	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		6	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		7	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		8	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		9	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		10	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		11	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		12	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		13	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
	13/11/21	**14**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		15	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		16	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		17	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		18	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		19	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		20	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		21	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		22	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				Witness Bridges #3 released
		23	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120	**499**		**513**	Witness Bridges #1 and #2 released - End of etch? To be confirmed with dektak measurements across the bridges
	13/11/22	**24**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		25	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		26	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		27	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	360	DI; N2	115	120				
		28	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	360	DI; N2	115	120				
		29	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	370	DI; N2	115	120				
		30	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	370	DI; N2	115	120				
		31	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	420	DI; N2	115	120				
		32	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	480	DI; N2	115	120				
		33	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	500	DI; N2	115	120	302	320	55	
TSoi-15N	13/11/20	0	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	0	DI; N2			3647	6897	5997	Step measured after Si etch
		1	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	300	DI; N2	115	60				Visual inspection. No Bridge #3 (sample broken previously)
		2	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	600	DI; N2	115	120				
		3	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	480	DI; N2	115	120				Dektak measurements across the bridges deteriorate the edges of the PR protecting them. Perform measurements only when required
		4	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	480	DI; N2	115	120				
		5	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	480	DI; N2	115	120				
		6	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	480	DI; N2	115	120				
		7	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	480	DI; N2	115	120				
		8	SiO2	S1822	BOE, BHF	NH4F	HF	6:1	RT	200	480	DI; N2	115	120				Handle Si visible and clean in the trenches around all bridges.
		9	SiO2	S1822	BOE, BHF	NH4F	HF	3:1	RT	200	300	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		10	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		11	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				PR starts peeling off at TiN electrodes borders!
		12	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		13	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		14	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		15	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		16	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		17	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
	13/11/21	**18**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		19	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				Witness Bridges #1 released
		20	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		21	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		22	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		23	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		24	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		25	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		26	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		27	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		28	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		29	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				Witness Bridges #3 released
		30	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		31	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120	**352**	**453**	**394**	Witness Bridges #2 released - End of etch? To be confirmed with dektak measurements across the bridges
	13/11/22	**32**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		33	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		34	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		35	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		36	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		37	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		38	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		39	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		40	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120	**214**	**209**	**220**	
TSoi-19N	13/11/20	**0**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**0**	DI; N2			2492	3693	3170	Step measured after Si etch
		1	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**300**	DI; N2	115	60				Visual inspection
		2	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**600**	DI; N2	115	60				
		3	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**480**	DI; N2	115	120				
		4	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**480**	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		5	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**480**	DI; N2	115	120				
		6	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**6:1**	RT	200	**480**	DI; N2	115	120				Handle Si visible and clean in the trenches around all bridges.
		7	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		8	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		9	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				Witness Bridges #1 released but its TiN seems deteriorated
		10	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		11	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		12	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		13	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		14	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		15	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
	13/11/21	**16**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		17	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		18	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		19	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		20	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		21	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		22	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		23	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		24	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**300**	DI; N2	115	120				
		25	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		26	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		27	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**330**	DI; N2	115	120				
		28	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		29	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		30	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		31	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		32	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120		**409**		Witness Bridges #2 released - End of etch? To be confirmed with dektak measurements across the bridges
	13/11/22	**33**	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		34	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		35	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		36	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		37	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**360**	DI; N2	115	120				
		38	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**370**	DI; N2	115	120				
		39	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**390**	DI; N2	115	120				
		40	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**420**	DI; N2	115	120				

Sample or Recipe name	Date	Etch/Clean Step/iteration #	Target layer material to etch or clean	Masking layer material for etch: Resist, metal, oxide, …	Wet Etchant/Cleaning Mixture usual name	Wet Mixture Component #1	Wet Mixture Component #2	Wet Mixture Component ratio #1:#2:#3	Mixture Temperature (°C)	Agitation : Stirring Speed (rpm) - M for Manual	Etch/Clean Time Duration (s)	DI H2O Rinse (DI): 2min ; Nitrogen blow dry (N2)	Post-Etch Bake Temperature (°C) - re-increase adhesion	Post-Etch Bake Time Duration (s)	Dektak measured step #1 post-etch (nm) +Target-Mask	Dektak measured step #2 post-etch (nm) +Target-Mask	Dektak measured step #3 post-etch (nm) +Target-Mask	Comments
		41	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**480**	DI; N2	115	120				
		42	SiO2	S1822	**BOE, BHF**	**NH4F**	**HF**	**3:1**	RT	200	**480**	DI; N2	115	120	**NA**	**225**	**NA**	

Annex 1F: *Plasma etching/cleaning with Tegal T901e RIE system*

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd; D:Plasma-Timer;	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Endpoint A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
Si-substrate	13/10/30	Si	none	**14**	**B, D,**	50	225	266	0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Tests prior to Plasma Clean of TSoi-13bN
					D, E, F		225	266	50	50	53	3.5	4.9	17	17	Off		31.2			**300**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				idem
TSoi-13bN					**D, E, F**		225	225	50	50	52	-102	1.9	19	19	Off		31.2			**1200**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Clean of TSoi-13bN after 1st bad litho for Ni lift-off
TSoi-13bN					**D, E, F**		225	225	50	50	52	3.5	2.3	18	18	Off		31.2			**1200**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Clean of TSoi-13bN after 2nd bad litho for Ni lift-off
TSoi-13bN					**D, E, F**		225	225	50	50	53	-94	1.8	18	17	Off		31.2			**1200**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Clean of TSoi-13bN after 3rd bad litho for Ni lift-off

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (calibration only, any time) A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
Si-substrate	13/11/01	Si	none	**14**	**B, D,**	50	225		0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Tests prior to Plasma Clean of TSoi-13bN
					D, E, F		225	244	50	50	54	-109	1.5	18	18	Off		31.2			**300**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				idem
TSoi-13bN					**D, E, F**		225	225	50	50	48	-109	1.4	20	19	Off		31.2			**1200**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Clean of TSoi-13bN after 4th bad litho for Ni lift-off
Si-substrate	13/11/04	Si	none	**14**	**B, D,**	50	225		0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Tests prior to Plasma Clean of TSoi-13bN
					D, E, F		225	248	50	50	50	-106	2.4	17	16	Off		31.2			**1200**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				idem
TSoi-13bN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	227	50	50	48	-3.8	1.3	20	19	Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma descum prior to Ni coating
TSoi-14bN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	48	3.5	1.3	18	18	Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma descum prior to Ni coating

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Automatic, by area, A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
TSoi-14cN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	48	3.5	1.3	18	18	Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma descum prior to Ni coating
TSoi-15N		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	48	-106	1.3	18	19	Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma descum prior to Ni coating
TSoi-19bN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	48	-106	1.3	18	19	Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma descum prior to Ni coating
Si-substrate	13/11/06	Si	none	**14**	**B, D,**	50	225		0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Tests prior to Plasma Strip of Sample batch 3B
					D, E, F		225	225	50	50	52	-3.8	1.6	18	18	Off		31.2			**600**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				idem
TSoi-13bN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.4	18	18	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Strip after 1st Wet Strips
TSoi-14bN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.4	18	18	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Strip after 1st Wet Strips
TSoi-14cN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.4	18	18	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Strip after 1st Wet Strips

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Normalization by area, A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
TSoi-15N		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.4	18	18	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Strip after 1st Wet Strips
TSoi-19N		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.4	18	18	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma Strip after 1st Wet Strips
TSoi-13bN	13/11/06	ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.3	18	19	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**2**				Plasma Strip after 2nd Wet Strips
TSoi-14bN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.3	18	19	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**2**				Plasma Strip after 2nd Wet Strips
TSoi-14cN		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.3	18	19	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**2**				Plasma Strip after 2nd Wet Strips
TSoi-15N		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.3	18	19	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**2**				Plasma Strip after 2nd Wet Strips
TSoi-19N		ma-N 1410	ma-N 1410	**14**	**D, E, F**		225	225	50	50	53	-125	1.3	18	19	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**2**				Plasma Strip after 2nd Wet Strips
Si-substrate	13/11/15	Si	none	**13**	**B, D**	50	400		0	0						Off	7		12	100	**30**	B/A	1	3	10	None	0.0032	0.0032				0				Tests prior to Si etch
					D, E, F		400	400	150	150	156	-204	3.1	18	17	Off	7		12	100	**300**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**1**				
					D, E, F		400	400	150	150	156	-149	3.1	18	19	Off	7		12	100	**300**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**2**				

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (…automatic, by step, A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
TSoi-13bN	13/11/15	Si	S1822	**13**	**B, D**	50	400		0	0						Off	7		12	100	**30**	B/A	1	3	10	None	0.0032	0.0032				0	**2597**	**2591**	**2605**	Dektak measurement prior to Si etch
					D, E, F		400	400	150	150	148	3.5	3.1	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**1**	3633	3567	3877	
					D, E, F		400	400	150	150	156	-3.8	3.4	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**2**	3170	3785	3415	
TSoi-14bN	13/11/15	Si	S1822	**13**	**B, D**	50	400		0	0						Off	7		12	100	**30**	B/A	1	3	10	None	0.0032	0.0032				0	**2863**	**2837**	**2711**	Dektak measurement prior to Si etch
					D, E, F		400	400	150	150	148	3.5	3.1	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**1**				
					D, E, F		400	400	150	150	156	3.5	3.1	18	17	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**2**	5872	4789	2282	
					D, E, F		400	400	150	150	149	-195	3.2	18	18	Off	7		12	100	**180**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**3**	5609	4496	2057	
TSoi-14cN	13/11/15	Si	S1822	**13**	**B, D**	50	400		0	0						Off	7		12	100	**30**	B/A	1	3	10	None	0.0032	0.0032				0	**2578**	**2593**	**2628**	Dektak measurement prior to Si etch
					D, E, F		400	400	150	150	148	3.5	3.1	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**1**				
					D, E, F		400	400	150	150	156	3.5	3.1	18	17	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**2**	4577	4791	4544	

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Normalization by gain, A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
					D, E, F		400	400	150	150	149	-195	3.2	18	18	Off	7		12	100	**180**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**3**	4380	4592	4432	
TSoi-15N	13/11/15	Si	S1822	**13**	**B, D**	50	400		0	0						Off	7		12	100	**30**	B/A	1	3	10	None	0.0032	0.0032				0	**2585**	**2587**	**2610**	Dektak measurement prior to Si etch
					D, E, F		400	400	150	150	148	3.5	3.1	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**1**				
					D, E, F		400	400	150	150	156	3.5	3.1	18	17	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**2**				
					D, E, F		400	400	150	150	156	-3.8	3.1	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**3**	3992	6073	6071	
					D, E, F		400	400	150	150	156	-3.8	3.4	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**4**	3628	7006	6233	
					D, E, F		400	400	150	150	149	-3.8	3.1	18	17	Off	7		12	100	**60**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**5**	3647	6897	5997	
TSoi-19N	13/11/15	Si	S1822	**13**	**B, D**	50	400		0	0						Off	7		12	100	**30**	B/A	1	3	10	None	0.0032	0.0032				0	**2598**	**2602**	**2597**	Dektak measurement prior to Si etch
					D, E, F		400	400	150	150	148	3.5	3.1	19	19	Off	7		12	100	**240**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**1**	2533	3853	3633	
					D, E, F		400	400	150	150	149	-195	3.2	18	18	Off	7		12	100	**180**	B/A	1	3	20	Low	0.0032	0.0032	50	3	20	**2**	2492	3693	3170	
Si-substrate	13/11/25	Si	None	**14**	**B, D,**	50	225		0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Tests prior to Plasma

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (calibration only, any time) A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
																																					Strip of TSoi-13bN, TSoi-14bN, TSoi-14cN, TSoi-15N,and TSoi-19N
					D, E, F		225	225	50	50	52	-121	2.1	20	19	Off		31.2			**300**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				
S160N; S162bN					D, E, F		225	225	50	50	53	-121	1.9	18	19	Off		31.2			**300**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				Plasma clean prior to CNT growth for these witness samples
TSoi-13bN; TSoi-14bN; TSoi-14cN; TSoi-15N; TSoi-19N		S1822	None	**14**	B, D,	50	225	225	0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Plasma Strip before Wet Strip and CNT Growth
					D, E, F		225	225	50	50	53	-121	1.8	20	19	Off		31.2			**1800**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				
Si-substrate	13/11/26	Si	None	**14**	B, D,	50	225		0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Tests

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Normalization by Gain, A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
					D, E, F		225	248	50	50	53	3.5	2	18	18	Off		31.2			**300**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				
TSoi-13bN; TSoi-14bN; TSoi-14cN; TSoi-15N; TSoi-19N		S1822	None	**14**	B, D,	50	225	225	0	0						Off		31.2			**30**	B/A	1	5	10	None	0.0032	0.0032				0				Last Plasma Strip before CNT Growth
					D, E, F		225	225	50	50	52	-122	1.7	20	19	Off		31.2			**600**	B/A	1	5	10	None	0.0032	0.0032	50	3	20	**1**				
TSoi-11	13/12/03	TiN	S1813	**15**	B, D	50	300	303	0	0				18	18	Off	10		5	25	**30**	A	1	3	10	None	0.0032	0.0032				0				Dektak measurement after postbake
					D, E, F		300	303	150	150	149	-3.8	3.1	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**1**				
					D, E, F		300	303	150	150	149	3.5	3.1	20	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**2**				
					D, E, F		300	303	150	150	149	3.5	3.1	20	19	Off	10		5	25	**60**	B/A	1	3	20	Low	1	1	50	3	20	**3**				
					D, E, F		300	303	150	150	156	-227	3.1	18	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**4**				

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd: D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3 = Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	[...] A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
					D, E, F		300	303	150	150	156	-3.8	3.3	18	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**5**	**891**	**613**	**707**	Dektak measurement after the TiN etch + 1st Dry PR stripping below. TiN etch was based on visual inspection and was clearly too long as Si substrate is surely etched underneath exposed TiN which was roughly 100nm. TiN/Si etch rate is roughly 82nm/min (average 737/9min).
TSoi-	13/12/	TiN	S18	**15**	**B,**	50	30	30	0	0				18	18	Of	10		5	25	**30**	A	1	3	10	No	0.00	0.00				0				Dektak

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Normalization by A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
11b	03		13		**D**		0	3								f										ne	32	32								measurement after postbake
					D, E, F		300	303	150	150	149	-3.8	3.1	18	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**1**				
					D, E, F		300	303	150	150	149	-3.8	3.1	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**2**				
					D, E, F		300	303	150	150	149	**-223**	3.1	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**3**				
					D, E, F		300	303	150	150	156	-3.8	3.3	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**4**	**509**	**470**	**546**	Dektak measurement after the TiN etch + 1st Dry PR stripping below. TiN etch was based on visual inspection and was clearly too long as Si substrate is surely etched underneath exposed TiN

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Normalization by Cell A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
																																						which was roughly 100nm. TiN/Si etch rate is roughly 64nm/min (average 508/8min).
TSoi-12	13/12/03	TiN	S1813	**15**	**B, D**	50	300	303	0	0				18	18	Off	10		5	25	**30**	A	1	3	10	None	0.0032	0.0032				0				Dektak measurement after postbake
					D, E, F		300	303	150	150	149	-3.8	3.1	18	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**1**				
					D, E, F		300	303	150	150	149	-3.8	3.1	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**2**				
					D, E, F		300	303	150	150	149	**-223**	3.1	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**3**				
					D, E, F		300	303	150	150	156	-3.8	3.3	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**4**	**628**	**551**		Dektak measurement after the TiN etch + 1st Dry PR stripping below. TiN etch was

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	E:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Automatic, by Etch, A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
																																					based on visual inspection and was clearly too long as Si substrate is surely etched underneath exposed TiN which was roughly 100nm. TiN/Si etch rate is roughly 74nm/min (average 590/8min).
TSoi-12b	13/12/03	TiN	S1813	**15**	**B, D**	50	300	303	0	0				18	18	Off	10		5	25	**30**	A	1	3	10	None	0.0032	0.0032				0				Dektak measurement after postbake
					D, E, F		300	303	150	150	156	3.5	3.2	20	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**1**				
					D, E, F		300	303	150	150	149	-3.8	3.1	18	17	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**2**				
					D,		30	30	15	15	15	-	3.	18	18	Of	10		5	25	**120**	B/	1	3	20	Lo	1	1	50	3	20	**3**				

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd; D:Plasma-Timer;	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3 = Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
					E, F		0	3	0	0	6	3. 8	1			f						A				w										
					D, E, F		30 0	30 3	15 0	15 0	15 6	- 3. 8	3. 3	18	18	Of f	10		5	25	**120**	B/ A	1	3	20	Lo w	1	1	50	3	20	**4**	**534**	**507**	**511**	Dektak measurement after the TiN etch + 1st Dry PR stripping below. TiN etch was based on visual inspection and was clearly too long as Si substrate is surely etched underneath exposed TiN which was roughly 100nm. TiN/Si etch rate is roughly 65nm/min (average 517/8min

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd- D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3= Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	Input (Normalization by Cell A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
																																					).
TSoi-18	13/12/03	TiN	S1813	**15**	**B, D**	50	300	303	0	0				18	18	Off	10		5	25	**30**	A	1	3	10	None	0.0032	0.0032				0					Dektak measurement after postbake
					D, E, F		300	303	150	150	156	3.5	3.2	20	19	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**1**				
					D, E, F		300	303	150	150	149	-3.8	3.1	18	17	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**2**				
					D, E, F		300	303	150	150	156	-3.8	3.1	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**3**				
					D, E, F		300	303	150	150	156	-3.8	3.3	18	18	Off	10		5	25	**120**	B/A	1	3	20	Low	1	1	50	3	20	**4**	**679**	**637**	**753**	Dektak measurement after the TiN etch + 1st Dry PR stripping below. TiN etch was based on visual inspection and was clearly

Sample or Recipe name	Date	Targeted layer for etching	Masking layer material - Resist, metal, …	Recipe Number	B:Pumpdown; C:Plasma-SensorEnd; D:Plasma-Timer:	Pumpdown Pressure - MKS - Baratron 127A (mTorr)	Working Pressure Setpoint - MKS Baratron 127A (mTorr)	Measured Working Pressure - MKS Baratron 127A (mTorr)	fwd. CW RF Power (W)	avg. RF Power (W)	Reflected RF Power (W) - ACG-10	DC Self-Bias Voltage (V)	Endpoint measured level during etch (DIV) max	Upper Electrode Temperature (°C)	Lower Electrode Temperature (°C)	Clean Channel (on, off) - O2 through metering valve	CHF3 = Freon23 flow (sccm) - MFC#1	O2 adjusted flow (sccm) - 50sccm C2F6 - MFC#2	SF6 flow (sccm) - MFC#3	He flow (sccm) - MFC#4	Timer (s)	A/B; Bias DC+, DC-)	Gain (1, 1.5, 2, 3.5, 5, 7.5, 10, 15) of the Input	Normalize (DIV) - Level 0-10 represents Plasma Intensity	Normalize (s) - Time 1-60k to normalize Plasma Intensity	Limiting (None, Low, High) - Ignored Plasma Int. changes	Cell A (µA) - Current level of Photocell A (0.0032-1)	Cell B (µA) - Current level of Photocell B (0.0032-1)	Purge Pumpdown threshold Pressure (mTorr) 0-5k	Number of Purges (1-9) - with N2 for 2s	Vent Time (s)	Etch iteration #	Dektak measured height at step #1 (nm) +Target -Mask	Dektak measured height at step #2 (nm) +Target -Mask	Dektak measured height at step #3 (nm) +Target -Mask	Comments
																																				too long as Si substrate is surely etched underneath exposed TiN which was roughly 100nm. TiN/Si etch rate is roughly 86nm/min (average 690/8min).

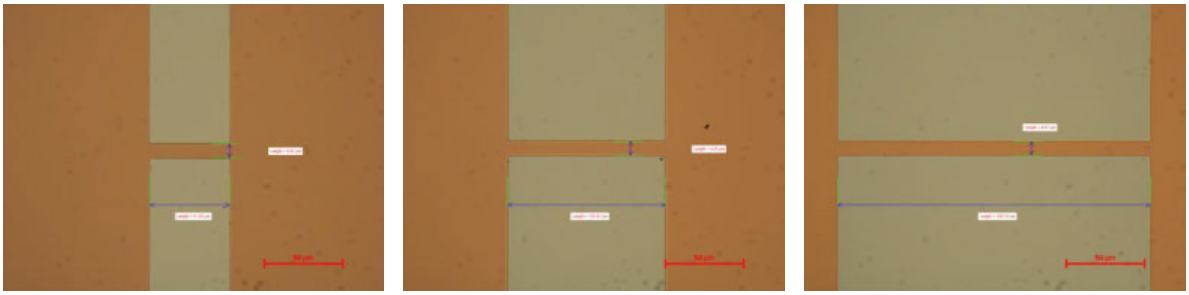
Annex 1G: *Microwave Plasma ashing/stripping with PLASMA-PREEN II-973 system*

Sample or Work name	Date	Etch iteration #	Targeted PR layer for stripping	Heat Sink (HS), Glass Plate (GP) on HS to raise process (°F) : Keep below 120° F;	HASKRIS water circulator Circuit #1 (CVC Sputter)	Cooling Water Flow (GPM): Keep in 0,3-25 GPM range; HASKRIS (Circuit #2)	HASKRIS water circulator	Pumpdown Base Pressure - Hastings/Teledyne (Torr)	Gas A Regulator Pressure (PSI) (1 PSI = 51.715 Torr)	Gas B Regulator Pressure (PSI) (1 PSI = 51.715 Torr)	Ar flow - Gas A (SCFH) (1 SCFH = 471.95 sccm)	O2 flow - Gas B (SCFH) (1 SCFH = 471.95 sccm)	Measured Working Pressure - Hastings/Teledyne (Torr)	Power Level set with Control Knob (%) 0% is 100W and 100% is 500W and 700W		Cooking Time (min)	Fan Cooling Time (min)	Comments
	13/11/01																	New Pyrex Bell Jar + Rubber Gasket received. Old Jar was found to have scratches on its sealing edge with the gasket. The old gasket shows black spots (burnt?)
None	13/11/04		None	HS	68	**Closed**	0,65	47	0.78		25							5.5 hours of pumping
	13/11/05		None	HS	68	**Closed**	0,65	47	0.78		25							5.5 hours of pumping
None	13/11/06	**1**	None	HS	68	**Closed**	0,65	47	0.77		25		3	3.6	80%	420	**15**	**30**	4 hours of pumping, Bell jar temperature is around 85degC after the run
		2	None	HS	68	**Closed**	0,65	47	0.76		25		2	2.93	80%	420	**15**	**20**	Bell jar temperature is around 112degC after the run
		3	None	HS	68	**Closed**	0,65	47	0.76		25		2.5	4.34	80%	420	**15**		Bell jar temperature is around 87degC after the run. Flow-Pressure relation is weird so rely on the pressure for future use since precision on flow is not good. Plasma more stable but less luminous
													3	5.82					Verification of the Flow-Pressure relation.
													2	3.2					Verification of the Flow-Pressure relation.
Si1	13/12/06	**1**	S1822	HS	68	**Closed**	0,65	46	0.78		25		3	3.7	80%	420	**15**	**15**	Test
		2		HS					0.78		25		3	3.73	80%	420	**15**	**15**	
TSoi-14N	13/12/06	**1**	S1822	HS	68	**Closed**	0,65	46	0.78		25		3	3.7	80%	420	**15**	**15**	The goal is to remove popped/burnt PR spots that could not be removed with wet and RIE strip
		2		HS					0.78		25		3	3.63	80%	420	**15**	**15**	
	13/12/09	**3**		GP					0.8		25		3	3.7	80%	420	**15**	**120**	
		4		GP					0.8		25		3	3.7	80%	420	**15**	**10**	
		5		GP					0.8		25		3	3.7	80%	420	**15**	**10**	
		6		GP					0.8		25		3	3.7	80%	420	**15**	**10**	Popped/Burnt PR spots are not removed by the MW plasma strip neither. However This treatment/cleaning might have played a role in conditioning the Ni layer and Ni-TiN interaction for the later observed aligned CNT growth on CTSoi-14N broken Bridge#3 !

Annex 2: Sample CTSoi-14N

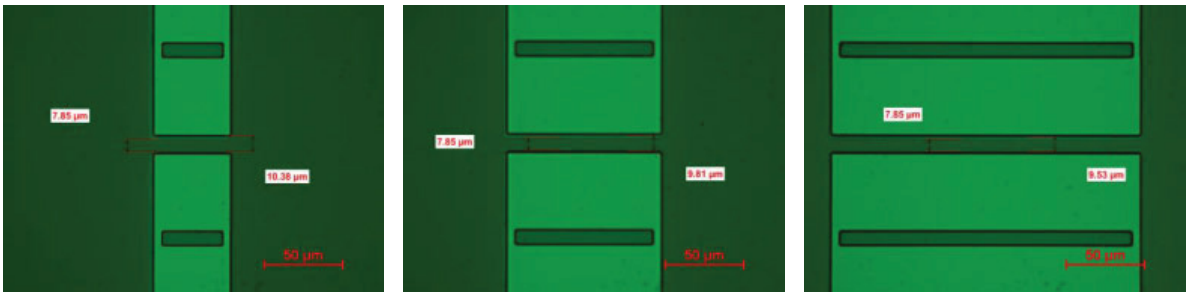
Bridge1 **Bridge2** **Bridge3**

TiN Patterning

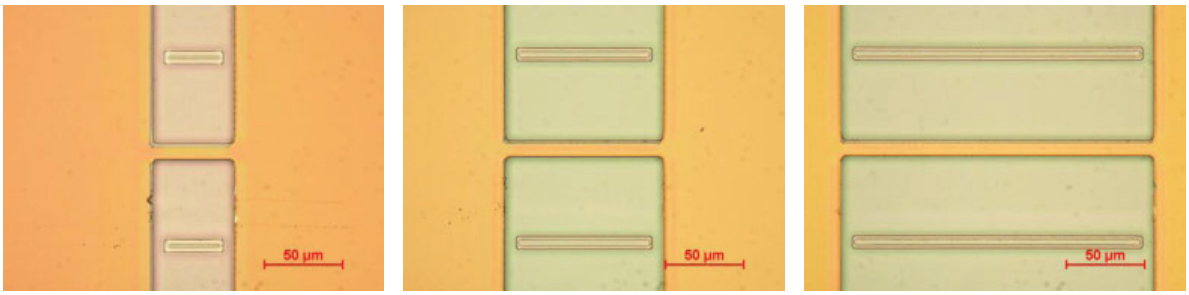


Lithography + Wet etch (ok!) + Strip (Wet)

Si Etching

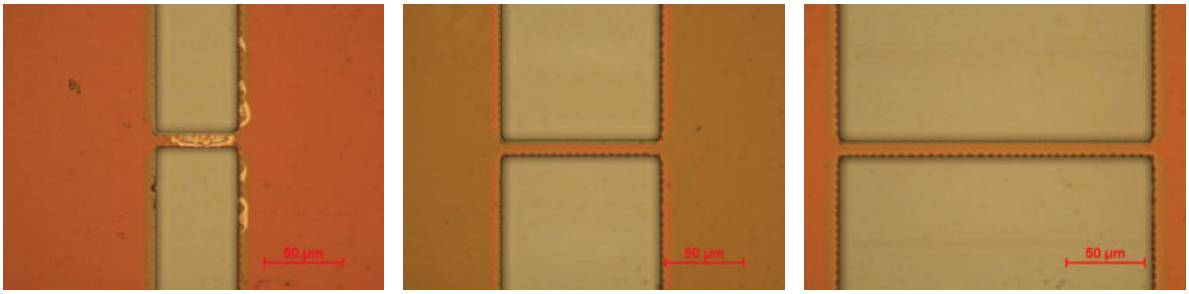


Lithography, Development

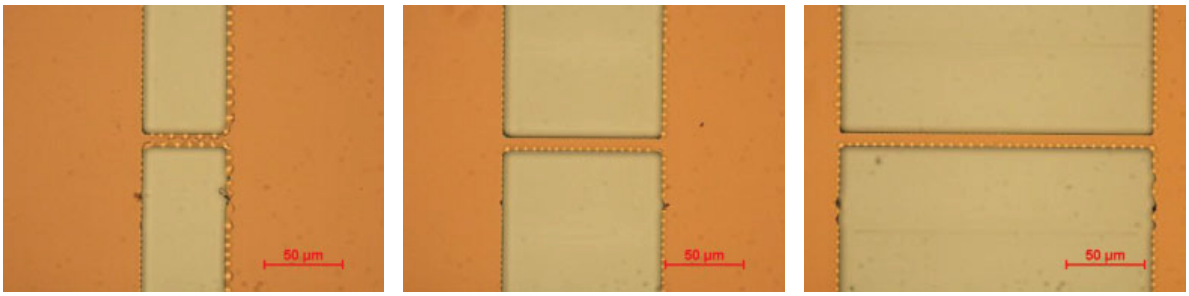


Plasma etch (RIE)

SiO2 etching

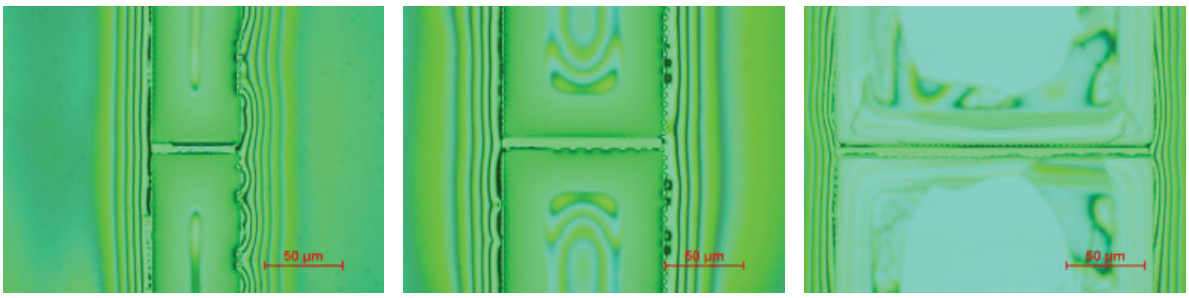


Wet Etch (BHF, HF)

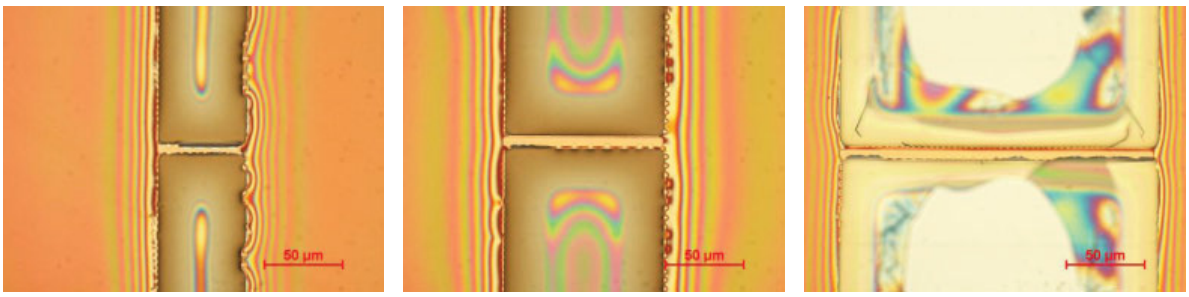


Strip (RIE + Wet)

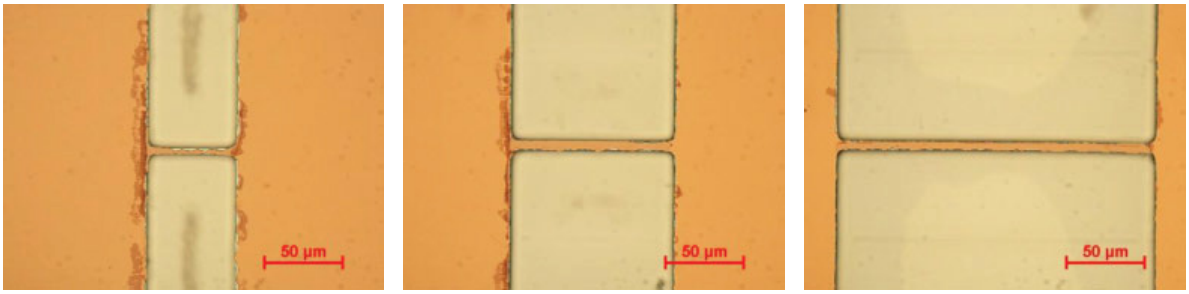
Ni Lift-off



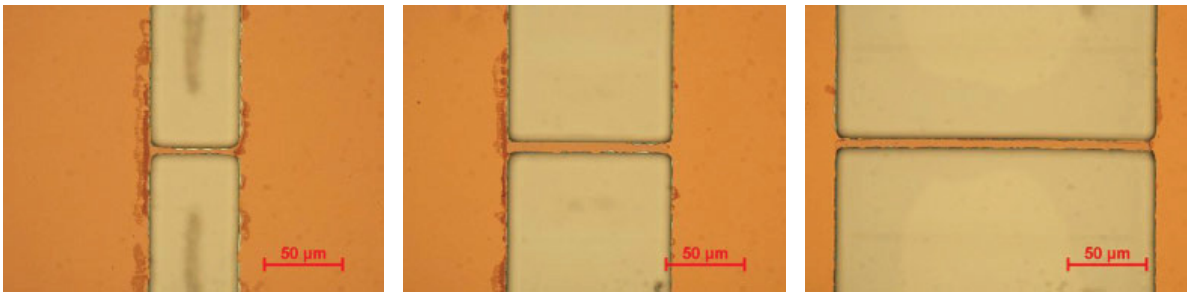
Lithography, Development #5 (HMDS + Negative PR with double coat+development)



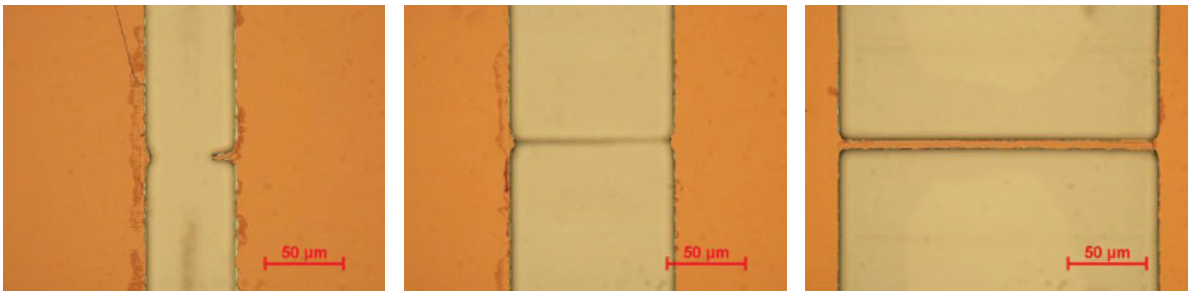
Flood Exposure (stabilizes PR for PVD process)



Strip (Wet + RIE + Gentle Q-tip scrub removal) #5e. Popped/Burnt PR spots still visible: add MW plasma strip with multi-step process? Is Bridge#3 broken during Q-tip scrubbing step?

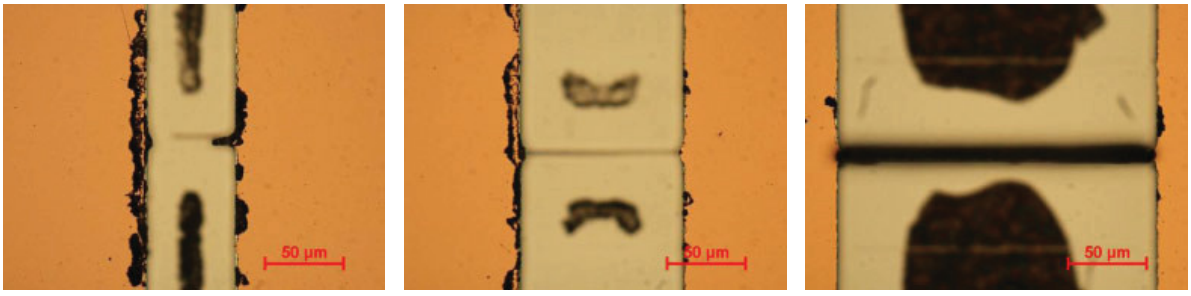


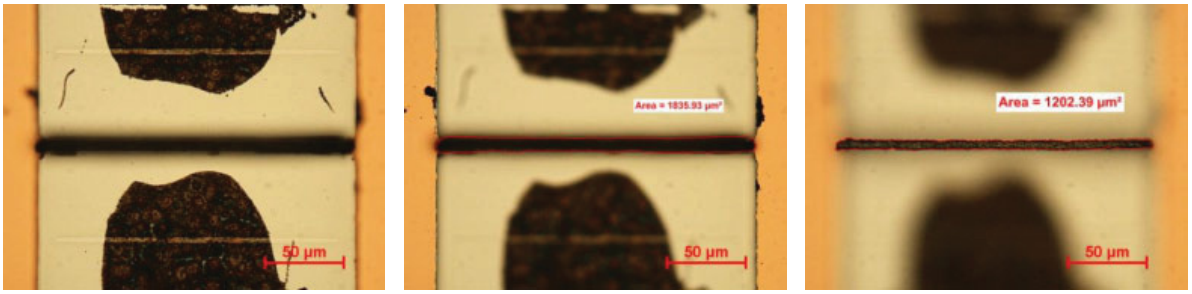
Strip (MW Plasma, 6 runs of 15 min) #6e. Popped/Burnt PR spots not removed by the MW plasma strip.



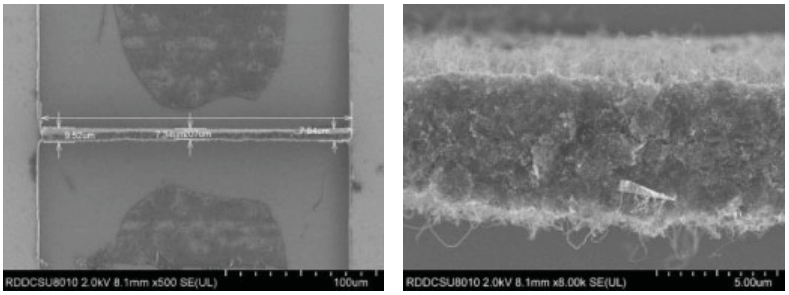
Strip (Wet + Gentle Q-tip scrub removal). Bridge#1 and Bridge#2 collapsed.

CNT growth

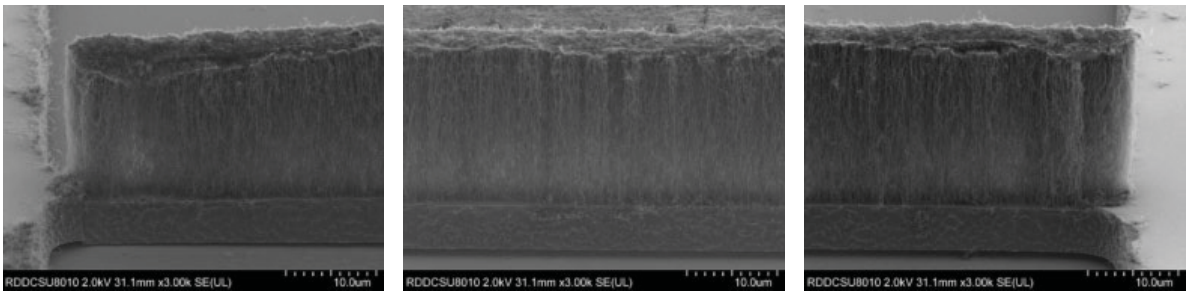




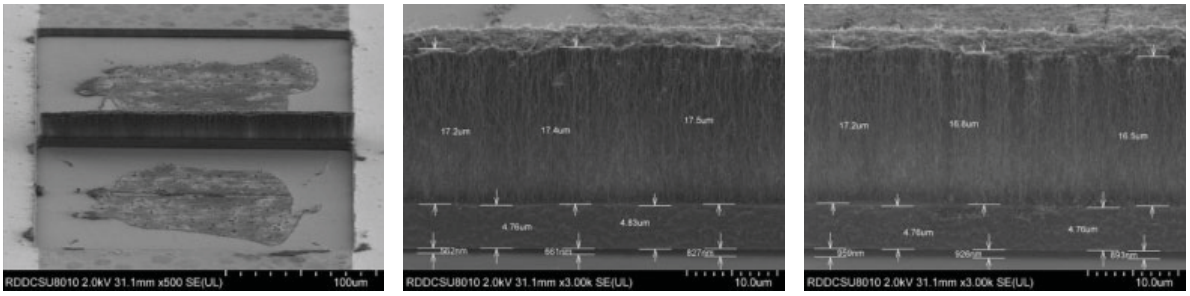
Bridge#3 - Optical images: Dimensions - Focus on Si handle (left), TiN surface (center), and CNT tip (right) for thickness estimation.



Bridge#3 - SEM images (No tilt): Dimensions



Bridge#3 - SEM images (70° tilt): Broken end (left), middle part (center), and holding end (right).

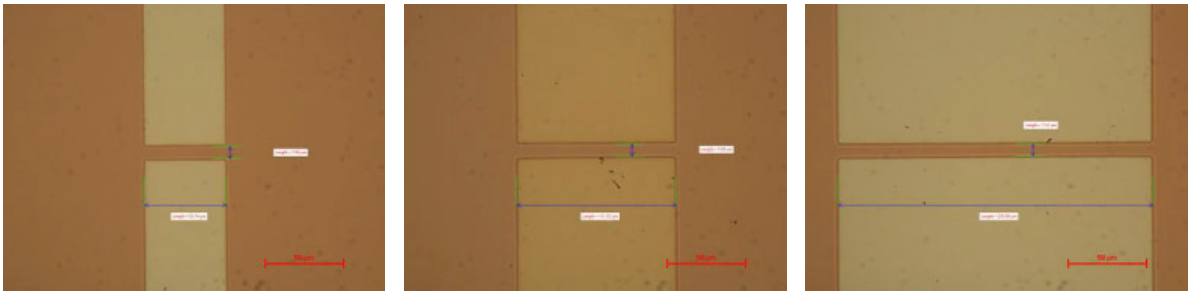


Bridge#3 - SEM images (70° tilt): Dimensions (uncorrected)

Annex 3: Sample CTSoi-13bN

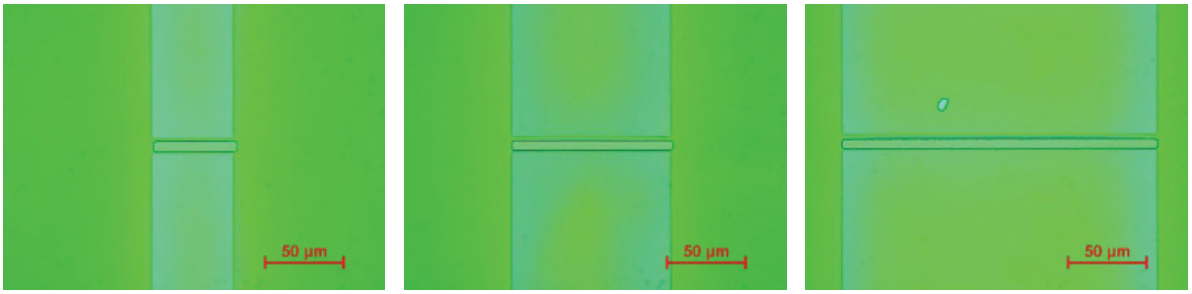
Bridge1 **Bridge2** **Bridge3**

TiN Patterning

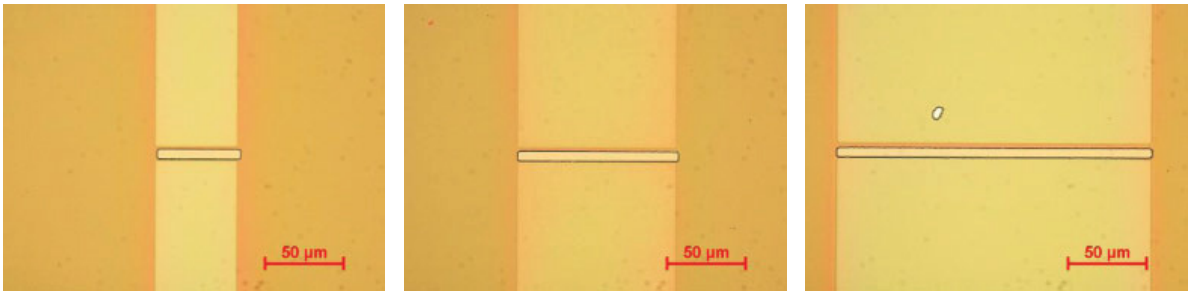


Lithography + Wet etch (ok?) + Strip (Wet) : TiN step thickness seems OK (no extra etch needed)

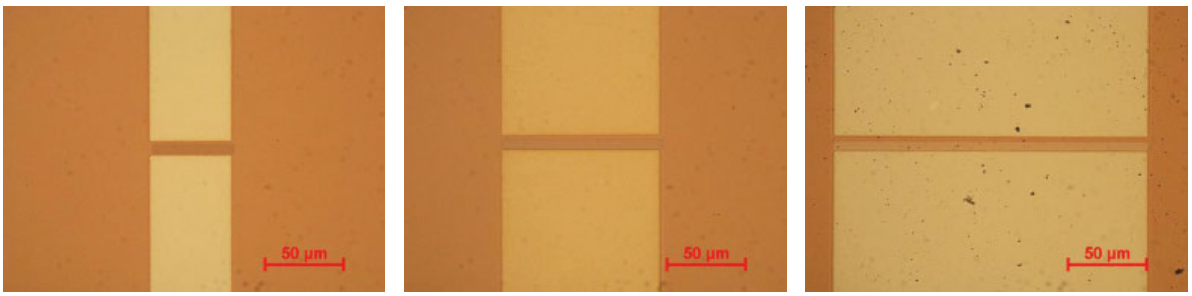
Ni Lift-off



Lithography (HMDS + Negative PR with double coat) + Development. #5

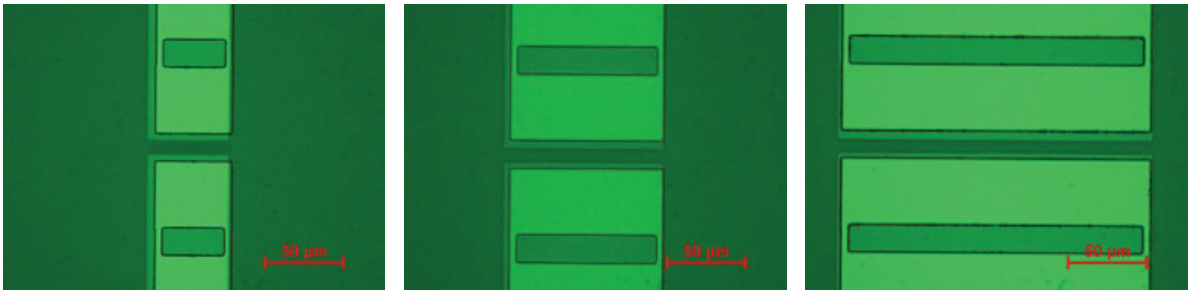


Flood Exposure (stabilizes PR for PVD process)

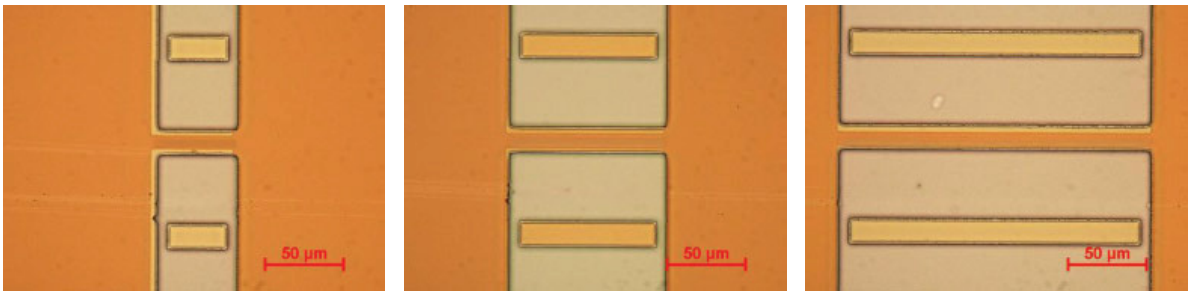


Strip (Wet + Gentle Q-tip scrub removal + RIE)x2 after Postbaking (oven), Descumming, and Ni coating.

Si Etching

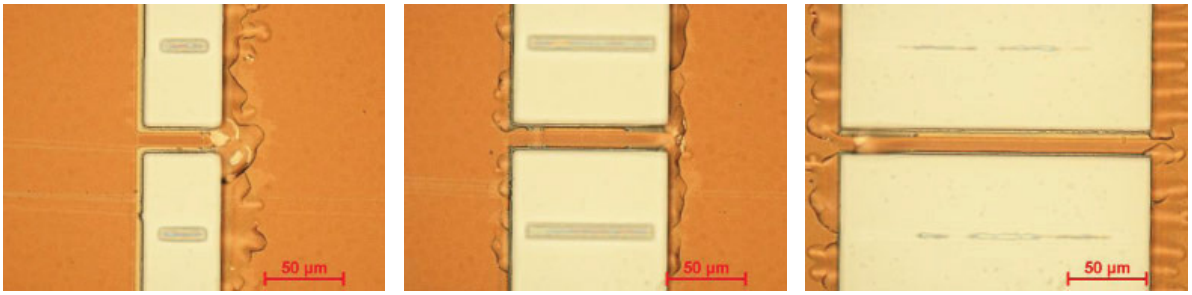


Lithography, Development

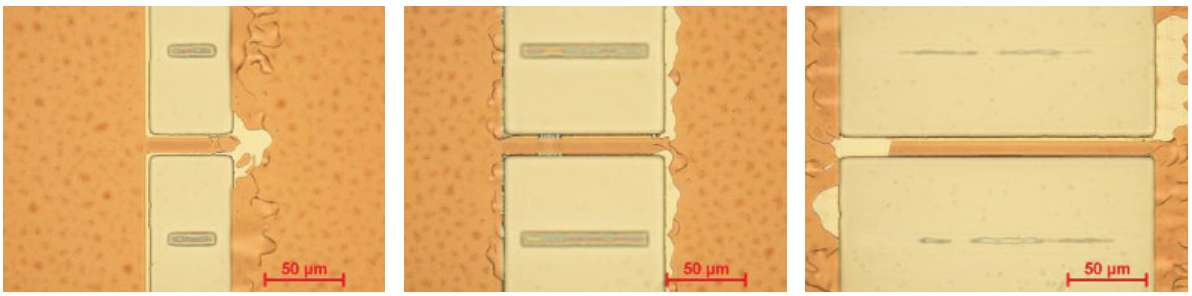


Plasma etch (RIE)

SiO2 etching

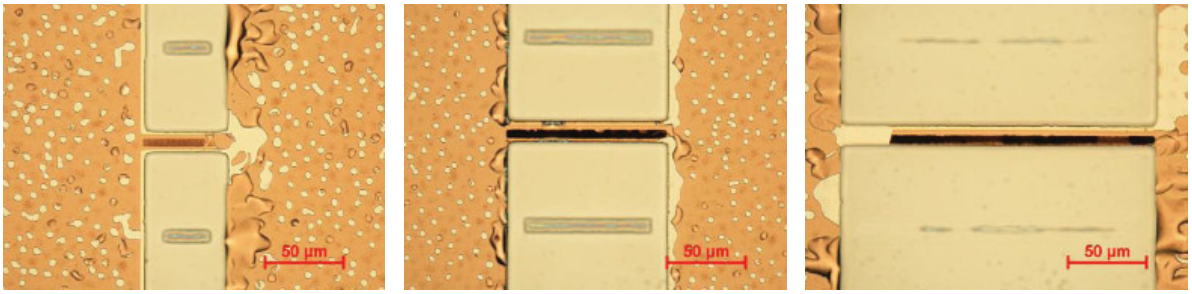


Wet Etch (BHF) #30: underetching of TiN

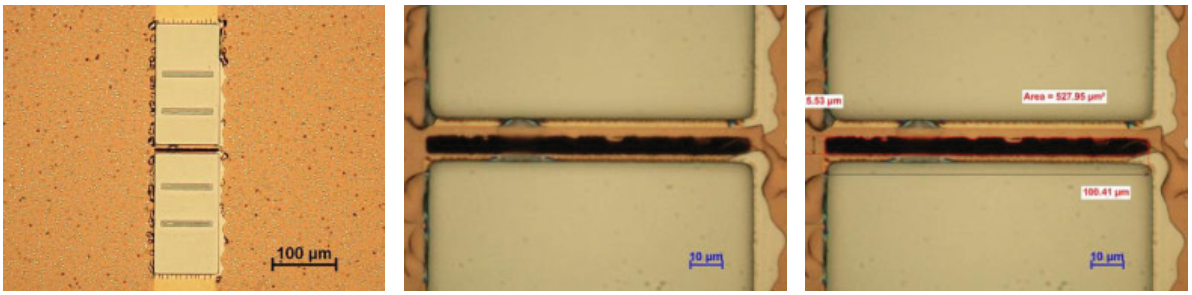


Strip (RIE + Wet)

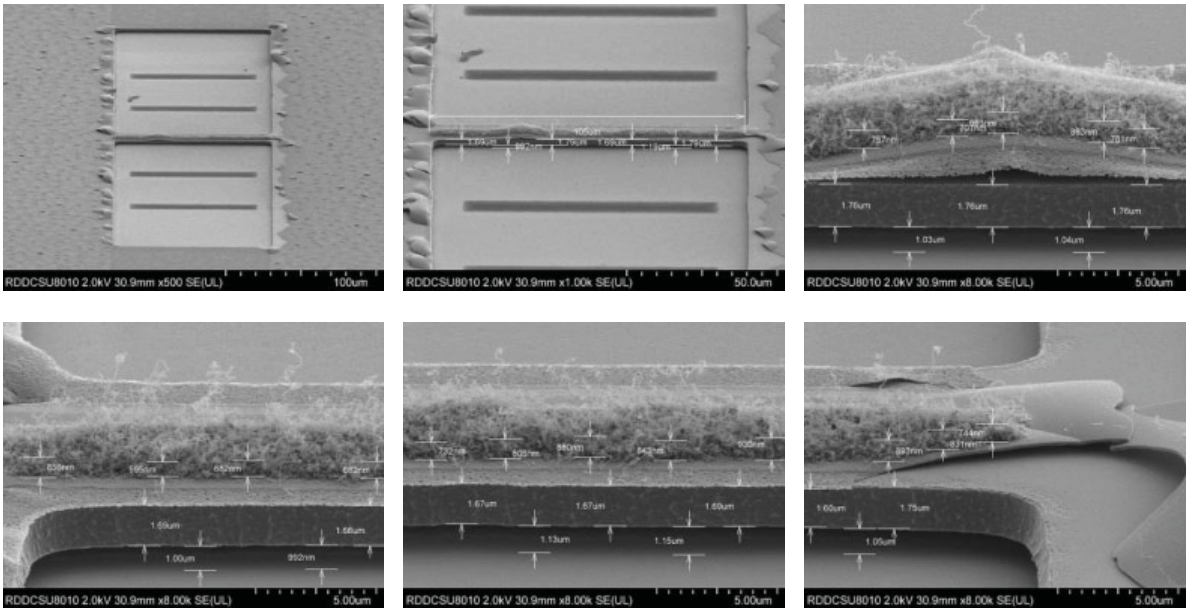
CNT growth



Optical images



Bridge#2 - Optical images: Dimensions

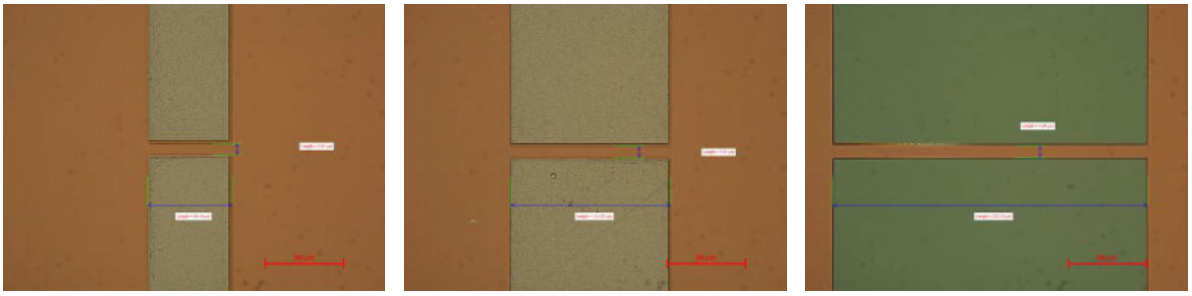


Bridge#1 - SEM images (70° tilt): Dimensions (uncorrected)

Annex 4: Sample CTSoi-14bN

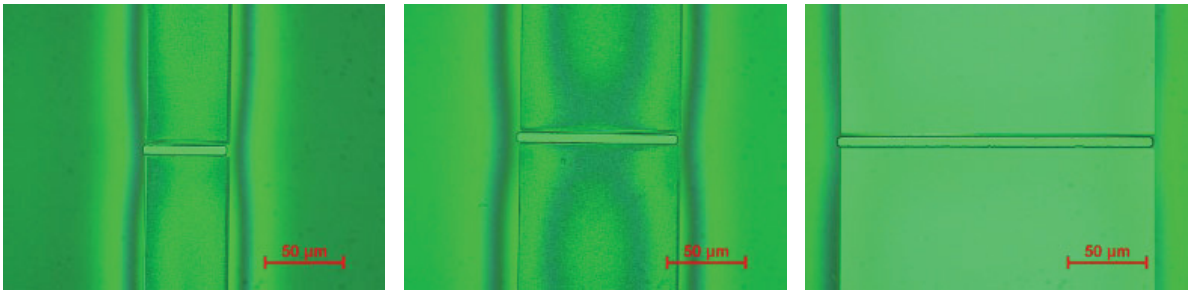
Bridge1 **Bridge2** **Bridge3**

TiN Patterning

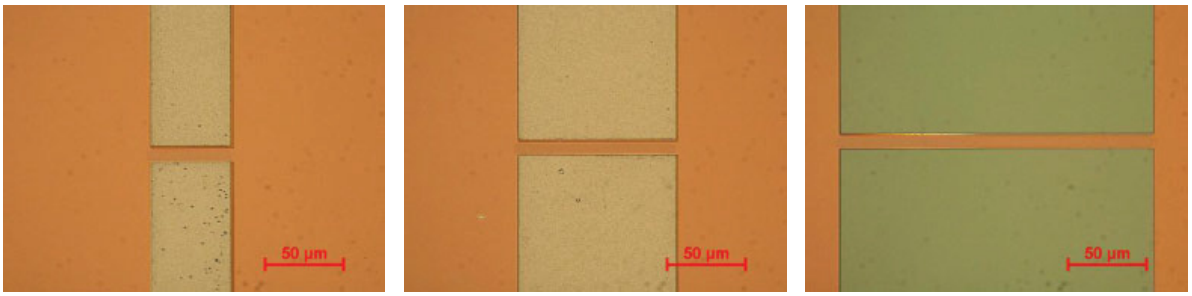


Lithography + Wet etch (APM, #8, stopped due to apparent but not real Si etch!, No Si device layer was present at Bridge#3 location due to thinning) + Strip (Wet) : TiN step thickness seems too low → + Lithography + Plasma etch (RIE recipe for TiN etches Si as well → no endpoint) + Strip (RIE + Wet)

Ni Lift-off

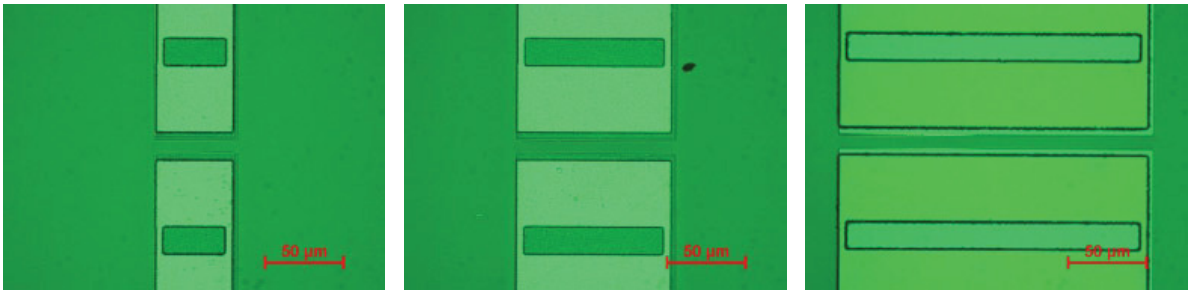


Lithography (HMDS + Negative PR with double coat) + Development(#2)

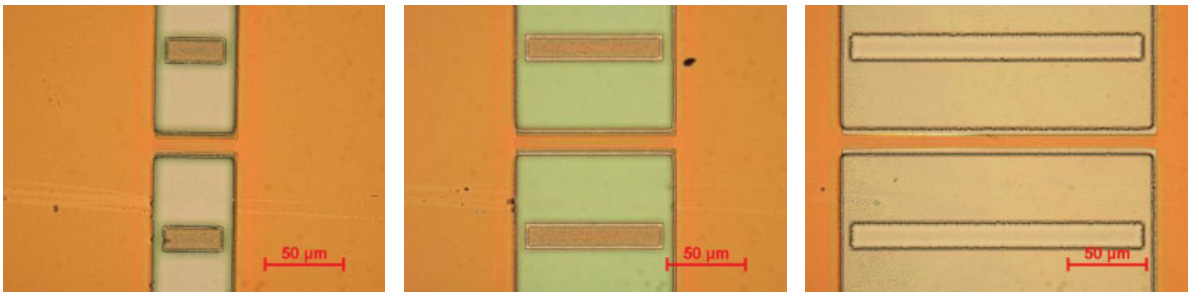


Strip (Wet + Gentle Q-tip scrub removal + RIE) #2 after Flood Exposure, Postbaking (oven), Descumming, and Ni coating.

Si Etching

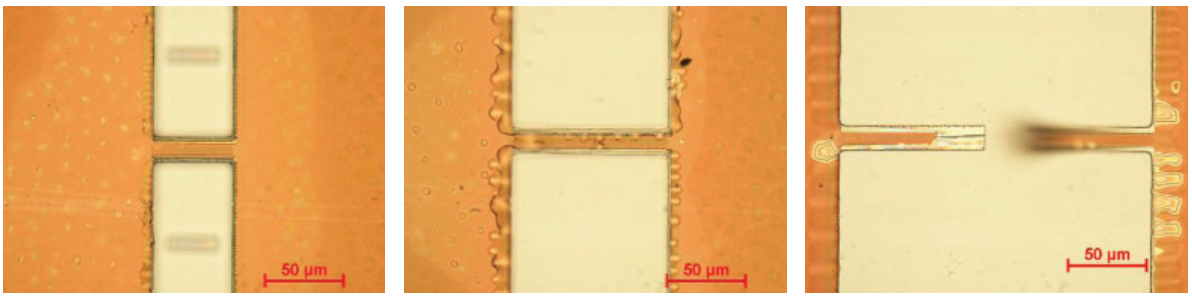


Lithography, Development (#3)

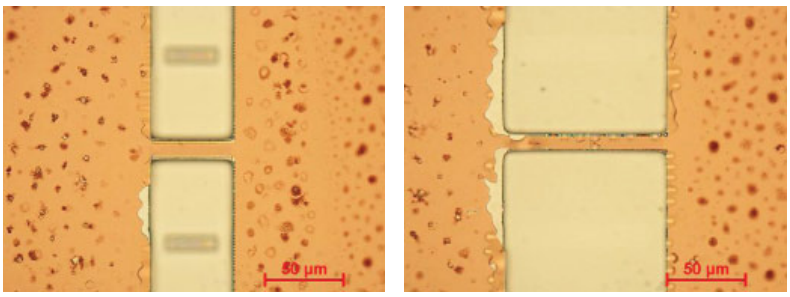


Plasma etch (RIE) #3

SiO2 etching



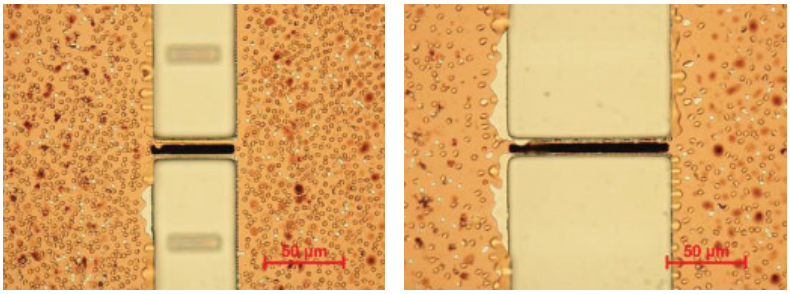
Wet Etch (BHF) #28: underetching of TiN



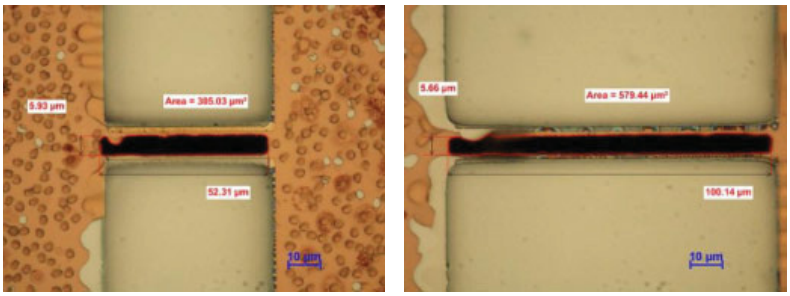
Strip (RIE + Wet + RIE)

Plasmionique Inc. **Sample CTSoi-14bN**

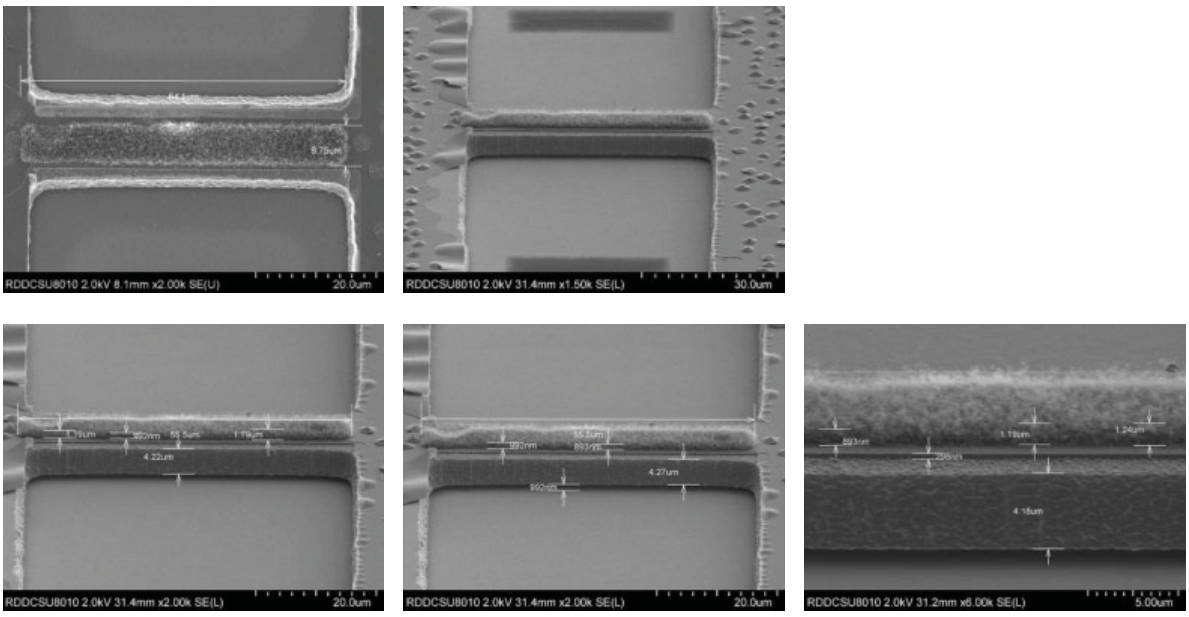
CNT growth



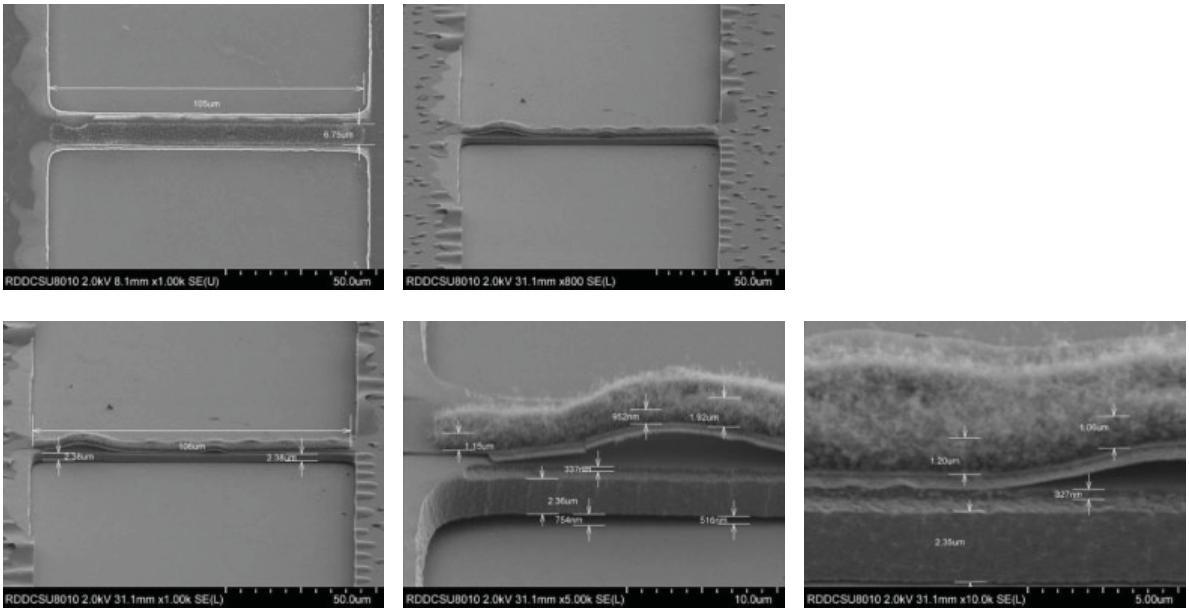
Optical images



Optical images: Dimensions



Bridge#1 - SEM images (70° tilt, except #1): Dimensions (uncorrected)

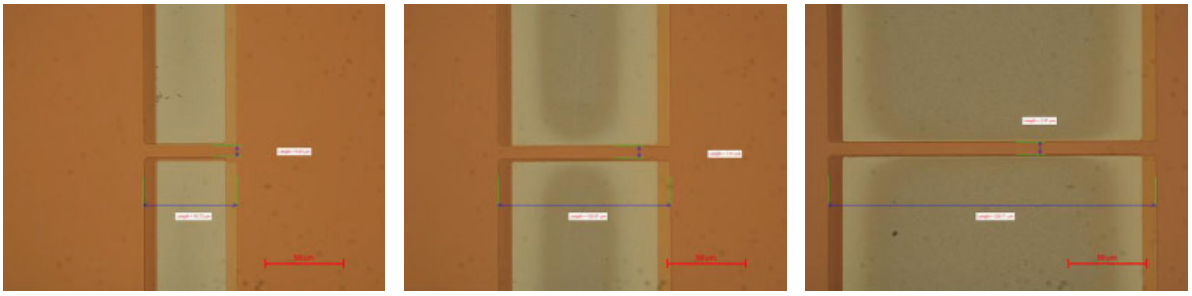


Bridge#2 - SEM images (70° tilt, except #1): Dimensions (uncorrected). Bridge#2 touches the Si handle!

Annex 5: Sample CTSoi-14cN

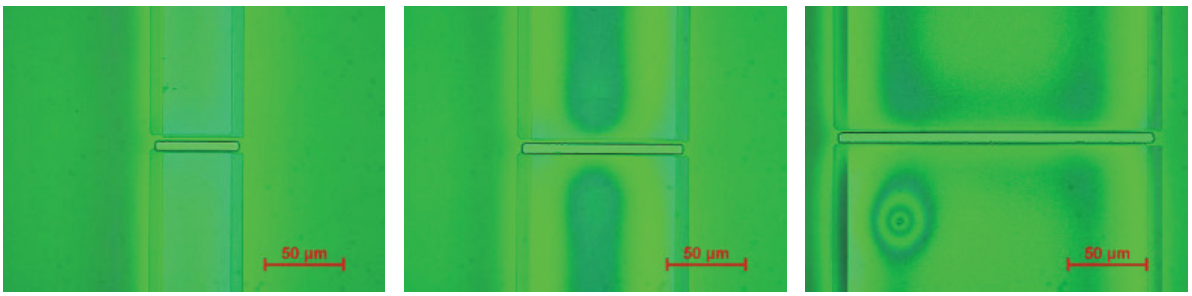
Bridge1 **Bridge2** **Bridge3**

TiN Patterning

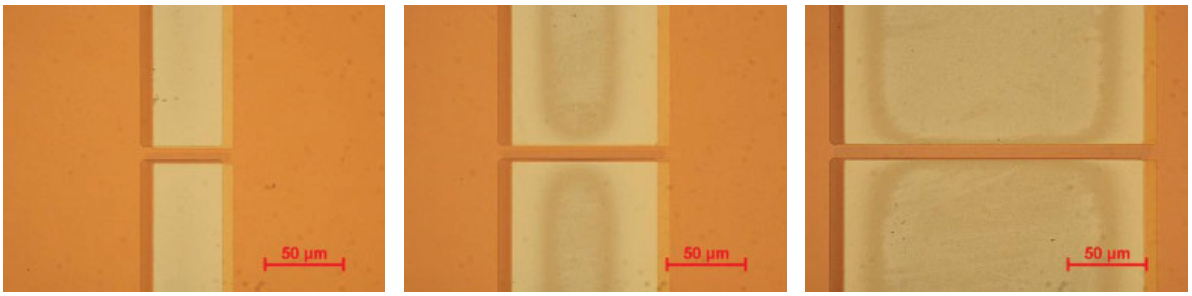


Lithography + Wet etch (APM, #5, stopped due to apparent but not real Si etch!) + Strip (Wet) : TiN step thickness seems too low → + Lithography #4 + Plasma etch (RIE recipe for TiN etches Si as well → no endpoint) + Strip (RIE + Wet) #2

Ni Lift-off

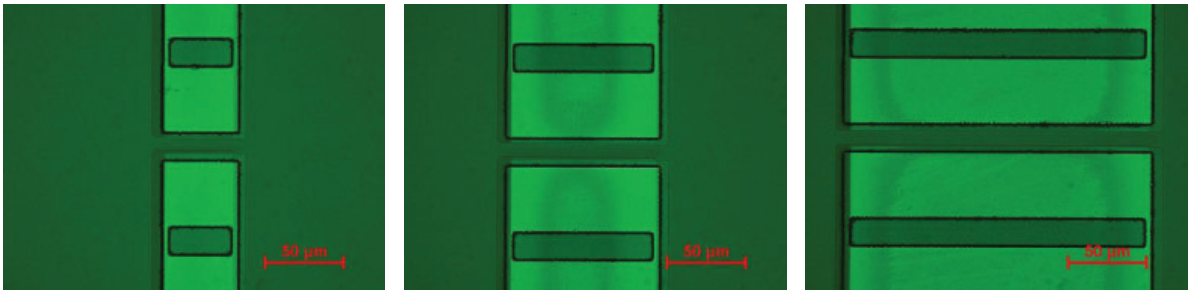


Lithography (HMDS + Negative PR with double coat) + Development #2

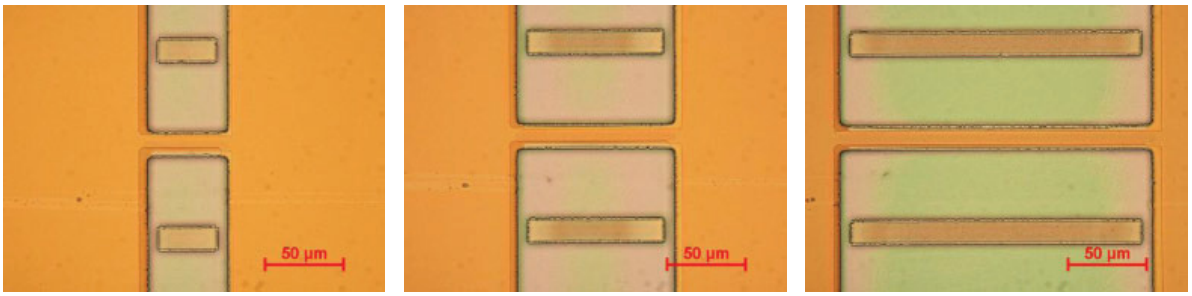


Strip (Wet + Gentle Q-tip scrub removal + RIE) #2 after Flood Exposure, Postbaking (oven), Descumming, and Ni coating.

Si Etching

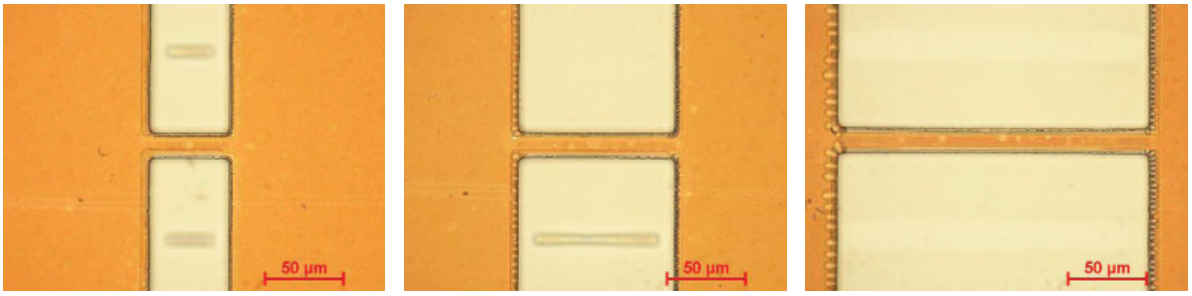


Lithography, Development

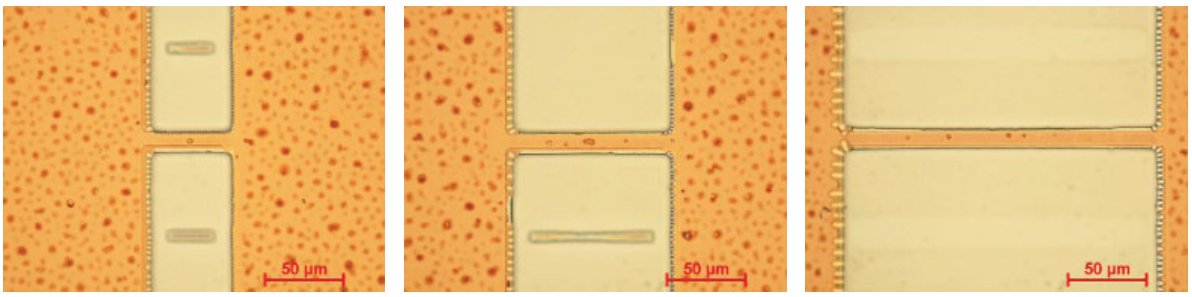


Plasma etch (RIE) #3

SiO2 etching



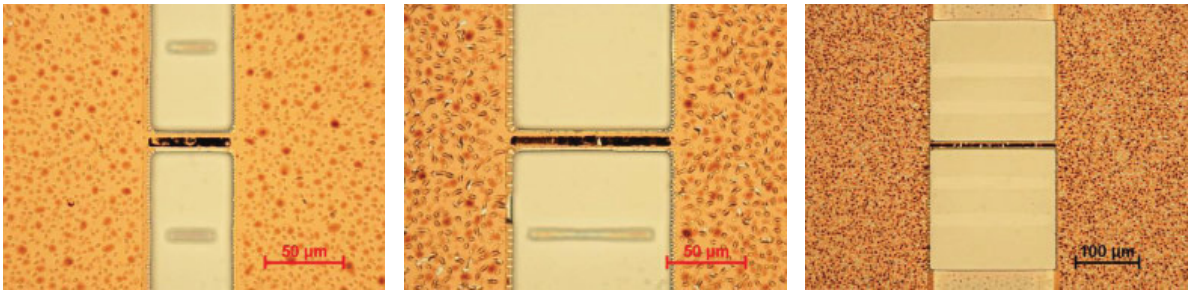
Wet Etch (BHF) #33: less underetching of TiN



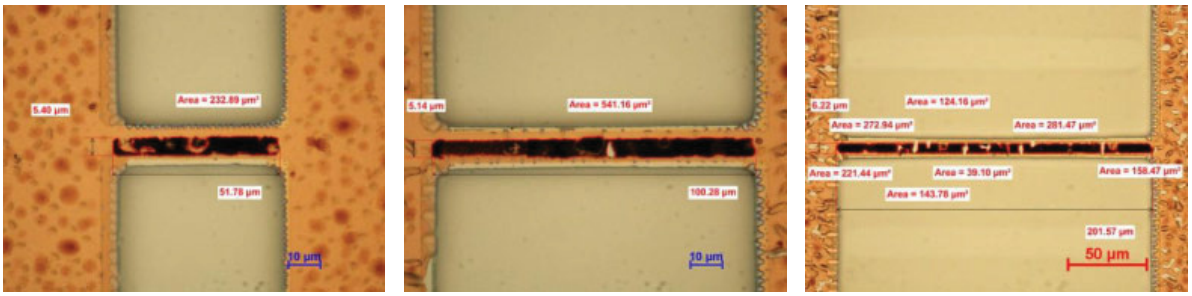
Strip (RIE + Wet + RIE)

Plasmionique Inc. **Sample CTSoi-14cN**

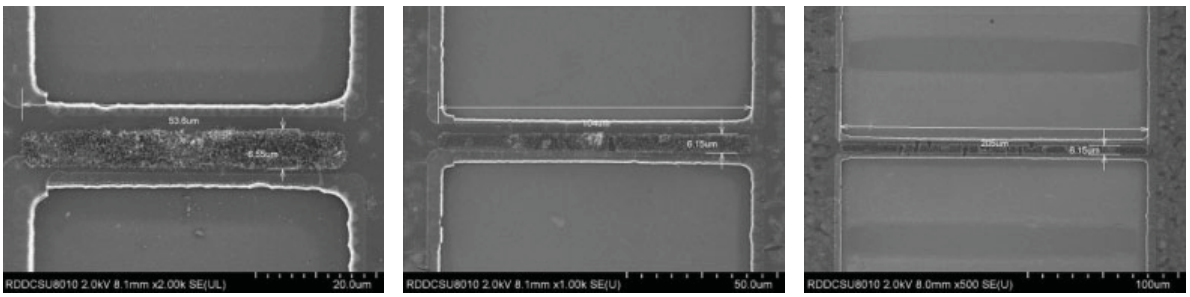
CNT growth



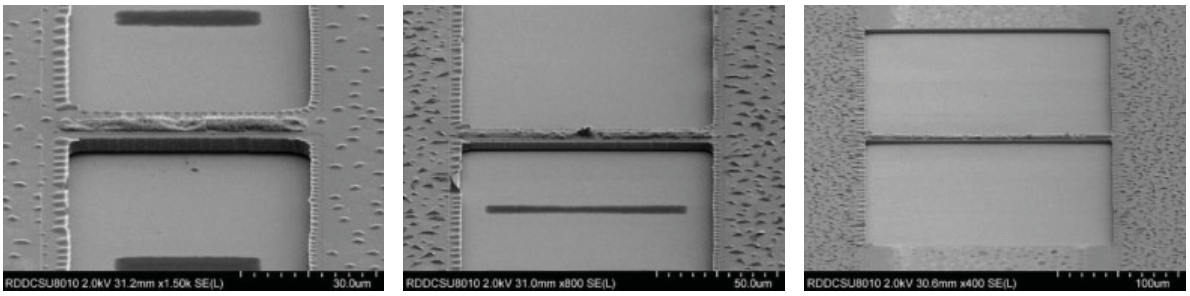
Optical images

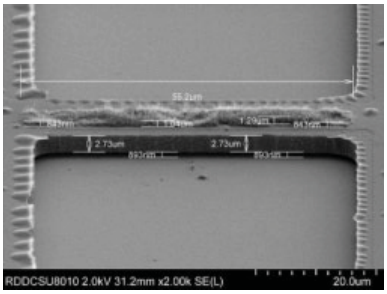


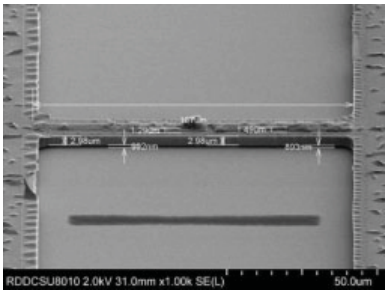
Optical images: Dimensions

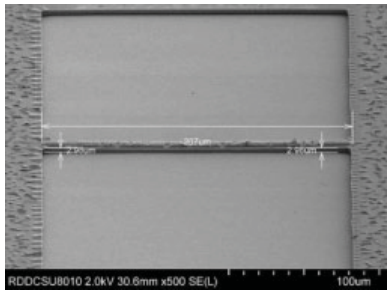


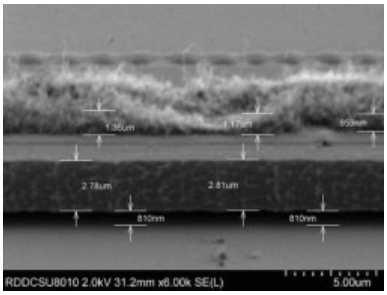
SEM images: Dimensions

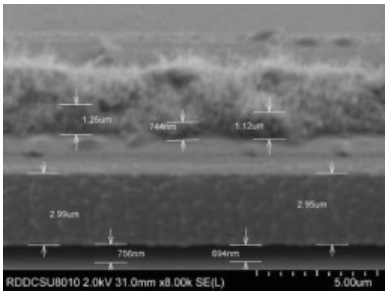


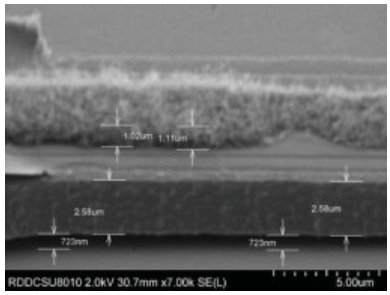


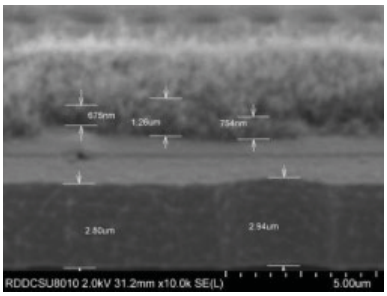


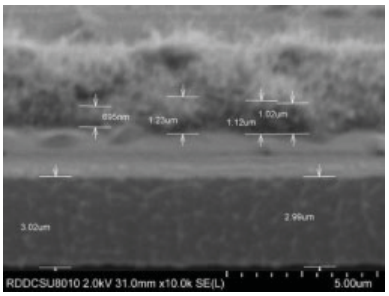


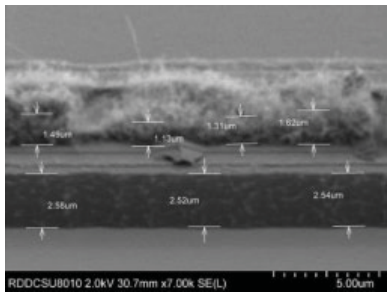


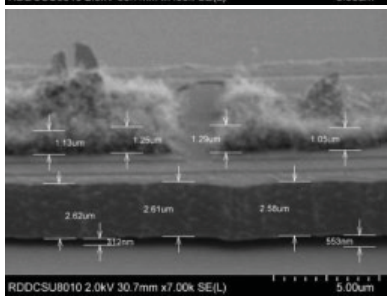


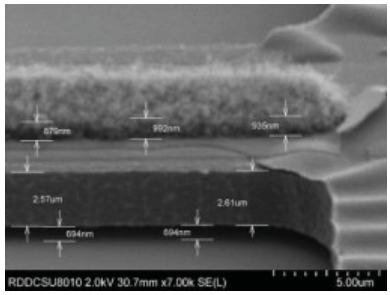










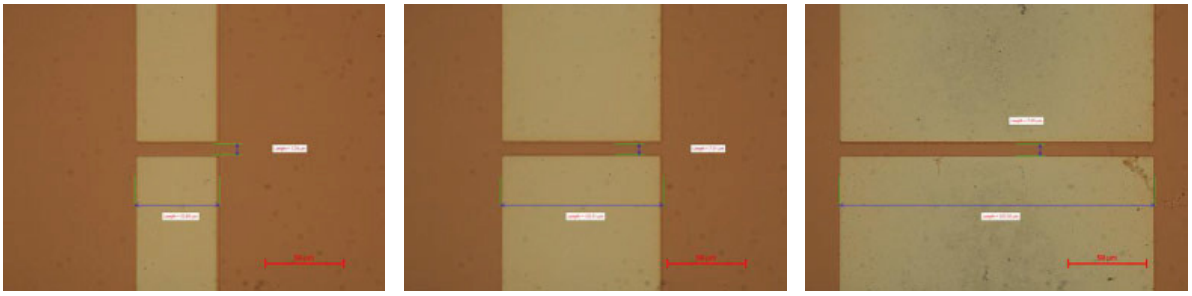


SEM images (65° tilt): Dimensions (uncorrected). Bridge#3 touches the Si handle!

Annex 6: Sample CTSoi-15N

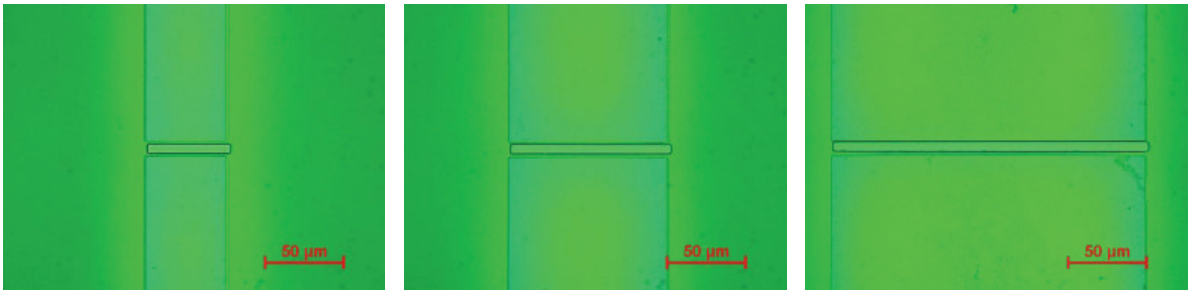
Bridge1 **Bridge2** **Bridge3**

TiN Patterning

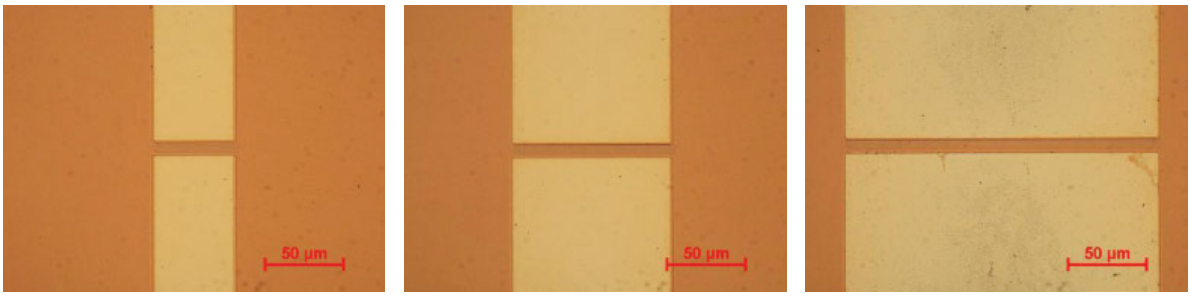


Lithography + Wet etch (APM, #5, stopped due to apparent but not real Si etch!) + Strip (Wet) : TiN step thickness seems too low → + Lithography + Plasma etch (RIE recipe for TiN etches Si as well → no endpoint) + Strip (RIE + Wet) #2

Ni Lift-off

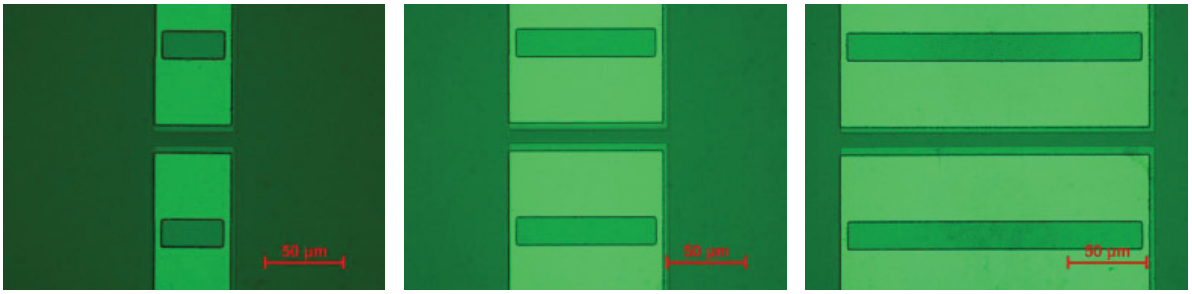


Lithography (HMDS + Negative PR with double coat) + Development #2

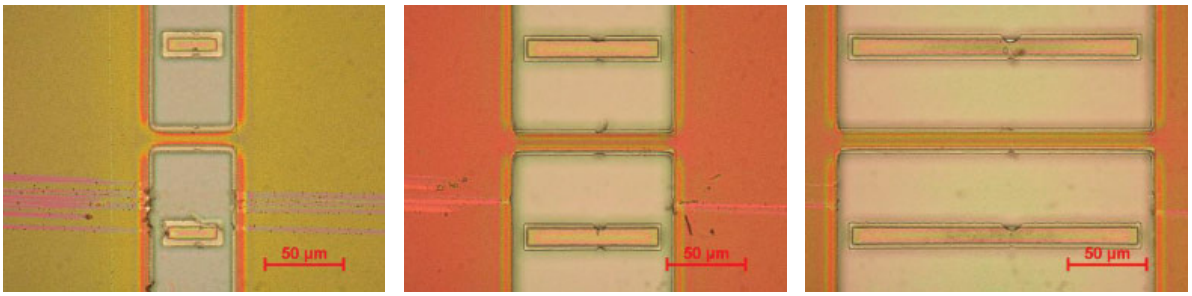


Strip (Wet + Gentle Q-tip scrub removal + RIE) #4 after Flood Exposure, Postbaking (oven), Descumming, and Ni coating.

Si Etching

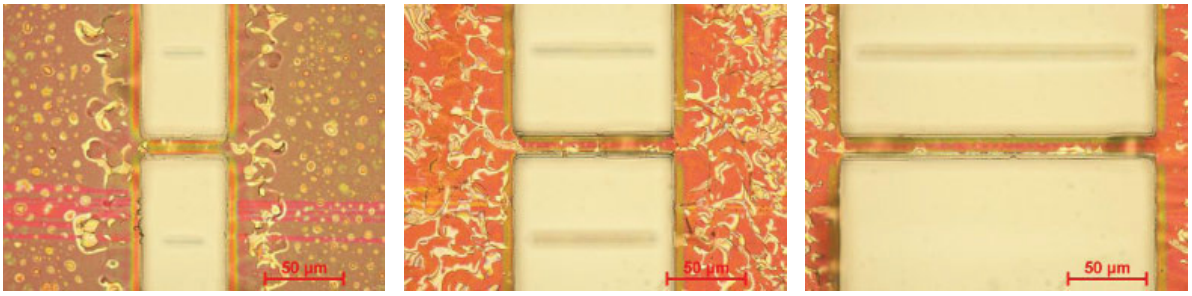


Lithography, Development

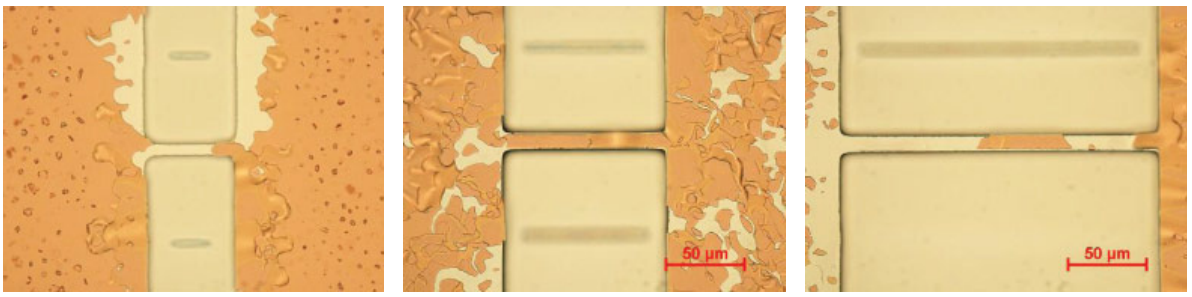


Plasma etch (RIE) #5

SiO2 etching



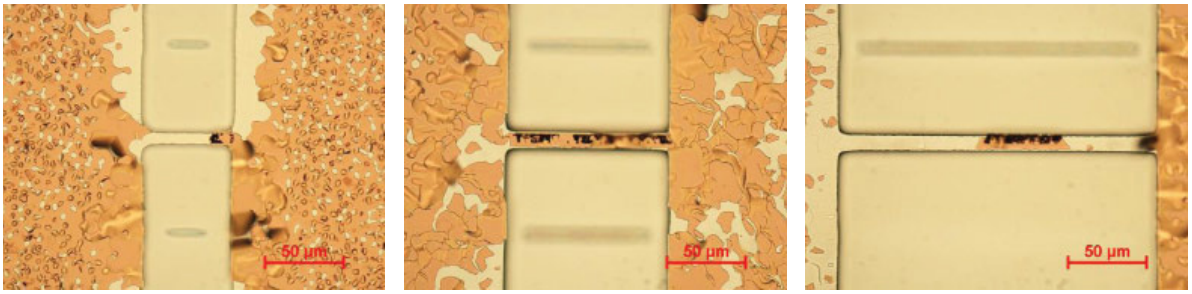
Wet Etch (BHF) #40: underetching of TiN



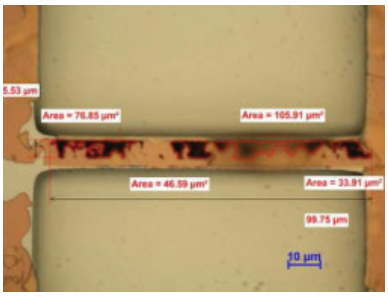
Strip (RIE + Wet + RIE)

Plasmionique Inc. **Sample CTSoi-15N**

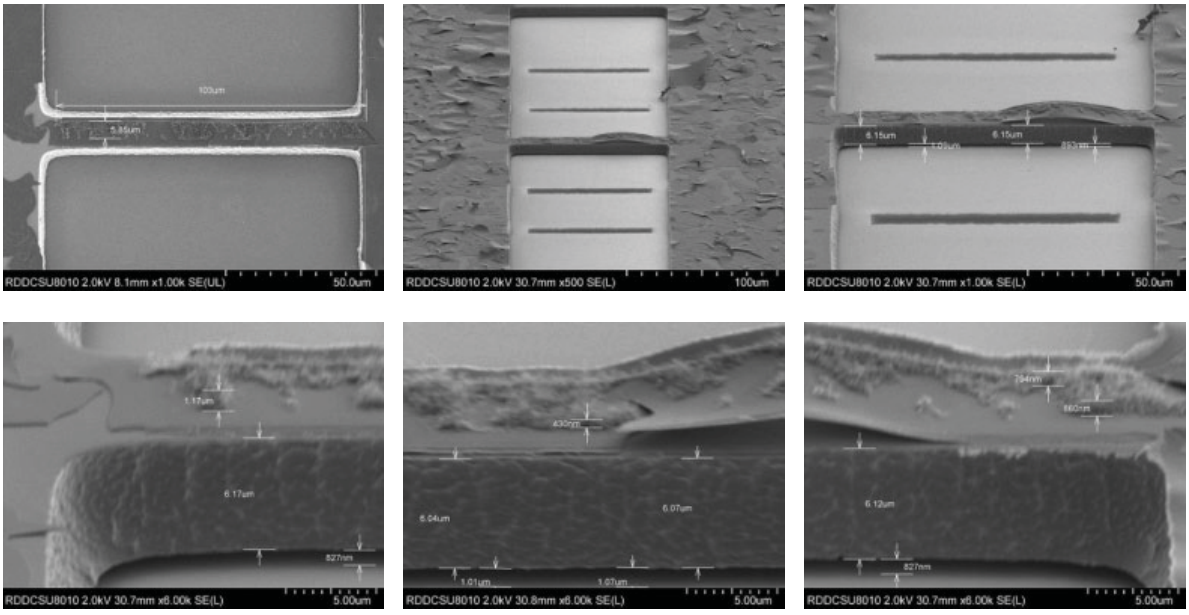
CNT growth



Optical images



Bridge#2 - Optical image: Dimensions

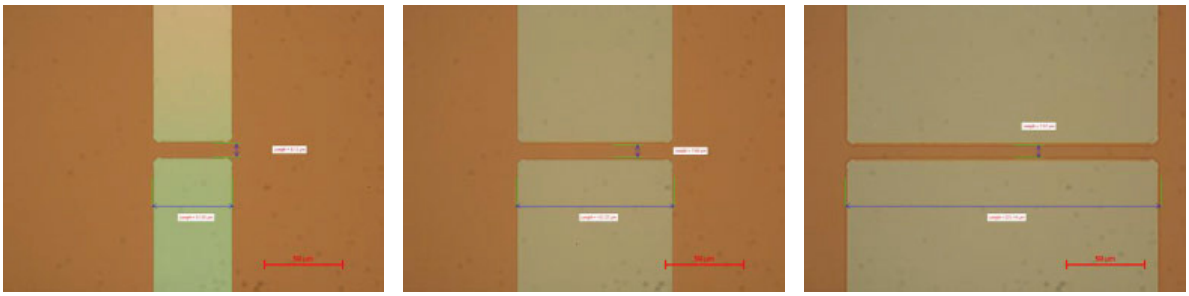


Bridge#2 - SEM images (65° tilt, except #1): Dimensions (uncorrected). TiN connection might become problematic!

Annex 7: Sample CTSoi-19N

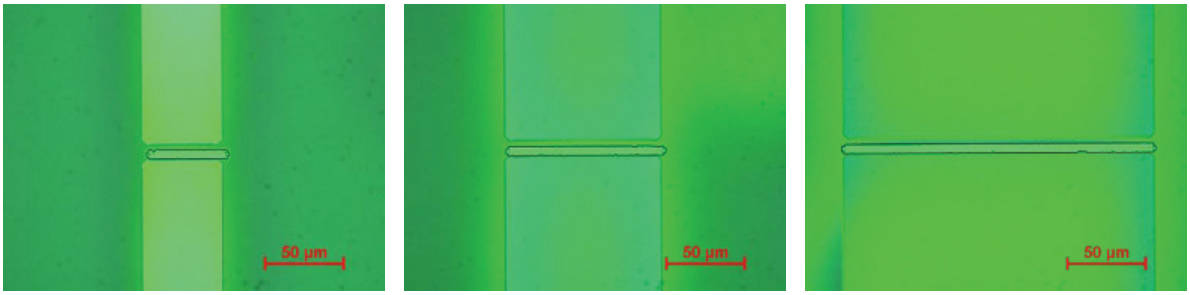
Bridge1 **Bridge2** **Bridge3**

TiN Patterning

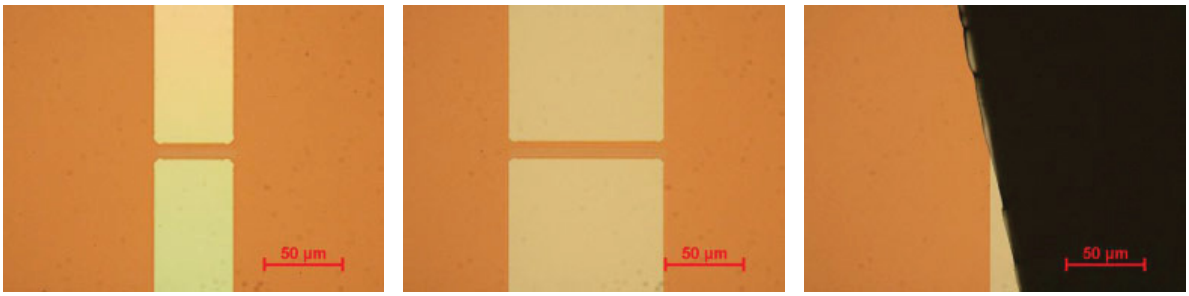


Lithography + Wet etch (ok?) + Strip (Wet) : TiN step thickness seems OK (no extra etch needed)

Ni Lift-off

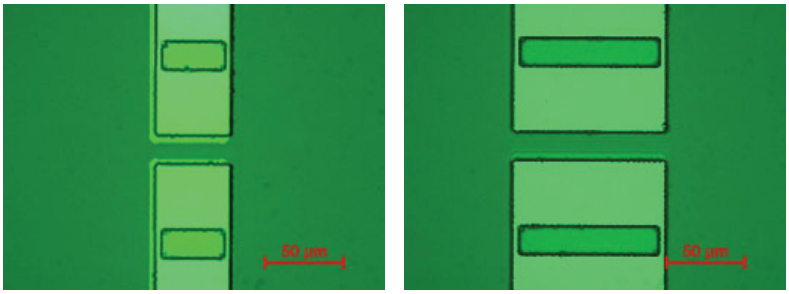


Lithography (HMDS + Negative PR with double coat) + Development (#2)

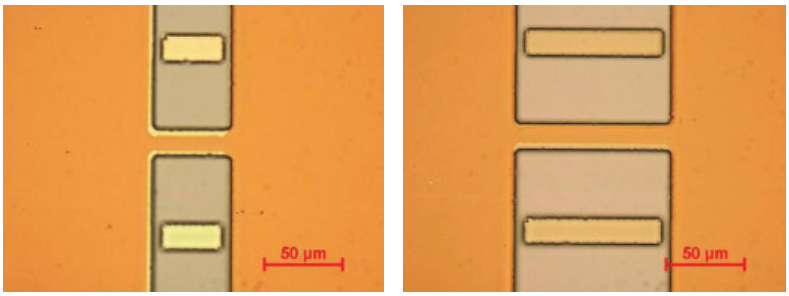


Strip (Wet + Gentle Q-tip scrub removal + RIE) #2 after Flood Exposure, Postbaking (oven), Descumming, and Ni coating. Sample broken at Bridge#3

Si Etching

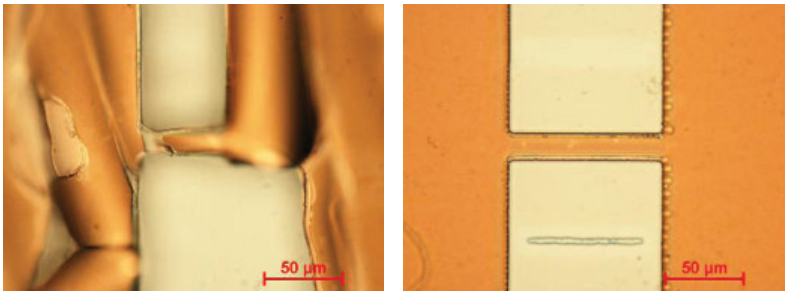


Lithography, Development

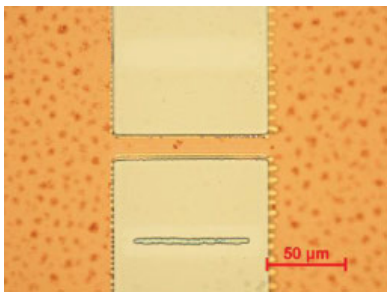


Plasma etch (RIE) #2

SiO2 etching



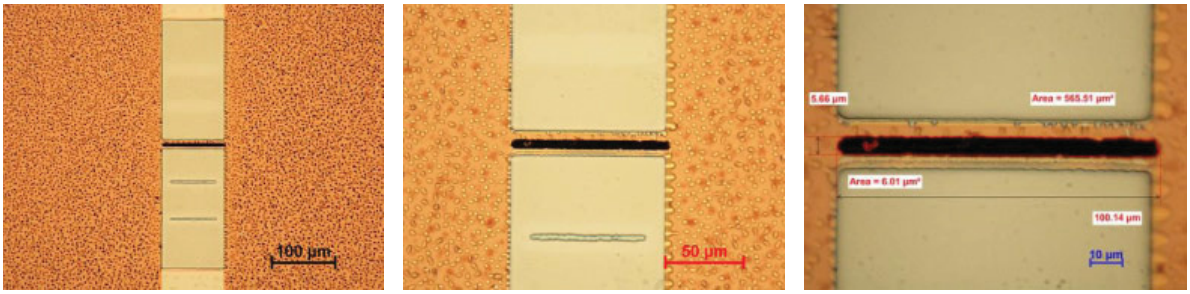
Wet Etch (BHF) #42: severe underetching of TiN at Bridge#1



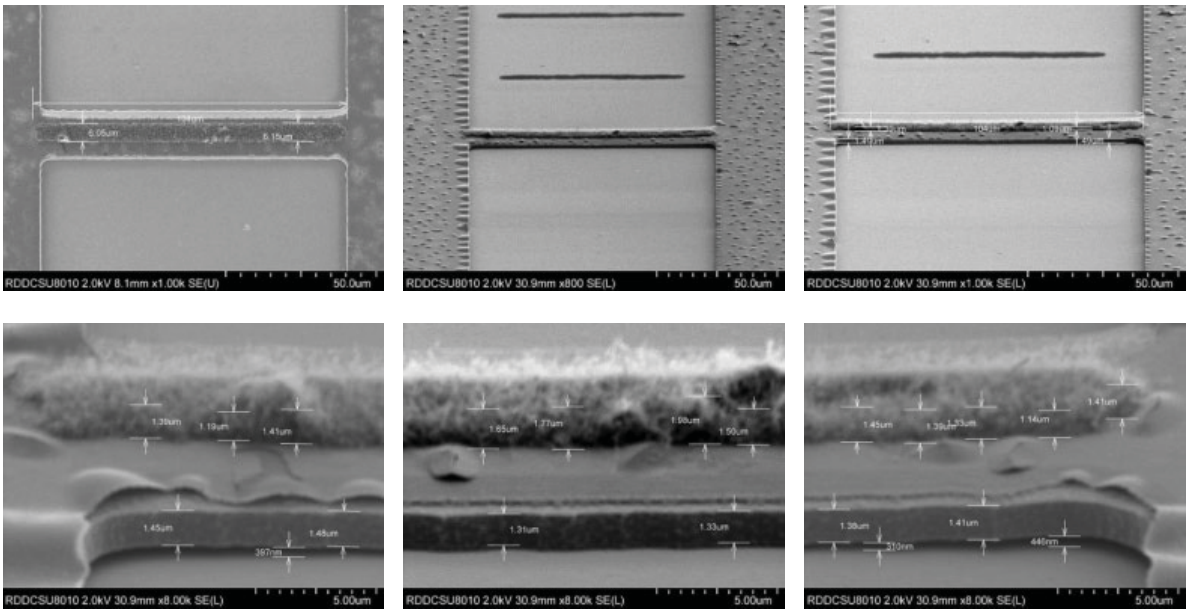
Strip (RIE + Wet + RIE)

Plasmionique Inc. **Sample CTSoi-19N**

CNT growth



Bridge#2 - Optical images + Dimensions



Bridge#2 - SEM images (65° tilt, except #1): Dimensions (uncorrected).