

BATCH MANUFACTURING RECORD

STM Hydrogen Desorption Lithography Process

Batch Number:	_____	Date Started:	_____
Device ID:	_____	Target Completion:	_____
Sample:	_____	Actual Completion:	_____
Primary Operator:	_____	QC Review:	_____

Step 1: Ex Situ — New Sample Mounting

Operator Initials:	Start Time:	2025-11-11 12:48	End Time:	2025-11-11 13:37
--------------------	-------------	---------------------	-----------	---------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Sample Plate Id	As required	G	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Id	As required	W200306B10U3	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Dopant	As required	B	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Resistivity Ohmcm	As required	3-10	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Thickness Um	As required	300 um	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Alias	As required	Kingsbury	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Id	As required	S20240419BMG	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Mount Resistance Kohm	As required	15	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Notes	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

✓	Check Description	Pass/Fail
<input checked="" type="checkbox"/>	Sample secured	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Contacts intact	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Plate ID matches log	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by:	<hr/>	Date/Time:	2025-11-11 13:37
Verified by:	<hr/>	Date/Time:	<hr/>

Step 2: Degassing

Operator Initials:	Start Time:	2025-11-11 12:45	End Time:	2025-11-11 12:52
--------------------	-------------	---------------------	-----------	---------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
P Mbe Base Mbar	As required	3.2E-10	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Ramp Up Min	As required	15	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Peak Pressure Mbar	As required	1.9E-9	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Peak Current A	As required	1.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Peak Temperature C	As required	450	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Ramp Down Min	As required	1	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Base Mbe Pressure Mbar	As required	3.5E-10	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Ramp Up Min	As required	5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Peak Pressure Mbar	As required	8E-10	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Peak Current A	As required	0.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Peak Temperature C	As required	600	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Ramp Down Min	As required	0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	20240419_OUTGAS.txt	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

✓	Check Description	Pass/Fail
<input type="checkbox"/>	Target temperatures reached	<input type="checkbox"/> Pass <input checked="" type="checkbox"/> Fail
<input type="checkbox"/>	Peak pressure within acceptable range	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 12:52
Verified by: _____	Date/Time: _____

Step 3: Flashing

Operator Initials:	Start Time: 2025-11-11 12:45	End Time: 2025-11-11 12:57
---------------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Idle Temperature C	As required	900	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Idle Current A	As required	2.4	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flash Temperature C	As required	1201.0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flash Current A	As required	6.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Cooldown Time Min	As required	30	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Number Of Flashes	As required	9	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	20240423 Flash.txt	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Flash Events (default 5 rows, max 10):

Flash #	Temperature (C)	Duration (s)	P_MBE (mbar)
1	1201	11	4.2E-9
2	1170	6	2.2E-9
3	1166	6	2.5E-9
4	1165	6	1.2E-9
5	1162	6	1.3E-9
6	1167	8	1.2E-9
7	1162	20	4.0E-9
8	1194	6	1.0E-9
9	1192	7	9.6E-10

Quality Checks:

✓	Check Description	Pass/Fail
<input type="checkbox"/>	Flashes sufficient	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input type="checkbox"/>	No abnormal P spikes	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 12:57
Verified by: _____	Date/Time: _____

Step 4: Temperature Calibration (Cooldown analysis)

Operator Initials:	Start Time: 2025-11-11 12:57	End Time: 2025-11-11 13:10
---------------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Current At 335C A	As required	0.040	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Current At 350C A	As required	0.074	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Current At 470C A	As required	0.140	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Current At 250C A	As required	0.027	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Calibration File	As required	C:/Users/kspruce/device_record	Device Data <input checked="" type="checkbox"/> Device <input type="checkbox"/> Data
Calibration Notes	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

✓	Check Description	Pass/Fail
<input type="checkbox"/>	Calibration points verified	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input type="checkbox"/>	Matches prior runs	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:10
Verified by: _____	Date/Time: _____

Step 5: Hydrogen Termination

Operator Initials:	Start Time: 2025-11-11 12:45	End Time: 2025-11-11 13:13
---------------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Termination Current A	As required	0.063	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Termination Temperature C	As required	360	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Termination Pressure Mbar	As required	5.34E-7	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Peak Cracker Temperature C	As required	1538	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Peak Cracker Current A	As required	11.36	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	20240423 HTERMINATE.txt	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Termination Process (7 labeled rows):

Time [HH:MM]	Cracker I [A]	Cracker V [V]	Cracker T [C]	I_sample [A]	V_sample [V]	T_pyro [C]	T_TC [C]	P_MBE [mbar]	Notes
1047	0	0	20						
1047	0	0	21						
1055	11.36	10.56	1283						
1056	11.36	10.66	1396						
1109	11.36	10.76	1538						
1119	0	0	420						

Quality Checks:

✓	Check Description	Pass/Fail
<input checked="" type="checkbox"/>	Cooling water on	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Valves configured	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	P_MAX within spec	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Uniform termination	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:13
Verified by: _____	Date/Time: _____

Step 6: Termination Check (STM)

Operator Initials:	Start Time: 2025-11-11 12:45	End Time: 2025-11-11 13:23
---------------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Scan Area Nm	As required	100	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Bias Voltage V	As required	-2	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Setpoint Current Pa	As required	60	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Scan Folder Location	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Scan Numbers Of Interest	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Coverage Assessment	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	20240423 HTERMINATE.txt	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

✓	Check Description	Pass/Fail
<input checked="" type="checkbox"/>	Uniform H coverage	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	No contamination	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:23
Verified by: _____	Date/Time: _____

Step 7: STM HDL

Operator Initials:	Start Time: 2025-11-11 13:14	End Time: 2025-11-11 13:14
---------------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Fem Voltage V	As required	6.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fem Current Pa	As required	1.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fem Speed	As required	400	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Voltage V	As required	3.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Current Pa	As required	3.5	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Speed	As required	50	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fem Pitch	As required	3	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Pitch	As required	1	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Passes	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Total Path Length Nm	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:14
Verified by: _____	Date/Time: _____

Step 8: Dose (XH3)

Operator Initials:	Start Time: 2025-11-11 12:45	End Time: 2025-11-11 13:17
---------------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Dopant Species	As required	PH3	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Target Dose Pressure Mbar	As required	5E-9	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dose Duration S	As required	600	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Initial Pressure Mbar	As required	2.65E-11	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Mean Dose Pressure Mbar	As required	4.23E-9	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Baseline Pressure Mbar	As required	2.65E-11	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Exposure Langmuirs	As required	2.59	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Leak Valve Start Turns	As required	2	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Leak Valve Operating Turns	As required	4.4	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dose Start Time	As required	0924	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dose End Time	As required	0934	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	C:/Users/kspruce/device_records/DeviceData/S20240419B	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
P_Vt Channel Name	As required	P_VT	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

✓	Check Description	Pass/Fail
<input checked="" type="checkbox"/>	Tip retracted	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Stage locked	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Matrix controller off	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Pressure stable (P_VT)	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:17
Verified by: _____	Date/Time: _____

Step 9: Incorporation

Operator Initials:	Start Time:	2025-11-11 12:45	End Time:	2025-11-11 13:19
--------------------	-------------	---------------------	-----------	---------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Incorporation Temperature C	As required	350	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Incorporation Time S	As required	120	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Planned Current A	As required	0.074	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Actual Current A	As required	0.067	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Initial Pressure Mbar	As required	2.98E-11	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Max Pressure Mbar	As required	3.4E-10	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Incorporation Location	As required	stage	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

✓	Check Description	Pass/Fail
<input checked="" type="checkbox"/>	350C ± 5C	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	2 min strict	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Pressure acceptable (P_MBE)	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:19
Verified by: _____	Date/Time: _____

Step 10: Overgrowth (LL + RTA + LTE)

Operator Initials:	Start Time:	2025-11-11 12:45	End Time:	2025-11-11 13:23
--------------------	-------------	---------------------	-----------	---------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Total Overgrowth Nm	As required	20	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Total Growth Time S	As required	1:31:28	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Susi Calibration Rate Nm Min	As required	1.6	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Susi Calibration Current A	As required	45	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Susi Calibration Date	As required	29/02/2024	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
LI Time S	As required	6:06	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
LI Current A	As required	0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
LI Temperature C	As required	20	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Rta Temperature C	As required	470	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Rta Time S	As required	15	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Rta Current A	As required	0.204	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Time S	As required	1:23:39	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Current A	As required	0.037	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Temperature C	As required	290	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Deposited Nm	As required	18,64	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Preheat Required	As required	no	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Preheat Time S	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Preheat Max Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Preheat Max Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Location	As required	Gate Valve	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	20240424 OVergrowth.txt	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Overgrowth Schedule (6 rows):

t	I_SUSI [A]	V_SUSI [V]	T_SUSI [C]	I_samp [A]	V_samp [V]	T_pyro [C]	T_TC [CP]	MBE [mbat]	theta [deg]	Shutter	Notes
0917	23.4	6.15	690								
0931	45	4.78	1069								
0936	45	4.73	1060								
0939	45	4.85	1061								
0952	45	4.85	1065								
1106	0	0									

Quality Checks:

✓	Check Description	Pass/Fail
<input checked="" type="checkbox"/>	Cooling on and pumping	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Position/angle verified	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Shutter operations correct	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by: _____	Date/Time: 2025-11-11 13:23
Verified by: _____	Date/Time: _____

FINAL REVIEW AND APPROVAL

Review Item	Complete	Initials
All process steps completed as specified	<input checked="" type="checkbox"/>	_____
All quality checks passed	<input checked="" type="checkbox"/>	_____
All parameters within specification	<input checked="" type="checkbox"/>	_____
All deviations documented and approved	<input checked="" type="checkbox"/>	_____
All required signatures obtained	<input checked="" type="checkbox"/>	_____
LabVIEW process files linked/attached	<input checked="" type="checkbox"/>	_____
STM scan files linked/attached	<input checked="" type="checkbox"/>	_____

Final Approvals:

Quality Control Review:

Signature: _____

Date: _____

Printed Name: _____

Process Engineer Review:

Signature: _____

Date: _____

Printed Name: _____

Principal Investigator Approval:

Signature: _____

Date: _____

Printed Name: _____

This batch manufacturing record must be completed in its entirety and approved by all designated reviewers before the device can proceed to electrical testing or further processing.