

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: 2025-11-11T12:48:00Z	End Time: 2025-11-11T12:49:52.843789
--------------------	----------------------------------	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Sample Plate Id	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Id	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Dopant	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Resistivity Ohmcm	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Substrate Thickness Um	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Alias	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Sample Id	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Mount Resistance Kohm	As required	_____	<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:	Date/Time: 2025-11-11T12:49:52.843789
Verified by:	Date/Time:

Step 2: Degassing

Operator Initials: Start Time: 2025-11-11T12:45:12 End Time: 2025-11-11T12:52:28.720680

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
P Mbe Base Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Ramp Up Min	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Peak Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Peak Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Peak Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Resistive Ramp Down Min	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Base Mbe Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Ramp Up Min	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Peak Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Peak Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Peak Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Direct Ramp Down Min	As required	_____	<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"/>	Target temperatures reached	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input checked="" type="checkbox"/>	Peak pressure within acceptable range	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by:	Date/Time: 2025-11-11T12:52:28.720680
---------------	---------------------------------------

Verified by:

Date/Time:

Step 3: Flashing

Operator Initials:	Start Time: 2025-11-11T12:45:17.078545
--------------------	--

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Idle Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Idle Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flash Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flash Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Cooldown Time Min	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Number Of Flashes	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Flash Table	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

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

Notes / Observations:

Completed by:	Date/Time: 2025-11-11T12:57:17.078545
Verified by:	Date/Time:

Step 4: Temperature Calibration (Cooldown analysis)

Operator Initials:	Start Time: 2025-11-11T12:57:22.092054	End Time: 2025-11-11T13:10:25.091032
--------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Current At 335C A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Current At 350C A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Current At 470C A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Current At 250C A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Calibration File	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
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: 2025-11-11T13:10:25.091032
Verified by:	Date/Time:

Step 5: Hydrogen Termination

Operator Initials:	Start Time: 2025-11-11T12:45:1	End Time: 2025-11-11T13:13:44.959654
--------------------	--------------------------------	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Termination Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Termination Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Termination Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Peak Cracker Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Peak Cracker Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Seven Step Table	As required	_____	<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"/>	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: 2025-11-11T13:13:44.959654
---------------	---------------------------------------

Verified by:	Date/Time:
--------------	------------

Step 6: Termination Check (STM)

Operator Initials:	Start Time: 2025-11-11T12:45:1	End Time: 2025-11-11T13:23:53.730366
--------------------	--------------------------------	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Scan Area Nm	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Bias Voltage V	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Setpoint Current Pa	As required	_____	<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		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Quality Checks:

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

Notes / Observations:

Completed by:	Date/Time: 2025-11-11T13:23:53.730366
Verified by:	Date/Time:

Step 7: STM HDL

Operator Initials:	Start Time: 2025-11-11T13:14:16.654400	End Time: 2025-11-11T13:14:49.184135
--------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Fem Voltage V	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fem Current Pa	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fem Speed	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Voltage V	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Current Pa	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Speed	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Fem Pitch	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Apm Pitch	As required	_____	<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: 2025-11-11T13:14:49.184135
---------------	---------------------------------------

Verified by:	Date/Time:
--------------	------------

Step 8: Dose (XH3)

Operator Initials:	Start Time: 2025-11-11T12:45:16.173700	End Time: 2025-11-11T13:17:45.364905
--------------------	--	--------------------------------------

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Dopant Species	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Target Dose Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dose Duration S	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Initial Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Mean Dose Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Baseline Pressure Mbar	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Exposure Langmuirs	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Leak Valve Start Turns	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Leak Valve Operating Turns	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dose Start Time	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Dose End Time	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
File Name	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
P_Vt Channel Name	As required		<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: 2025-11-11T13:17:45.364905
Verified by:	Date/Time:

Step 9: Incorporation

Operator Initials:	Start Time: 2025-11-11T12:45:17.189630
--------------------	--

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Incorporation Temperature C	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Incorporation Time S	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Planned Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Actual Current A	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Initial Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Max Pressure Mbar	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Incorporation Location	As required	_____	<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: 2025-11-11T13:19:17.189630
---------------	---------------------------------------

Verified by:	Date/Time:
--------------	------------

Step 10: Overgrowth (LL + RTA + LTE)

Operator Initials:	Start Time: 2025-11-11T12:45:17.189630
--------------------	--

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Total Overgrowth Nm	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Total Growth Time S	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Susi Calibration Rate Nm Min	As required	_____	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Susi Calibration Current A	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Susi Calibration Date	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
LI Time S	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
LI Current A	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
LI Temperature C	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Rta Temperature C	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Rta Time S	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Rta Current A	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Time S	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Current A	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Temperature C	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Lte Deposited Nm	As required		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Preheat Required	As required		<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		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Overgrowth Events Table	As required		<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 type="checkbox"/>	Cooling on and pumping	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input type="checkbox"/>	Position/angle verified	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
<input type="checkbox"/>	Shutter operations correct	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Notes / Observations:

Completed by:	Date/Time: 2025-11-11T13:23:35.973890
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.