BATCH MANUFACTURING RECORD

STM Hydrogen Desorption Lithography Process

Batch Number:	_____	**Date Started:**	_____
Device ID:	1	**Target Completion:**	_____
Sample:	_____	**Actual Completion:**	_____
Primary Operator:	_____	**QC Review:**	_____

Step 1: Sample Preparation & Cleaning

Operator Initials:	**Start Time:**	**End Time:**	2025-11-10T12:32:42.529080

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Cleaning Method	Acetone + IPA ultrasonic	_____	■ Yes ■ No
Inspection Result	No visible contamination	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Surface cleanliness	■ Pass ■ Fail
■	No visible contamination	■ Pass ■ Fail

Notes / Observations:

Completed by:		**Date/Time:**	2025-11-10T12:32:42.529080
Verified by:		**Date/Time:**	

Step 2: Sample Loading & Pumpdown

Operator Initials:	**Start Time:**	**End Time:**

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Load Time	As required	_____	■ Yes ■ No
Base Pressure (Torr)	< 1×10■■	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Loadlock pressure < 5×10■■ mbar	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 3: Degas

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Temperature (°C)	200-300	_____	■ Yes ■ No
Duration (min)	30-120	_____	■ Yes ■ No
Pressure During (Torr)	< 5×10■■	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Target temperatures reached	■ Pass ■ Fail
■	Pressure stable	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 4: Flash Clean

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Flash Temperature (°C)	1200 ± 50	_____	■ Yes ■ No
Flash Duration (s)	5-10	_____	■ Yes ■ No
Flash Current (A)	Per calibration	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Temperature profile correct	■ Pass ■ Fail
■	Surface reconstructed	■ Pass ■ Fail

Notes / Observations:

Completed by:	**Date/Time:**
Verified by:	**Date/Time:**

Step 5: H-Termination

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Temperature (°C)	330 ± 5	_____	■ Yes ■ No
H■ Pressure (Torr)	1×10■■	_____	■ Yes ■ No
Dose Time (s)	As required	_____	■ Yes ■ No
Dose (Langmuirs)	~ 1000 L	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Temperature 330°C ± 5°C	■ Pass ■ Fail
■	Uniform H coverage	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 6: STM Imaging Pre-Lithography

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Scan Area (nm)	As required	_____	■ Yes ■ No
Bias (V)	Typically -2.0 to +2.0	_____	■ Yes ■ No
Setpoint (pA)	10-100	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Atomically resolved	■ Pass ■ Fail
■	Terrace quality acceptable	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 7: STM Lithography

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Pattern Design	Per device spec	_____	■ Yes ■ No
Litho Voltage (V)	6-8 V typical	_____	■ Yes ■ No
Desorption Speed	Per pattern	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Pattern complete	■ Pass ■ Fail
■	Line quality good	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 8: Post-Litho STM Imaging

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Scan Area (nm)	Cover pattern	_____	■ Yes ■ No
Feature Measurements	Within design spec	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Pattern verified	■ Pass ■ Fail
■	Dimensions within spec	■ Pass ■ Fail

Notes / Observations:

Completed by:	**Date/Time:**
Verified by:	**Date/Time:**

Step 9: Dopant Dosing (PH3 or AsH3)

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Dopant Species	PH■ or AsH■	_____	■ Yes ■ No
Dose Pressure (Torr)	1×10■■ to 1×10■■	_____	■ Yes ■ No
Dose Duration (s)	As required	_____	■ Yes ■ No
Dose (Langmuirs)	Per design	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Dose within spec	■ Pass ■ Fail
■	Pressure stable during dose	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 10: Dopant Incorporation

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Temperature (°C)	350 ± 5	_____	■ Yes ■ No
Duration (s)	60-180	_____	■ Yes ■ No
Thermal Budget Δ (°C·s)	Track cumulative	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Temperature 350°C ± 5°C	■ Pass ■ Fail
■	Surface morphology acceptable	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 11: Post-Incorporation STM Imaging

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Scan Area (nm)	Cover pattern	_____	■ Yes ■ No
Pattern Visibility	Features visible	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Pattern still visible	■ Pass ■ Fail
■	No major defects	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 12: Silicon Overgrowth - RT Phase

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Growth Temp (°C)	25 (RT)	_____	■ Yes ■ No
Growth Time (s)	Per rate	_____	■ Yes ■ No
Target Thickness (nm)	~ 7 nm	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Growth rate calibrated	■ Pass ■ Fail
■	Uniform coverage	■ Pass ■ Fail

Notes / Observations:

Completed by:	**Date/Time:**
Verified by:	**Date/Time:**

Step 13: Silicon Overgrowth - RTA Anneal

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Anneal Temp (°C)	550	_____	■ Yes ■ No
Anneal Time (s)	60	_____	■ Yes ■ No
Thermal Budget Δ (°C·s)	Track cumulative	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Temperature profile correct	■ Pass ■ Fail
■	No delamination	■ Pass ■ Fail

Notes / Observations:

Completed by:	Date/Time:
Verified by:	Date/Time:

Step 14: Silicon Overgrowth - LTE Phase

Operator Initials:	Start Time:	End Time:

Process Parameters:

Parameter	Specification	Actual Value	Within Spec?
Growth Temp (°C)	250	_____	■ Yes ■ No
Growth Time (s)	Per rate	_____	■ Yes ■ No
Total Thickness (nm)	~ 20 nm	_____	■ Yes ■ No

Quality Checks:

✓	Check Description	Pass/Fail
■	Target thickness achieved	■ Pass ■ Fail
■	Final thermal budget acceptable	■ Pass ■ Fail

Notes / Observations:

Completed by:	**Date/Time:**	
Verified by:	**Date/Time:**	

FINAL REVIEW AND APPROVAL

Review Item	Complete	Initials
All process steps completed as specified	■	_____
All quality checks passed	■	_____
All parameters within specification	■	_____
All deviations documented and approved	■	_____
All required signatures obtained	■	_____
LabVIEW process files linked/attached	■	_____
STM scan files linked/attached	■	_____

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.