

APPROVAL REQUIREMENTS

Title	Dept.	Name (Printed)	Signature/ E-mail approval	Date
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REV	DESCRIPTION	DATE
<b>A</b>	<b>Initial Release</b>	12/30/13



<b>Thomas Ferraguto</b>	<b>Director</b>
<b>Cambridge Nano Tech ALD SOP</b>	<b><u>RES-01-012-A</u></b>

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## **Introduction**

### **1.0 Purpose**

- 1.1 Purpose of this Standard Operating Procedure is to guide the user in the basic use of the Cambridge Nanotech Atomic Layer Deposition Tool. The system as configured as of this date is capable of depositing Hafnium and Aluminum Oxide, with either a plasma or heat only.

### **2.0 Description Describe Equipment or Process**

- 2.1 List Chemicals needed for process.
  - 2.1.1 TMA or Trimethylaluminum
  - 2.1.2 Hafnium

### **3.0 List related internal documents:**

- 3.1 UML Chemical Hygiene Plan

### **4.0 List related external documents:**

- 4.1 Fiji\_F200 ALD SYSTEM Installation and Users Guide

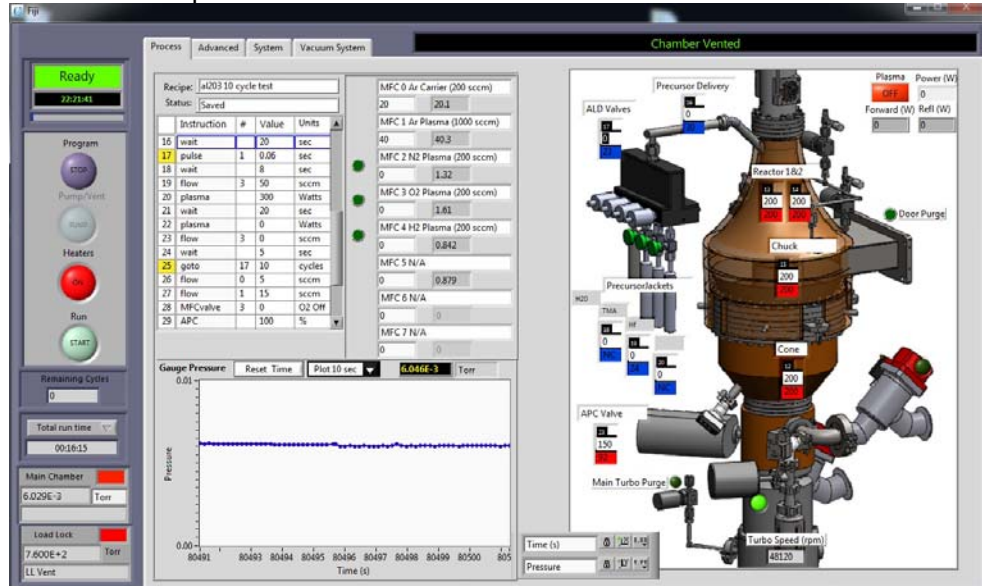
## **Operation**

### **5.0 Process Description**

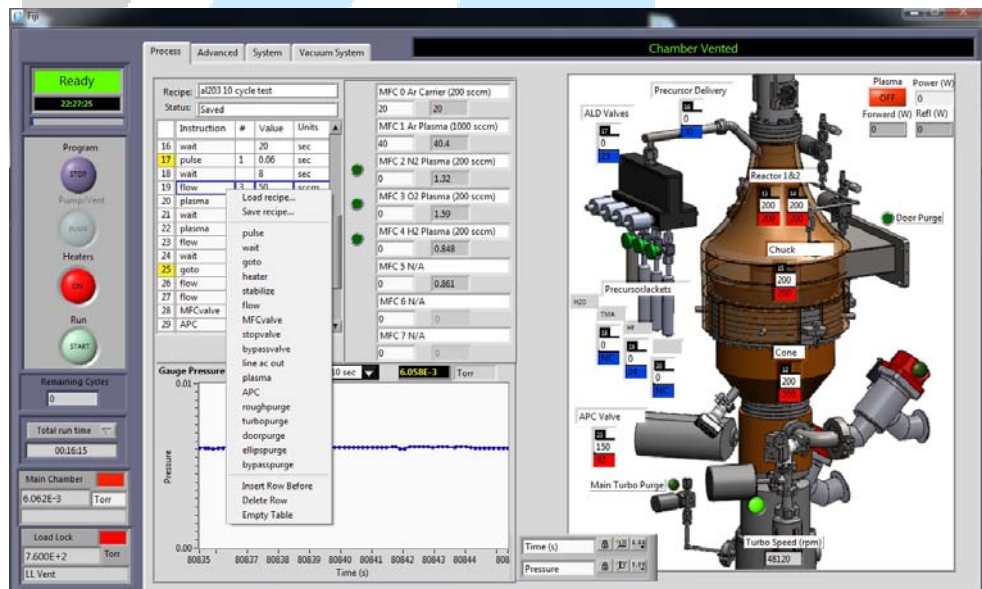
- 5.1 System Setup
  - 5.1.1 Asses the systems state by viewing the main computer screen. (Check with staff the day before your run to set the temperatures on the system to save time)
  - 5.1.2 If the FIJI Operating Interface is viewable continue to the next step. If not move the mouse to the right side of the screen to access the tool bar. Click on the "C" icon
  - 5.1.3 From the Vacuum Tab - The Sequencer Abort and valve lock should be RED. This means the system is in an interlocked state and safe to use.
  - 5.1.4 The Main Turbo should be lit green and at a speed of 48120
  - 5.1.5 ALD Valve set to 150 c
  - 5.1.6 Pre-cursor delivery set to 150 c
  - 5.1.7 Reactor 1 set to process temp (depending on the recipe)
  - 5.1.8 Reactor 2 set to process temp (depending on the recipe)
  - 5.1.9 Chuck Temp set to process temp (depending on the recipe)

5.1.10 Cone Temp set to process temp (depending on the recipe)

5.1.11 APC valve Temp set to 150c



5.1.12 From the Process Tab, place the cursor on the recipe field and right click the mouse to select a recipe



5.1.13 Choose the maintenance folder

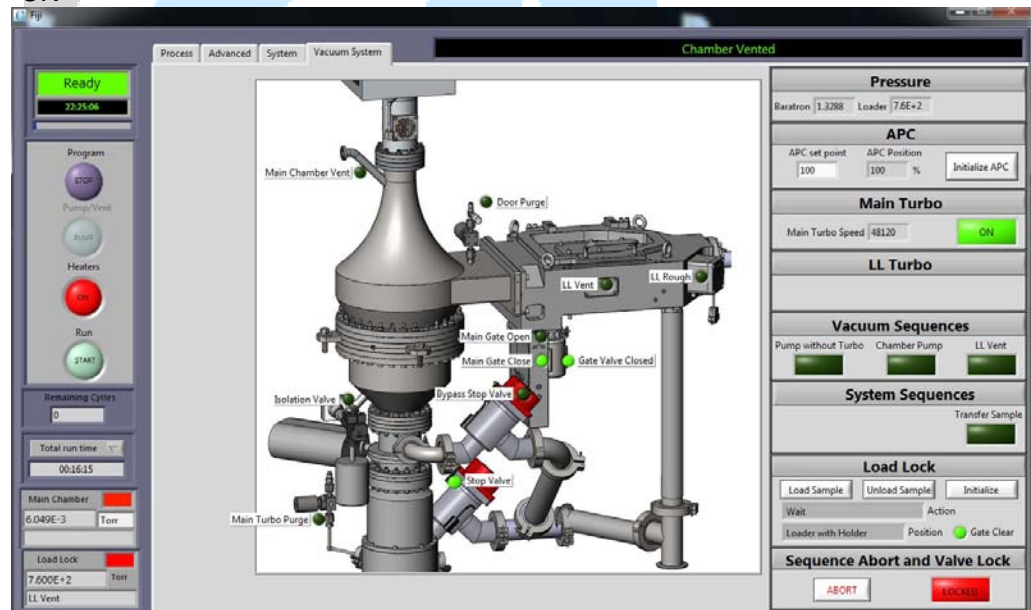
5.1.14 Select the "Pulse recipe" for the material you would like to deposit. ALD1 for Alumina or ALD2 for Hafnium

5.1.15 Check the precursor valves in the back of the machine to insure the appropriate one is open. (2<sup>nd</sup> from left is TMA for Alumina, 3<sup>rd</sup> from the left is Hafnium). Note: Hafnium needs to be heated to 75C for at least 1 hour before deposition.

- 5.1.16 Turn on the Door Purge and Turbo Purge
- 5.1.17 Click on the Run Icon on left side of the screen and then Yes to begin the pulse test
- 5.1.18 Observe the pulse test looking for an increase in pressure when the pulse is executed (if no pressure increase has been observed call for engineering help).
- 5.1.19 When you are satisfied that a pulse has occurred abort the pulse test
- 5.1.20 From the Process Tab, place the cursor on the recipe field and right click the mouse to select a recipe
- 5.1.21 Choose the Process folder
- 5.1.22 Select the "Deposition Recipe" for the material you would like to deposit.
- 5.1.23 Edit the Cycle number to set the appropriate thickness (Line 25 for Al2O3). One cycle for every Angstrom of deposition.

## 5.2 Sample Transfer

- 5.2.1 Click on the Vacuum Tab
- 5.2.2 Click on the LL Vent Tab (wait for the Lid to release, before acknowledging the vent process is complete with "OK")
- 5.2.3 Place your sample on the substrate holder and close the lid of the load lock
- 5.2.4 Click on the transfer sample icon to pump down the load lock and transfer the wafer and wait for the system to equalize the chamber pressure and transfer the sample.
- 5.2.5 Observe that the gate valve is clear before acknowledging status with "OK"



## 5.3 Deposition

- 5.3.1 Click on the Process tab
- 5.3.2 Click on the "Start Icon" and observe the recipe running (Upper right of screen will indicate current status)

- 5.3.3 The projected total run time will be indicated in the lower left hand panel
- 5.3.4 When the run is complete , it will be indicated on the upper right status message
- 5.3.5 Click on the Vacuum Tab
- 5.3.6 Click on the Transfer sample Icon and OK when the gate valve is clear
- 5.3.7 Click on the LL Vent Icon and OK when the lid has released
- 5.3.8 Remove sample from Load Loak
- 5.3.9 Turn off the door purge and main turbo purge

## **6.0 Safety**

- 6.1** Engineering Controls: (Fume hood, glove box, snorkel....)
- 6.2** Administrative Controls:
  - 6.2.1 Receive laboratory-specific training.
  - 6.2.2 Read this SOP and applicable safety data sheets.
  - 6.2.3 Do not work alone in the lab. Implement the buddy system.
- 6.3** PPE Requirement
- 6.4** Storage location for chemicals: (Be aware of incompatibility with other chemicals already in use in the lab.)
- 6.5** Hazardous waste: Label the hazardous waste container with a UMass Lowell hazardous waste label before pouring hazardous waste in the container. Fill out all the information on the hazardous waste label (generator information, full names of chemicals, hazard classes, etc.) When the waste is full, please date the waste. EEM-EHS checks satellite accumulation areas (SAAs) every Wednesday. If the waste is generated on a Thursday, Friday, Saturday, or Sunday; please call extension 42543 to schedule a pick-up of your waste. The hazardous waste can only be stored in your lab for a total of 3 days once it is dated. If the waste is dated on a Monday, Tuesday, or Wednesday (before the SAA check), there will be no need to call to schedule the pick-up of the waste since the waste will be picked up within 3 days.
- 6.6** Safety Protocol

## **7.0 Accident Procedures: (Found in the Safety Data Sheet)**

- 7.1** Contact, Skin, Eyes, Inhalation , Ingestion
- 7.2** Spill or leak: (How do you deal with a small spill? Are there specific absorbents that should be used?) For spills that are an inhalation hazard, please evacuate the lab and post a restriction on the door. Call 44911 from a campus phone.
- 7.3** Fire: (Are there specific concerns to be considered in the event of a fire? For example, some chemicals are water reactive, and using water on a fire where these chemicals are involved will make the problem worse.) Evacuate the lab and pull the nearest fire pull alarm before exiting the building.

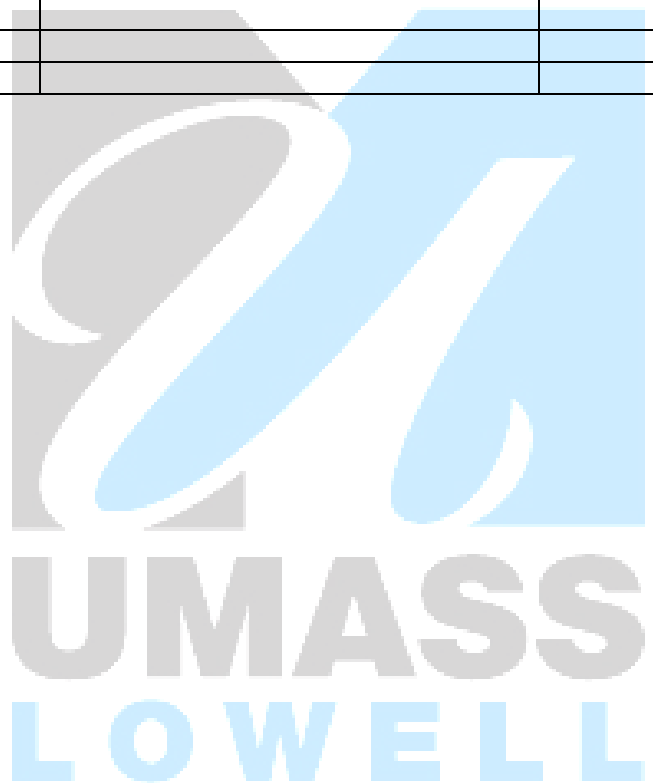
**8.0 Maintenance**

8.1 Preventive Maintenance Instruction

8.2 Maintenance Contact information

**Document Revision History**

Date	Description of Modifications	Name	Revision
12/30/2013	Initial Release	Thomas Ferraguto	A



### Training Certification Check Sheet

	UCard ID	Name (Last, First)	Signature	Date
Trainer				
Trainee				

Operation Number	Operation Description	Initial if the Trainee is Proficient
1	System Assesment	
2	Recipe Editing	
3	Sample transfer	
4	Deposition	
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