



# **Standard Operating Procedure (SOP)**

## **Explorer 14 Magnetron Sputterer**

# (PVD-05)

In case of fire or injury, please call 911 (511 from Penn phones)

# Please report errors on IRIS, and the staff will take care of it.

# Please *DO NOT* run diagnostics without the supervision of a staff member.

## General safety tips and common mistakes

- 1) If the system is <u>not</u> running, make sure you are logged into the tool on IRIS.
- 2) Do not exceed the maximum sputtering power (material specific; see next page).
- 3) The Ag target must cool down for 15 min in vacuum before venting. All other targets must cool down for 5 minutes.
- 4) You MUST stay logged in until the pump-down recipe is complete.
- 5) If neither voltage, current nor power reaches the desired setpoint, check if the power supply is on. If it is, contact staff.

## Maximum sputtering power

Material name	Target	Max allowed power [W]	Power type
Silver	Ag	600	DC
Aluminum	Al	600	DC
Gold	Au	140	DC
Chromium	Cr	560	DC
Copper	Cu	600	DC
Iron	Fe	350	DC
Germanium	Ge	140	DC
Indium tin oxide	ITO	140	RF/DC
Manganese	Mn	140	DC
Molybdenum	Мо	600	DC
Nickle	Ni	350	DC
Palladium	Pd	140	DC
Platinum	Pt	140	DC
Silicon - doped	Si (doped)	280	DC
Silicon - undoped	Si (undoped)	140	RF
Silicon dioxide	SiO2	210	RF
Titanium	Τi	350	DC
Titanium oxide	TiO2	140	RF
Tungsten	W	600	DC
Yttria stabilized zirconia	YSZ	140	RF

- Ensure that the deposition power does not exceed the values on the spreadsheet.
- Failure to adjust the deposition power can destroy the targets and will be considered tool misuse.
- Contact staff if you wish to deposit materials not on this list.

Material	Power [W]	Pressure [mTorr]	Rate [nm/min]	Rate [A/sec]	Base pressure [Torr]	Recipe name
AI	450 (DC)	3	18.0	3.0	$\sim 5 \times 10^{-6}$	Al-master recipe
Ti	350 (DC)	3	12.0	2.0	$\sim 5 \times 10^{-6}$	Ti-master recipe
Au	140 (DC)	3	27.5	4.6	$\sim 5 \times 10^{-6}$	Au-master recipe
Cu	400 (DC)	3	38.5	6.4	$\sim 5 \times 10^{-6}$	Cu-master recipe
Pt	140 (DC)	3	15.4	2.5	$\sim 5 \times 10^{-6}$	Pt-master recipe
Ag	140 (DC)	3	44	7.3	$\sim 5 \times 10^{-6}$	Ag-master recipe

# Sputtering rates/master recipes

# Explorer 14 Magnetron Sputterer



- Primary tool owner: Jason A. Rohr
- For processing-related questions: jarohr@seas.upenn.edu
- Issues must be reported on IRIS. Do not contact primary tool owner directly with tool issues.

## **Tool Overview**

The *Denton Explorer-14* (**PVD-05**) is a magnetron sputter deposition tool for depositing metallic and dielectric films. Sputter deposition is achieved by bombarding a source material (the target) with energetic ions, typically ionized Ar. Atoms at the surface of the target are knocked loose, and transported to the surface of the substrate, where deposition occurs. Sputter deposition tends to give smooth, uniform films; the films tend to be more conformal than what is achieved with thermal or e-beam evaporation, which might have complications for certain lift-off procedures.

The tool is an open load system in sputter-down configuration with one dedicated DC gun and two guns that can use either a DC or RF power supply (three sputter sources in total). Co-deposition from two DC sources or one DC and one RF source is possible. The tool is equipped with a cryo-pump, with an automated interface, accepting substrate sizes from pieces through wafers with 150 mm diameters. The tool has platen rotation and cooling.

The Denton cannot deposit magnetic materials. See the **PVD-03** system for deposition of magnetics.

## **Tool policies**

- Source #2 always contains the titanium (Ti) target. Source #1 and #3 rotate depending on target requests.
- You have to stay with the tool while active vent and pump recipes are running (unless there is an emergency, i.e., a fire alarm or toxic gas alarm).
  - As soon as the 'A\_Pump' recipe is complete, the system will continue to pump down the system. You can leave the system as soon as the tool alarm rings telling you that the pump-down recipe is complete.
- You are allowed to leave the tool while a long deposition is running. If your deposition is less than 10 minutes, please stay with the tool.
  - Ensure that the plasma is stable at the desired deposition power.
- Do not adjust the deposition parameters in the master recipes beyond the deposition time. This includes processing gas pressure, the ramp up parameters, and the final dwell time. They all serve a purpose.
- Always leave the tool pumped down after you're done; do not leave the tool or logout of IRIS before the pump-down recipe is complete.
- Stick to your schedule; if you run over time and someone else has booked the system after you, please let them know in a timely fashion.

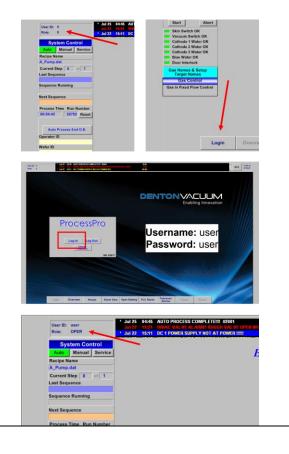
1.	Before you begin	6
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#### 1. Before you begin

- 1.1. Login to the tool (PVD-05) on IRIS (<u>https://iris.nano.upenn.edu/</u>)
- 1.2. Ensure that the power supplies are on! The power supplies can be found at the bottom of the tool, underneath the computer (dashed orange boxes).
- 1.3. Make sure that you're logged into the tool as a basic user. If you're not logged in, the 'user ID' will say "0" in the top left corner.
- 1.4. To log in, please click **Login** at the bottom of the screen.
- 1.5. Click Log In;

Username: user Password: user

1.6. The User ID will now say "user" instead of "0".



## 2. Venting the chamber

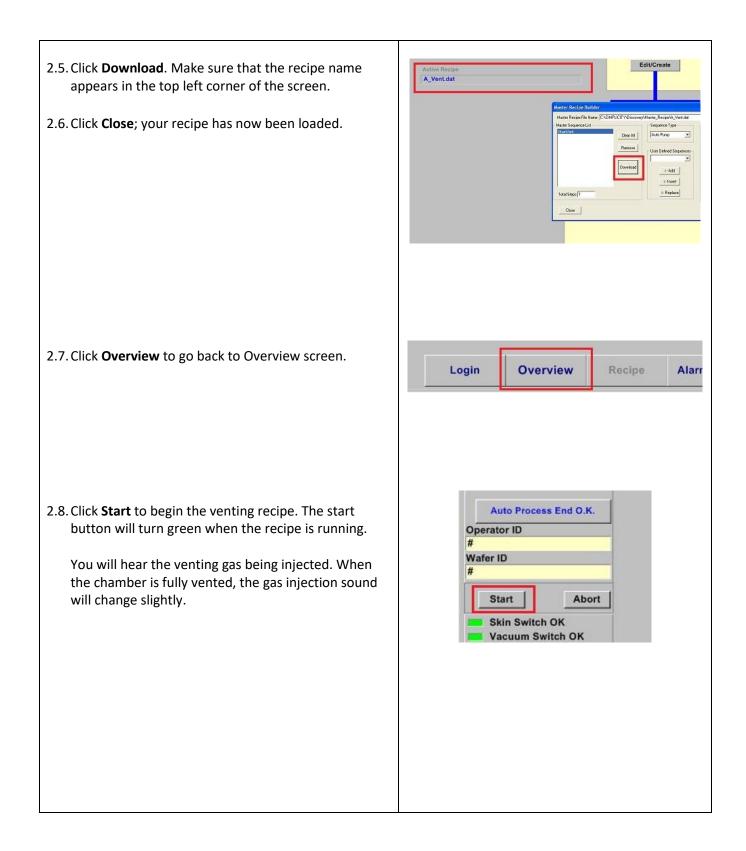
- 2.1. Click **Recipe** at the bottom of the overview screen to open the recipe screen.
- 2.2. Click **Edit/Create** under the Master Recipe box to open Master Recipe Builder window (red box).
- Login Overview Recipe Alarm View

Master Recipe Builder

2.3. Set the "Sequence Type" to Auto Pump. Click **Open** under "File Options" to open the list of recipes.

2.4. Choose "A\_Vent.dat" and click **Open**.

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#### 3. Loading your sample

- 3.1. Open the sputter chamber.
- 3.2. Place your sample on the rotatable stage underneath the sputter sources.

You can mount your sample to the stage with Kapton tape if needed.



R

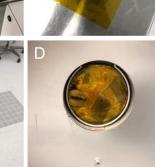
#### 3.3. Replace Kapton on chamber window

A. Take off the metal clamp; take out the window; remove metal-covered Kapton.

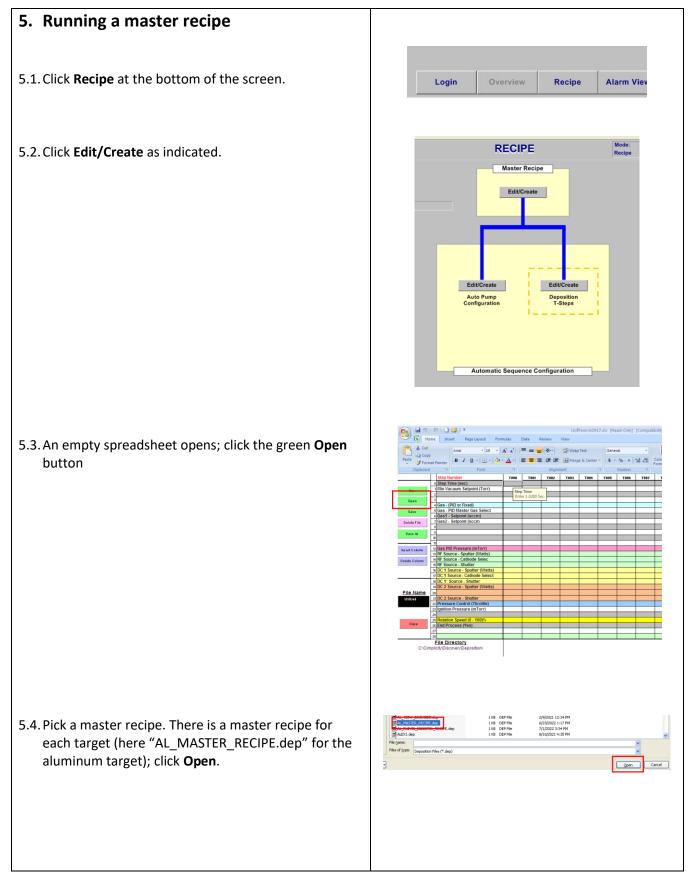
- B. Place glass window on Kapton sheet
- C. Wrap the sheet; tape it in place.

D. Place the wrapped window in the door; ensure that the smooth Kapton surface is facing the inside of the chamber; mount the metal clamp.

3.4. Close the sputter chamber. Lock the chamber door slightly; just enough to keep the chamber door closed.



4. Pumping down the chamber	
Follow the same procedure as for venting, but use recipe "A_Pump.dat".	
See page 7-8.	



5.5. The master recipe name is now visible under "File Name". as - (PID or Fixed) ias1 - Setpoint (sccm) Process parameters can now be changed Delete File Ins ert Column *Note:* You should not have to change any other Delete Colu process parameters besides the deposition time. Contact staff if you want to develop your own File Nam recipe. The column containing the "Open" statement for the File Directory specific sputter source is the actual deposition step. C:IC The deposition time can be altered under "Step Time (sec)". 5.6. Once the parameters have been set, click **Save as**. Find the same master recipe you opened (here AL\_MASTER\_RECIPE.dep). Click Save. 5.7. When it asks you whether you want to overwrite, click Yes. 5.8. **Optional:** The spreadsheet can now be closed by clicking the outermost **x**. Σ AutoSum 🛃 Fill 👻 Insert Delete Format Sort & Find & 2 Clear • Filter Alternatively, alt + Tab back to the main tool screen Cells T014 T017 T015 T016 T018

0.00

Select

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- 5.9. Click **Recipe** at the bottom of the screen and click **Edit/Create** under "Master Recipe".
- Mode:

   Master Recipe

   Edit/Create

   Edit/Create

   Auto Pump

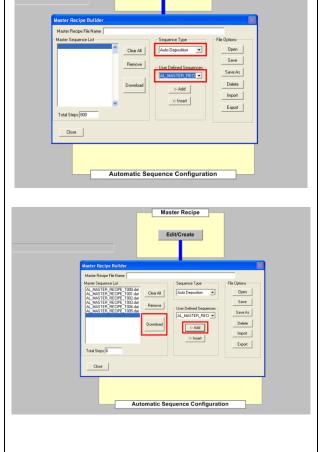
   Configuration

   T-Steps

Edit/Create

5.10. Under "Sequence Type", pick Auto Deposition. Under "User Defined Sequences", pick your edited master recipe (here "AL\_MASTER\_RECIPE.dep")

- 5.11. Click **Add**. You will see several items in the "Master Sequence List". This corresponds to each column in the editable spreadsheet.
- 5.12. Click Download.



5.13. It will now ask you to save your recipe, this time as a *.dat* file.

**Critical:** Save your recipe as "master\_recipe\_X.dat", where X is the material name (here "master\_recipe\_Al.dat"). This file should already exist, and you need to overwrite it by clicking Save.

- 5.14. It will ask you whether you want to replace the existing file. Click **Yes**.
- 5.15. Once saved, click Close.

Please Save Master Recipe ? 🗙 Save in: 🗀 Master\_Recipe - 🗧 🖆 📰 -Manisha.dat Manisha.dat master\_recipe\_Au.dat master\_recipe\_Cu.dat master\_recipe\_Cu.dat master\_recipe\_T.dat master\_recipe\_T.dat master\_recipe\_T.dat metyue\_Cu\_200W.dat metyue\_Cu\_450W2min.dat Ì My Recent Documents Desktop  $\rightarrow$ My Documents My Computer < My Netwo Places File name: master\_recipe\_ALdat • Save Save as type: ALL FILES • Cancel

- 5.16. Click **Overview**. You can now see that your recipe has been loaded.
- 5.17. Click the **Start** button. It will turn green as the recipe begins. You can now follow along each step in your sequence list, which shows the process pressure, process power, time, etc.

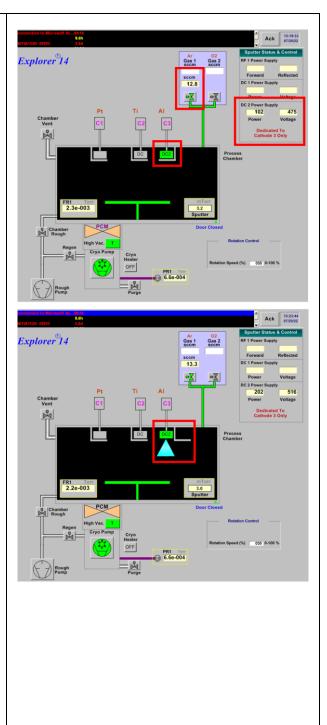
Step Time (sec)     5       Auto     Manual     Service       Recipe Name     0       master, recipe, Al.dat     0       Gas-(PID or Fixed)     0       Current Step 1     of 6       Gas-Sequence     Gas 1-Setpoint (sccm)       Gas 2-Setpoint (sccm)     0       Sequence Running     0       AL_MASTER_RECIPE_T000.d t     0       Process Time Run Number     0       RF Source - Sputter (Watts)     0       RF Source - Cathode Selec.     0       Dor 1 Source Shutter     0       Do 2 Source - Sputter (Watts)     0	Step Time (sec)     5       Auto Manual Service     Vacuum Setpoint (Torr)     1.0e+001       Recipe Name     0       master rocipe, Al.dat     0       Current Step 1     of       Gas (PID or Fixed)     0       Case (PID or Fixed)     0       Gas PID Pressure(more)     0       AL_MASTER, RECIPE_T001.d     Recipe Source Souter       Process Time 0     Secce - Sputter (Watts)     0       Dor on core     2 Source Shutter     0       Dor Source Shutter     0     0       Dor Source Shutter     0     0       Dor Stim Switch OK     Cathode Selec.     0       Cathode Stuber OK     0     0       Door Interlock     Gas Names &	Step Time (sec)     5       Auto Manual Service     Vacuum Setpoint (Torr)     1.0e+001       Recipe Name     0       master rocipe, Al.dat     0       Current Step 1     of       Gas (PID or Fixed)     0       Case (PID or Fixed)     0       Gas PID Pressure(more)     0       AL_MASTER, RECIPE_T001.d     Recipe Source Souter       Process Time 0     Secce - Sputter (Watts)     0       Dor on core     2 Source Shutter     0       Dor Source Shutter     0     0       Dor Source Shutter     0     0       Dor Stim Switch OK     Cathode Selec.     0       Cathode Stuber OK     0     0       Door Interlock     Gas Names &	Step Time (sec)     5       Auto Manual Service     Vacuum Setpoint (Torr)     1.0e+001       Recipe Name     0       master rocipe, Al.dat     0       Current Step 1     of       Gas (PID or Fixed)     0       Case (PID or Fixed)     0       Gas PID Pressure(more)     0       AL_MASTER, RECIPE_T001.d     Recipe Source Souter       Process Time 0     Secce - Sputter (Watts)     0       Dor on core     2 Source Shutter     0       Dor Source Shutter     0     0       Dor Source Shutter     0     0       Dor Stim Switch OK     Cathode Selec.     0       Cathode Stuber OK     0     0       Door Interlock     Gas Names &	Currie Control	Step Nu	mber AL MASTER	R RECIPE TOOO.d	at
Recipe Name     0       master rocipe, Al.dat     0       Gas-(PID or Fixed)     0       Gas-PID Master Gas Select     0       Gas 1-Setpoint (secm)     0       Sequence     Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL, MASTER, RECIPE T000.dit     0       MAL, MASTER, RECIPE T001.dit     0       MAL, MASTER, RECIPE T001.dit     0       Master Recipe Setter     0       Gas 7-Setpoint (secm)     0       Master Recipe Setter     0       Gas 7-Setpoint (secm)     0       Master Recipe Setter     0       Gas 7-Setpoint (secm)     0       Master Recipe Setter     0       Cas PID Pressure(mTorr)     0       RF Source - Sputter (Watts)     0       Doc 1 Source - Sputter (Watts)     0       Dec 1 Source - Shutter     0       Doc 2 Source - Shutter     0       D D C 2 Source Shutter     0       D C 2 Source Shutter     0       Rester     0       Rester     0       Rester     0       D D C 2 Source Shutter     0       D D C 2 Source Shutter     0       Rester     0       Rester     0       Rester     0 <t< th=""><th>Recipe Name     0       master recipe, Al.dat     Gas-(PID Master Gas Select       Current Step 1     d       Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL_MASTER_RECIPE_Torold, t     0       MAL_MASTER_RECIPE_Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       D0:00:02     28703       Rest     F5 Source - Sputter (Watts)       Dirol 2     28703       Rest     Master D       Dirol 2     Ster       Dirol 0     C1 Source - Sputter (Watts)       Dirol 0     C1 Source - Shutter       Dirol 1     Dir C Source Shutter       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 2     Source - Shutter       Dirol 1     Dirold 1       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Star Names &amp; Setup     0       Target Names     0   &lt;</th><th>Recipe Name     0       master recipe, Al.dat     Gas-(PID Master Gas Select       Current Step 1     d       Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL_MASTER_RECIPE_Torold, t     0       MAL_MASTER_RECIPE_Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       D0:00:02     28703       Rest     F5 Source - Sputter (Watts)       Dirol 2     28703       Rest     Master D       Dirol 2     Ster       Dirol 0     C1 Source - Sputter (Watts)       Dirol 0     C1 Source - Shutter       Dirol 1     Dir C Source Shutter       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 2     Source - Shutter       Dirol 1     Dirold 1       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Star Names &amp; Setup     0       Target Names     0   &lt;</th><th>Recipe Name     0       master recipe, Al.dat     Gas-(PID Master Gas Select       Current Step 1     d       Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL_MASTER_RECIPE_Torold, t     0       MAL_MASTER_RECIPE_Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       D0:00:02     28703       Rest     F5 Source - Sputter (Watts)       Dirol 2     28703       Rest     Master D       Dirol 2     Ster       Dirol 0     C1 Source - Sputter (Watts)       Dirol 0     C1 Source - Shutter       Dirol 1     Dir C Source Shutter       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 2     Source - Shutter       Dirol 1     Dirold 1       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Star Names &amp; Setup     0       Target Names     0   &lt;</th><th></th><th>Step Tim</th><th></th><th>5</th><th></th></t<>	Recipe Name     0       master recipe, Al.dat     Gas-(PID Master Gas Select       Current Step 1     d       Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL_MASTER_RECIPE_Torold, t     0       MAL_MASTER_RECIPE_Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       D0:00:02     28703       Rest     F5 Source - Sputter (Watts)       Dirol 2     28703       Rest     Master D       Dirol 2     Ster       Dirol 0     C1 Source - Sputter (Watts)       Dirol 0     C1 Source - Shutter       Dirol 1     Dir C Source Shutter       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 2     Source - Shutter       Dirol 1     Dirold 1       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Star Names & Setup     0       Target Names     0   <	Recipe Name     0       master recipe, Al.dat     Gas-(PID Master Gas Select       Current Step 1     d       Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL_MASTER_RECIPE_Torold, t     0       MAL_MASTER_RECIPE_Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       D0:00:02     28703       Rest     F5 Source - Sputter (Watts)       Dirol 2     28703       Rest     Master D       Dirol 2     Ster       Dirol 0     C1 Source - Sputter (Watts)       Dirol 0     C1 Source - Shutter       Dirol 1     Dir C Source Shutter       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 2     Source - Shutter       Dirol 1     Dirold 1       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Star Names & Setup     0       Target Names     0   <	Recipe Name     0       master recipe, Al.dat     Gas-(PID Master Gas Select       Current Step 1     d       Gas 1-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       Gas 2-Setpoint (secm)     0       AL_MASTER_RECIPE_Torold, t     0       MAL_MASTER_RECIPE_Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       Master Recipe Torold, t     0       D0:00:02     28703       Rest     F5 Source - Sputter (Watts)       Dirol 2     28703       Rest     Master D       Dirol 2     Ster       Dirol 0     C1 Source - Sputter (Watts)       Dirol 0     C1 Source - Shutter       Dirol 1     Dir C Source Shutter       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 1     Dirold 1       Dirol 2     Source - Shutter       Dirol 1     Dirold 1       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Star Names & Setup     0       Target Names     0   <		Step Tim		5	
Recipe Name     0       master_rocipe_Al.dat     0       Cas-PiD Master Gas Select     0       Gas-PiD Master Gas Select     0       Sequence     Gas 2-Setpoint (sccm)     0       Sequence Running     0     0       AL_MASTER_RECIPE_T000.dt     0     0       AL_MASTER_RECIPE_T001.dt     0     0       AL_MASTER_RECIPE_T001.dt     0     0       AL_MASTER_RECIPE_T001.dt     0     0       Ref Source - Sputter (Watts)     0     0       Operator ID     0     1     0       Step Timer     0     0     0       Dig Store - Sputter (Watts)     0     0       Doc 1 Source - Sputter (Watts)     0     0       Dig Store - Sputter (Watts)     0     0       Dig Store - Sputter (Watts)     0     0       Doc 1 Source - Sputter (Watts)     0     0       Dig Store - Sputter (Watts)     0     0       Doc 2 Source - Sputter (Watts)     0     0       Store State     0     0       Store State     0     0       Doc 2 Source - Sputter (Watts)     0       Doc 2 Source State     0       Doc 1 Source - Sputter (Watts)     0       Store State     0       Store	Recipe Name     0       master_rocipe_Aldat     0       Cas-(PID or Fixed)     0       Cas-PID Master Cas Select     0       Sequence     Cas-PID Master Cas Select     0       Sequence Running     0     0       AL_MASTER_RECIPE_TOURD     0     0       Ref Source - Cathode Selec.     0     0       Operator ID     0     1     0       Doperator ID     0     2     2       Vacuum Switch OK     Cathode Selec.     0     0       Cathode Swater OK     0     0     0       Bias Water OK     0     0     0       Bias Water OK     0     0     0       Bias Water OK     0     0     0       Bias	Recipe Name     0       master_rocipe_Aldat     0       Cas-(PID or Fixed)     0       Cas-PID Master Cas Select     0       Sequence     Cas-PID Master Cas Select     0       Sequence Running     0     0       AL_MASTER_RECIPE_TOURD     0     0       Ref Source - Cathode Selec.     0     0       Operator ID     0     1     0       Doperator ID     0     2     2       Vacuum Switch OK     Cathode Selec.     0     0       Cathode Swater OK     0     0     0       Bias Water OK     0     0     0       Bias Water OK     0     0     0       Bias Water OK     0     0     0       Bias	Recipe Name     0       master_rocipe_Aldat     0       Cas-(PID or Fixed)     0       Cas-PID Master Cas Select     0       Sequence     Cas-PID Master Cas Select     0       Sequence Running     0     0       AL_MASTER_RECIPE_TOURD     0     0       Ref Source - Cathode Selec.     0     0       Operator ID     0     1     0       Doperator ID     0     2     2       Vacuum Switch OK     Cathode Selec.     0     0       Cathode Swater OK     0     0     0       Bias Water OK     0     0     0       Bias Water OK     0     0     0       Bias Water OK     0     0     0       Bias	Auto Manual Serv	vice Vacuum	Setpoint (Torr)	1.0e+001	
Batt     Abort     Gas.PID or Fixed)       Gas.PID Arter Gas.Select     0       AL_MASTER_RECIPE_TOULd     T       Gas.PID Arter Gas.Select     0       Conscience     0       Al.MASTER_RECIPE_TOULd     T       Ref.Source - Cathode Selec.     0       Oct 1 Source - Sputter (Watts)     0       Doc 2 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Doct Arter Cot     0       Stand Swater OK     0       Bias Water OK     0       Boor Interlock     Castonde Stanse </td <td>Batt     Abort     Gas. PID or Fixed)       Gas. PID Arster Gas. Select     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       Ref. Gas. PID Pressure(mTorr)     0       Process Time Run Number     0       Ref. Source - Sputter (Watts)     0       Oct. 1 Source - Sputter (Watts)     0       Door Inder Control     0       Step Timer     0       Decess Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Cathode 2 Water OK     0       Bias Water OK     0       Door Interlock     Gas Control</td> <td>Batt     Abort     Gas. PID or Fixed)       Gas. PID Arster Gas. Select     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       Ref. Gas. PID Pressure(mTorr)     0       Process Time Run Number     0       Ref. Source - Sputter (Watts)     0       Oct. 1 Source - Sputter (Watts)     0       Door Inder Control     0       Step Timer     0       Decess Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Cathode 2 Water OK     0       Bias Water OK     0       Door Interlock     Gas Control</td> <td>Batt     Abort     Gas. PID or Fixed)       Gas. PID Arster Gas. Select     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       Ref. Gas. PID Pressure(mTorr)     0       Process Time Run Number     0       Ref. Source - Sputter (Watts)     0       Oct. 1 Source - Sputter (Watts)     0       Door Inder Control     0       Step Timer     0       Decess Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Cathode 2 Water OK     0       Bias Water OK     0       Door Interlock     Gas Control</td> <td>Recipe Name</td> <td></td> <td></td> <td>0</td> <td></td>	Batt     Abort     Gas. PID or Fixed)       Gas. PID Arster Gas. Select     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       Ref. Gas. PID Pressure(mTorr)     0       Process Time Run Number     0       Ref. Source - Sputter (Watts)     0       Oct. 1 Source - Sputter (Watts)     0       Door Inder Control     0       Step Timer     0       Decess Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Cathode 2 Water OK     0       Bias Water OK     0       Door Interlock     Gas Control	Batt     Abort     Gas. PID or Fixed)       Gas. PID Arster Gas. Select     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       Ref. Gas. PID Pressure(mTorr)     0       Process Time Run Number     0       Ref. Source - Sputter (Watts)     0       Oct. 1 Source - Sputter (Watts)     0       Door Inder Control     0       Step Timer     0       Decess Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Cathode 2 Water OK     0       Bias Water OK     0       Door Interlock     Gas Control	Batt     Abort     Gas. PID or Fixed)       Gas. PID Arster Gas. Select     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       AL_MASTER_RECIPE_TOURD     0       Ref. Gas. PID Pressure(mTorr)     0       Process Time Run Number     0       Ref. Source - Sputter (Watts)     0       Oct. 1 Source - Sputter (Watts)     0       Door Inder Control     0       Step Timer     0       Decess Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source - Sputter (Watts)     0       Cathode 2 Water OK     0       Bias Water OK     0       Door Interlock     Gas Control	Recipe Name			0	
Current Step 1 of 6 Gas-PID Master Gas Select 0 Gas-PID Master Gas Select 0 O Gas-PID Master Gas Control Sequence Running AL_MASTER_RECIPE_T000.d I Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 Gas-PID Pressure(mTorr) 0 For Source - Sputter (Watts) 0 C 1 Source Shutter 0 C 2 Source - Sputter (Watts) 0 C 1 Source Shutter 0 C 2 Source - Sputter (Watts) 0 C 1 Source Shutter 0 C 2 Source Shutter 0 C 2 Source - Sputter (Watts) 0 C 1 Source Shutter 0 C 2 Source (MTorr) 0 C 1 Source Shutter 0 C 2 Source Shuter 0 C 2 Source Shuter 0	Current Step 1 of 6 Gas-PID Arster Gas Select 0 Gas-PID Master Gas Select 0 Gas 1-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 O Gas 2-Setpoint (sccm) 0 O C 15 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 D C 2 Source - Sputter (Watts) 0 D C 1 Source Source (m C Cathode 2 Water OK C Cathode 2 Water OK Bias Water OK Bias Water OK Bias Water OK	Current Step 1 of 6 Gas-PID Arster Gas Select 0 Gas-PID Master Gas Select 0 Gas 1-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 O Gas 2-Setpoint (sccm) 0 O C 15 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 D C 2 Source - Sputter (Watts) 0 D C 1 Source Source (m C Cathode 2 Water OK C Cathode 2 Water OK Bias Water OK Bias Water OK Bias Water OK	Current Step 1 of 6 Gas-PID Arster Gas Select 0 Gas-PID Master Gas Select 0 Gas 1-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 Gas 2-Setpoint (sccm) 0 O Gas 2-Setpoint (sccm) 0 O C 15 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 O C 1 Source - Sputter (Watts) 0 D C 2 Source - Sputter (Watts) 0 D C 1 Source Source (m C Cathode 2 Water OK C Cathode 2 Water OK Bias Water OK Bias Water OK Bias Water OK	master recipe Al.dat			0	
ast Sequence     Gas 1-Setpoint (socim)     0       Gas 1-Setpoint (socim)     0       Sequence Running     0       AL_MASTER_RECIPE_T001.d     0       Atmoster Recipe_T001.d     0       Atmoster Recipe_T001.d     0       Process Time Run Number     0       RF Source - Sputter (Watts)     0       Occol:02     28703 Reset       RF Source - Souter     0       Dori Source - Sputter (Watts)     0       DC 1 Source - Sputter (Watts)     0       DC 2 Source Shutter     0       Pressure (mTorr)     0       Rotation Speed (0-100)%     50       End Process (Yes)     0       Vacuum Switch OK     0       Cathode 3 Water OK     0       Bas Water OK     0       Boor Interlock     0       Gas Control     0	aat Sequence     Gas 1-Setpoint (accm)     0       Gas 1-Setpoint (accm)     0       Sequence Running     0       AL_MASTER_RECIPE_T00.dt     0       AL_MASTER_RECIPE_T01.dt     0       Process Time Run Number     0       RF Source - Sputter (Watts)     0       October     0       Step Timer     0       Derator ID     RF Source - Sputter (Watts)       Dor 1 Source - Sputter (Watts)     0       DC 1 Source Shutter     0       DC 2 Source Shutter     0       Pressure (mTorr)     0       Redation Speed (0-100)%     50       End Process (Yes)     0       Vacuum Switch OK     0       Cathode 3 Water OK     0       Biast Water OK     0       Biast Water OK     0       Biast Water OK     0       Gas Control     0	aat Sequence     Gas 1-Setpoint (accm)     0       Gas 1-Setpoint (accm)     0       Sequence Running     0       AL_MASTER_RECIPE_T00.dt     0       AL_MASTER_RECIPE_T01.dt     0       Process Time Run Number     0       RF Source - Sputter (Watts)     0       October     0       Step Timer     0       Derator ID     RF Source - Sputter (Watts)       Dor 1 Source - Sputter (Watts)     0       DC 1 Source Shutter     0       DC 2 Source Shutter     0       Pressure (mTorr)     0       Redation Speed (0-100)%     50       End Process (Yes)     0       Vacuum Switch OK     0       Cathode 3 Water OK     0       Biast Water OK     0       Biast Water OK     0       Biast Water OK     0       Gas Control     0	aat Sequence     Gas 1-Setpoint (accm)     0       Gas 1-Setpoint (accm)     0       Sequence Running     0       AL_MASTER_RECIPE_T00.dt     0       AL_MASTER_RECIPE_T01.dt     0       Process Time Run Number     0       RF Source - Sputter (Watts)     0       October     0       Step Timer     0       Derator ID     RF Source - Sputter (Watts)       Dor 1 Source - Sputter (Watts)     0       DC 1 Source Shutter     0       DC 2 Source Shutter     0       Pressure (mTorr)     0       Redation Speed (0-100)%     50       End Process (Yes)     0       Vacuum Switch OK     0       Cathode 3 Water OK     0       Biast Water OK     0       Biast Water OK     0       Biast Water OK     0       Gas Control     0					
Sequence Running     Gas 2-Setpoint (sccm)     0       Sequence Running     Gas 2-Setpoint (sccm)     0       Jack MASTER_RECIPE_T000.dt     0       AL_MASTER_RECIPE_T001.dt     0       Proceas Time Run Number     0       Obc:002     28703       Rest     Secure - Sputter (Watts)       Oct 1 Source - Sputter (Watts)     0       Oct 2 Source - Sputter (Watts)     0       Oct 3 Source - Sputter (Watts)     0       De 7 Source - Sputter (Watts)     0       De 7 Source - Sputter (Watts)     0       Retailon Speed (0-100)%     50       End Process (Yes)     0       Target Names     0       Gas Control     Yes	Sequence Running     Gas 2-Setpoint (sccm)     0       AL_MASTER_RECIPE_T000.dit     0       AL_MASTER_RECIPE_T001.dit     0       Process Time Run Number     0       MATER_RECIPE_T001.dit     0       RF Source - Sputter (Watts)     0       00:002     28703       Rest     F Source - Sputter (Watts)       0C1 i Source - Sputter (Watts)     0       0C1 i Source - Sputter (Watts)     0       0C i Source - Sputter (Watts)     0       0 C i Source - Sputter (Watts)     0 <t< td=""><td>Sequence Running     Gas 2-Setpoint (sccm)     0       AL_MASTER_RECIPE_T000.dit     0       AL_MASTER_RECIPE_T001.dit     0       Process Time Run Number     0       MATER_RECIPE_T001.dit     0       RF Source - Sputter (Watts)     0       00:002     28703       Rest     F Source - Sputter (Watts)       0C1 i Source - Sputter (Watts)     0       0C1 i Source - Sputter (Watts)     0       0C i Source - Sputter (Watts)     0       0 C i Source - Sputter (Watts)     0       <t< td=""><td>Sequence Running     Gas 2-Setpoint (sccm)     0       AL_MASTER_RECIPE_T000.dit     0       AL_MASTER_RECIPE_T001.dit     0       Process Time Run Number     0       MATER_RECIPE_T001.dit     0       RF Source - Sputter (Watts)     0       00:002     28703       Rest     F Source - Sputter (Watts)       0C1 i Source - Sputter (Watts)     0       0C1 i Source - Sputter (Watts)     0       0C i Source - Sputter (Watts)     0       0 C i Source - Sputter (Watts)     0       <t< td=""><td></td><td>Gas-PiD</td><td></td><td></td><td></td></t<></td></t<></td></t<>	Sequence Running     Gas 2-Setpoint (sccm)     0       AL_MASTER_RECIPE_T000.dit     0       AL_MASTER_RECIPE_T001.dit     0       Process Time Run Number     0       MATER_RECIPE_T001.dit     0       RF Source - Sputter (Watts)     0       00:002     28703       Rest     F Source - Sputter (Watts)       0C1 i Source - Sputter (Watts)     0       0C1 i Source - Sputter (Watts)     0       0C i Source - Sputter (Watts)     0       0 C i Source - Sputter (Watts)     0 <t< td=""><td>Sequence Running     Gas 2-Setpoint (sccm)     0       AL_MASTER_RECIPE_T000.dit     0       AL_MASTER_RECIPE_T001.dit     0       Process Time Run Number     0       MATER_RECIPE_T001.dit     0       RF Source - Sputter (Watts)     0       00:002     28703       Rest     F Source - Sputter (Watts)       0C1 i Source - Sputter (Watts)     0       0C1 i Source - Sputter (Watts)     0       0C i Source - Sputter (Watts)     0       0 C i Source - Sputter (Watts)     0       <t< td=""><td></td><td>Gas-PiD</td><td></td><td></td><td></td></t<></td></t<>	Sequence Running     Gas 2-Setpoint (sccm)     0       AL_MASTER_RECIPE_T000.dit     0       AL_MASTER_RECIPE_T001.dit     0       Process Time Run Number     0       MATER_RECIPE_T001.dit     0       RF Source - Sputter (Watts)     0       00:002     28703       Rest     F Source - Sputter (Watts)       0C1 i Source - Sputter (Watts)     0       0C1 i Source - Sputter (Watts)     0       0C i Source - Sputter (Watts)     0       0 C i Source - Sputter (Watts)     0 <t< td=""><td></td><td>Gas-PiD</td><td></td><td></td><td></td></t<>		Gas-PiD			
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AL_MASTER_RECIPE_TO01.0     0       AL_MASTER_RECIPE_TO01.0     Gas PID Pressure(mTorr)     0       Porceas Time Run Number     0     0       00:00:02     28703     Reset     R Source - Sputter (Watts)     0       00:00:02     28703     Reset     R Source - Cathode Selec.     0       Step Timer     0     Step Timer     0     0       0:1 Source Shutter     0     0     0       0:2 Source Shutter     0     0     0       0:1 Source Shutter     0     0     0       0:2 Source Shutter     0     0     0       0:2 Source Shutter     0     0     0       0:3 Stim Switch OK     Cathode 1 Water OK     0     0       1:3 Start OK     0     0     0       0:3 Start OK     0     0     0       1:3 Start OK     0     0	text Sequence     0       AL_MASTER_RECIPE_TOOLO     0       Gas PiD Pressure(mTorr)     0       Poccess Time Run Number     0       00:00:02     28703     Reset       RF Source - Sputter (Watts)     0       00:00:02     28703     Reset       RF Source - Sputter (Watts)     0       0:1 Source Shutter     0       0:1 Source Shutter     0       0:2 Source Shutter     0       0:3 Stan Switch OK     Ignition Pressure (mTorr)     0       1 Stan Switch OK     End Process (Yes)     0       1 Stan Switch OK     End Process (Yes)     0       1 Stan Switch OK     Door Interlock     0       Gas Control     Gas Control     0	text Sequence     0       AL_MASTER_RECIPE_TOOLO     0       Gas PiD Pressure(mTorr)     0       Poccess Time Run Number     0       00:00:02     28703     Reset       RF Source - Sputter (Watts)     0       00:00:02     28703     Reset       RF Source - Sputter (Watts)     0       0:1 Source Shutter     0       0:1 Source Shutter     0       0:2 Source Shutter     0       0:3 Stan Switch OK     Ignition Pressure (mTorr)     0       1 Stan Switch OK     End Process (Yes)     0       1 Stan Switch OK     End Process (Yes)     0       1 Stan Switch OK     Door Interlock     0       Gas Control     Gas Control     0	text Sequence     0       AL_MASTER_RECIPE_TOOLO     0       Gas PiD Pressure(mTorr)     0       Poccess Time Run Number     0       00:00:02     28703     Reset       RF Source - Sputter (Watts)     0       00:00:02     28703     Reset       RF Source - Sputter (Watts)     0       0:1 Source Shutter     0       0:1 Source Shutter     0       0:2 Source Shutter     0       0:3 Stan Switch OK     Ignition Pressure (mTorr)     0       1 Stan Switch OK     End Process (Yes)     0       1 Stan Switch OK     End Process (Yes)     0       1 Stan Switch OK     Door Interlock     0       Gas Control     Gas Control     0					_
AL_MASTER RECIPE_T001:di AL_MASTER RECIPE_T001:di Process Time Run Number     0       Process Time Run Number     RF Source - Sputter (Watts)     0       Step Timer     0     Sec       Step Timer     0     Sec       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Sputter (Watts)     0       D0 2 Source Shutter     0       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Skin Switch OK     So       Vacuum Switch OK     End Process (Yes)       Door Interlock     Gas Control	AL_MASTER RECIPE_T001:di AL_MASTER RECIPE_T001:di Process Time Run Number     0       Process Time Run Number     RF Source - Sputter (Watts)     0       Step Timer     0     Sec       Step Timer     0     Sec       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Sputter (Watts)     0       D0 2 Source Shutter     0       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Skin Switch OK     So       Vacuum Switch OK     End Process (Yes)       Door Interlock     Gas Control	AL_MASTER RECIPE_T001:di AL_MASTER RECIPE_T001:di Process Time Run Number     0       Process Time Run Number     RF Source - Sputter (Watts)     0       Step Timer     0     Sec       Step Timer     0     Sec       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Sputter (Watts)     0       D0 2 Source Shutter     0       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Skin Switch OK     So       Vacuum Switch OK     End Process (Yes)       Door Interlock     Gas Control	AL_MASTER RECIPE_T001:di AL_MASTER RECIPE_T001:di Process Time Run Number     0       Process Time Run Number     RF Source - Sputter (Watts)     0       Step Timer     0     Sec       Step Timer     0     Sec       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Sputter (Watts)     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Cathode Selec.     0       D0 1 Source - Sputter (Watts)     0       D0 2 Source Shutter     0       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Skin Switch OK     So       Vacuum Switch OK     End Process (Yes)       Door Interlock     Gas Control	AL_MASTER_RECIPE_TO	DOD.dat			_
AL minol RCR (EULP)     Output       AL minol RCR (EULP)     Output       Objectsa Time (IN Number)     RF Source - Cathode Selec.     Output       Objectsa Time (IN Number)     Output     RF Source - Sputter (Watts)     Output       Step Timer (IN Second)     Output     Output     Output       Operator ID     Output     Output     Output       Valer ID     Output     Output     Output       Pressure Control     Yes     Ignition Pressure (mTorr)     Output       Vacuum Switch OK     Cathode 1 Water OK     Output     Output       Bias Water OK     Bias Water OK     Output     Output       Obor Interlock     Gas Control     Yes     Output	AL_mino IER_REQUIE_1001-0     Gas PID Pressure(mTorr)     0       Process Time Number     0       00:00:02     28703     Reset       RF Source - Cathode Selec.     0       Step Timer     0       Derator ID     DC 1 Source - Sputter (Watts)       Do 1 Source - Sputter (Watts)     0       Derator ID     DC 1 Source - Sputter (Watts)       Derator ID     DC 2 Source Shutter       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Door Interlock     Cathode 3 Water OK       Door Interlock     Gas Control	AL_mino IER_REQUIE_1001-0     Gas PID Pressure(mTorr)     0       Process Time Number     0       00:00:02     28703     Reset       RF Source - Cathode Selec.     0       Step Timer     0       Derator ID     DC 1 Source - Sputter (Watts)       Do 1 Source - Sputter (Watts)     0       Derator ID     DC 1 Source - Sputter (Watts)       Derator ID     DC 2 Source Shutter       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Door Interlock     Cathode 3 Water OK       Door Interlock     Gas Control	AL_mino IER_REQUIE_1001-0     Gas PID Pressure(mTorr)     0       Process Time Number     0       00:00:02     28703     Reset       RF Source - Cathode Selec.     0       Step Timer     0       Derator ID     DC 1 Source - Sputter (Watts)       Do 1 Source - Sputter (Watts)     0       Derator ID     DC 1 Source - Sputter (Watts)       Derator ID     DC 2 Source Shutter       Pressure Control     Yes       Ignition Pressure (mTorr)     0       Door Interlock     Cathode 3 Water OK       Door Interlock     Gas Control	Vext Ocquence				_
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5.18. As the recipe is running, the chosen sputter source will turn green, the process gas injection will be visible and the power will increase to reach the desired setpoint. Pay attention to whether the process power matches the power set in the recipe.

**Note:** The power will ramp up in discrete increments in different ways depending on the material being deposited. It might take some time before the actual deposition power is reached.

- 5.19. You can observe the plasma through the Kapton deposition window. Make sure that it's steady and not flickering.
- 5.20. During the deposition step, the shutter graphic will be open, and a cone representing the emitted material is shown.
- 5.21. When the deposition is over, an alarm will notify you. You can now vent the system.

**Note:** All the master recipes have built-in dwell times at the end of the recipe to allow the target to cool. This cooling step prevents the build-up of oxides on the target surface.



### 6. Venting the chamber

Follow the procedure for venting.

See page 7-8.

### 7. Taking out your samples

- 7.1. Remove your samples from the chamber.
- 7.2. It is good practice to replace the Kapton tape on the chamber window after your deposition, especially if a long deposition was performed.

#### 8. Pumping down the chamber

Follow the same procedure as for venting, but use recipe "A\_Pump.dat".

Note: Do not leave the system until the chamber has been pumped down and until your hear the alarm.

## 9. Log out of IRIS

Do not log out of IRIS until the chamber is pumped down. If you do, the recipe will abort and the chamber will not be pumped down for the next user.