Sensors and Actuators
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Lecture - 51
Installation and Introduction to Physical Vapour Deposition System

Hello. Welcome to this particular module. This module is really interesting because if you recall the last lab component we were discussing each and every or most of the parts within a PVD system, and when we talk about PVD we were talking about thermal and E beam evaporation, right. So, in that last module what we were discussing? We were discussing how the penning gauges are there, how the pirani gauge are there, right how the E beam control circuit is there, where is a transformer to apply the power for the boat the reviews in the thermal evaporator, right, how the chamber looks like, where are the displays everything like in a fragmented manner.

And the role of this PVD or you can say thermal evaporator slash E beam evaporator is to deposit metals, semiconductors and certain insulators, all right. So, please focus on this module. This is my one of the my favourite modules because actually you will be able to see, how the system is in a operating mode and you will see how the substrate is loaded, where is the E beam. And you cannot see E beam actually, but where is a crucible, right and there are 4 crucibles and then where is a boat, right, so how the chamber looks like. So, whatever we learn in theory is one thing, when we look something in the lab or we experience at in the lab is very different thing.

So, I hope that you like this particular module. And any questions again you are free to ask me in a forum. So, I will request a few of my students to show it to you, along with we have called the engineer from Hindhivac, Mister Rajanna. And he will show us how the system operates, but we can also operate independently. It is very simple and easy system provided you understand the concept, ok. So, I will see you in a some other class. Till then you take care. Bye.

(Refer Slide Time: 02:47)

Welcome to this module. As you know we use lot of instruments to make our sensors as part of the sensors and fabrications course. You have been introduced to a lot of unit processes that are used to make the sensors. So, one of the basic processes is deposition, where you deposit lots of different types of materials on your substrate, your substrate may be glass silicon different types of wafers.

So, today we are running you through a system installation in the lab, so that you understand how these things are working and how they are assembled, ok. So, we are in the process of assembling the system which is an E beam and thermal evaporator combined into a system. So, we have people from the company who are installing the system. He will quickly talk to you about these basics of the system and then we will go into the installation.

I am Rajanna from has Hindhivac Company Private Limited. We supplied vacuum thermal evaporation and E beam evaporation system, today I will be starting the mechanical dismantling the packing and start a mechanical work, tomorrow I will be going for start the running the system like that.

So, he will talk about different gauges inside and what are the wafer holders, chuck, everything we will see each part. To start off they will install the power supply unit for the machine and we will see it as it progresses.

Thank you.

(Refer Slide Time: 04:04)

Now, as you can see we are pushing the power supply unit for the electron beam, electron beam power supply into the system into the housing of the system.

Control panel.

Into the control panel, below the control panel. What you see above the power supply unit is the control panel, so which very heavy that is why we are using a trolley to align with the height of the housing and then push it in.

(Refer Slide Time: 04:30)

So, above the power supply unit is the control panel.

Started.

(Refer Slide Time: 04:53)

Now, we have finally, pushed the power supply into the control panel housing. Now, we will make the connections from behind. We have made three-phase connections with a good ampere rating for this power supply unit. And this power supply unit will power the control panel, separately on the left side you can see the chamber. The chamber will have its own separate power supply that will be supplied through a dedicated connection.

So, now, we have pushed the power supply unit inside and attached few panels onto it, so that only the knobs that are required to control it are visible outside. So, that is how they have assembled it. Now, they are giving the connections from backside. We have a very high power socket behind that we have made for installing this equipment, so that is there at behind and we will connect it, ok.

So, for the system we need a two main additional things which is a chiller unit and a compressor unit. So, chiller unit actually what it will be filled with di water, deionized water. So, that will basically used for the cooling purposes inside the chamber, I mean not inside the chamber around the chamber, so that temperature control can be done and the compressor unit as you know would be used for flushing in air, taking out air, creating vacuum and all those purposes. So, now, they are unpacking the compressor unit which will be installed.

So, with regard to safety purposes chiller, compressor, gas cylinders everything should not be kept inside the lab. So, what we have, what we will do is we will take these units and we have a utility room that is made outside the lab with connections coming into the lab. So, this system after it is unpacked the equipment will be taken out into the utility room and connections will be taken from there into the system.

(Refer Slide Time: 06:39)

(Refer Slide Time: 06:48)

We have now unpacked the chiller unit. Now, Mister Rajannaji here will explain us the different knobs that are there because we will be taking it back in the utility room, after that you will not be able to see it. So, it is better that you understand what is there basically, how it chiller unit is works before we take it. Sir.

(Refer Time: 07:05), this is one of similar make chiller unit. This is a main power supply, main circuit factor then the familiar day mineral (Refer Time: 07:18) water, then this is our quarter level. This should be a maximum level.

Ok

Ok. This is a power of main, main switch are managed. This is a temperature indication. You can be able to vary whatever required temperature.

So, what is required for our system usually?

20-25. 18 to 20 degree.

Ok.

Now, this will be once a temperature is going up automatically compressor is run, vacuum is cooling down, once it is 18 degree compression will automatically cut off.

Cut off.

Right. This is with the circulation motor also will be there. For our unit it need two bar pressure water chiller, water circulation no; it is required two bar pressure. This will be over to reach up to 3 to 4 bar (Refer Time: 08:02) water circulation bar (Refer Time: 08:04) like that.

And other knobs are for LP trip, HP trip (Refer Time: 08:08).

This is our, this is our LP, HP trip means, this compressor on, pump on, circulation pump on, this is compressor on. This LP through water level is going down, automatically motor is trip. This should be maintained maximum level. Your water level sometime during maintenance power time water is wasted, then slowly water level is coming down. This will be automatically tripped.

Ok.

Again you have to re tap the water.

Refill the water.

Refill the water.

Ok.

Ok.

Good.

And you have to maintain the two bar pressure gauge.

(Refer Slide Time: 08:15)

So, that is a pressure gauge.

Yeah, pressure gauge.

Now, this is a throttle valve insulator. You have maintain the you can set the pressure.

So, how do you set the pressure?

Have inside a.

Already.

Oh, it is set. It is setted, setted, ok, fine, ok. Thank you.

This is pressure drain gauge.

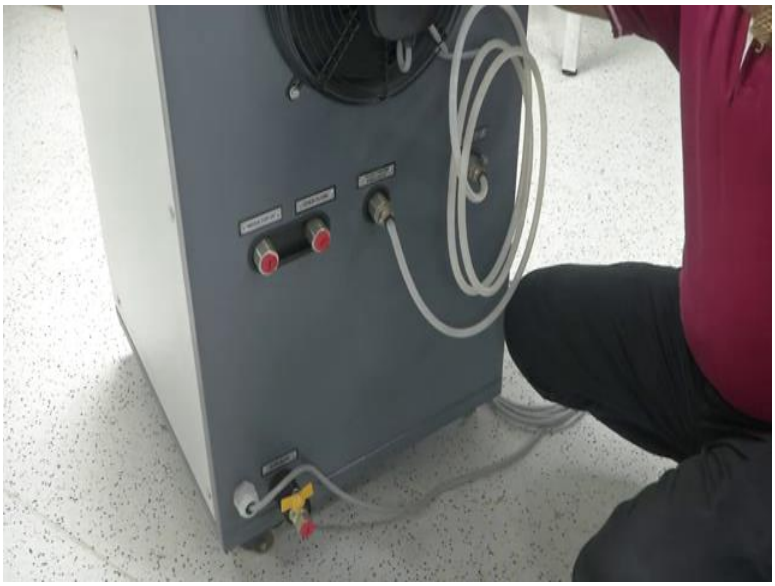
You have some (Refer Time: 09:06).

Sir, you can tell from first, this one, yeah.

This is the, this is the fan for water cooling purpose. This is water outlet from the chiller unit and water release from the to the chiller unit. You know actually whatever once you filled water you can able to run same water minimum 3 to 4 months.

3 to 4 months.

(Refer Slide Time: 09:35)



After water contamination can drain the water from through this valve, drain valve. Clean the tank water, tank and refill fresh water.

Ok.

(Refer Time: 09:47) chiller (Refer Time: 09:48) came continues waste, a water will be waste.

Yeah, correct, correct.

You can save water and then may temperature also should be maintained here.

Correct. So, this tube will go around the system.

Yeah.

To cool it.

This one.

Yeah.

It will be providing water (Refer Time: 10:02).

Ok.

See water inlet.

From process, ok, ok. And that media top up overflow is.

This is over flow. Suppose water is going to fill over this will be.

Coming.

Over flow; till the even over (Refer Time: 10:24).

Ok. That.

In (Refer Time: 10:26) and over flow will be there like that. Simple.

Ok.

(Refer Slide Time: 10:29)

With this unit we can do LT process and HT process (Refer Time: 10:35). This major three process is there. You can see this is LT transform and that is a HT transform.

Loudly.

(Refer Slide Time: 10:50)

With that LT transformer we can move upto 200 Amps, by that HT transformer before initial process you can go with a HT transformer for ion bombardment to cleaning the chamber (Refer Time: 11:02). This is the rotor pump to achieve the initial (Refer Time: 11:09) vacuum. After that achieving (Refer Time: 11:12) vacuum will move to turbo pump to switch on the (Refer Time: 11:17) pump, it is required some (Refer Time: 11:19) vacuum; without (Refer Time: 11:21) vacuum you will not move for to switch on a turbo pump.

So, it requires certain light vacuum that will provide from rotor pump. So, after achieving (Refer Time: 11:33) we will move to turbo pump to switch on the turbo pump. After getting some lightning vacuum-vacuum, we will switch on the turbo pump. From turbo pump is also backside. It is here (Refer Time: 11:48).

Ok, ok. Inside the chamber. Yeah, go.

Yeah.

You can just point it once.

(Refer Slide Time: 11:52)

Yeah, here.

That is turbo molecular pumps.

This is a turbo pump after reaching a (Refer Time: 11:57) vacuum you have to switch on the turbo pump, then by using the turbo pump we can move it up to 96 vacuum 10 minus 7 (Refer Time: 12:06).

But, so there are size wise (Refer Time: 12:08) for this bigger than the turbo pump.

Yeah, size wise (Refer Time: 12:11) is bigger turbo will rotate here.

It is turbo molecular pump, TMP.

Yeah. In between, in between the.

(Refer Time: 12:19) important.

In between from chamber to turbo pump one vacuum, one valve is there that is called high vacuum valve, that after achieving certain vacuum level, so we have go for that high vacuum valve.

So, manually we have to so open the valve (Refer Time: 12:40).

Yeah, manually we have to open after achieving certain (Refer Time: 12:44)

Actually, all are electro pneumatic work, ok.

Electro pneumatic work.

Ok. Electro pneumatic work.

Electro pneumatic work not butterfly valve. For switching on any valve may compress (Refer Time: 12:55), ok. When you have control panel you have internal switches backing pressing (Refer Time: 13:02). Just can this toggle switch when you switch on the (Refer Time: 13:08) automatically valves will be open.

(Refer Slide Time: 13:00)

Actually, first switch on the water pump wait until this 5 to minus 2 in the (Refer Time: 13:21), switch on turbo. For switching on turbo need water also, without water it is not getting run.

(Refer Slide Time: 13:27)

That is turbo is not switching on.

Water for the cooling water.

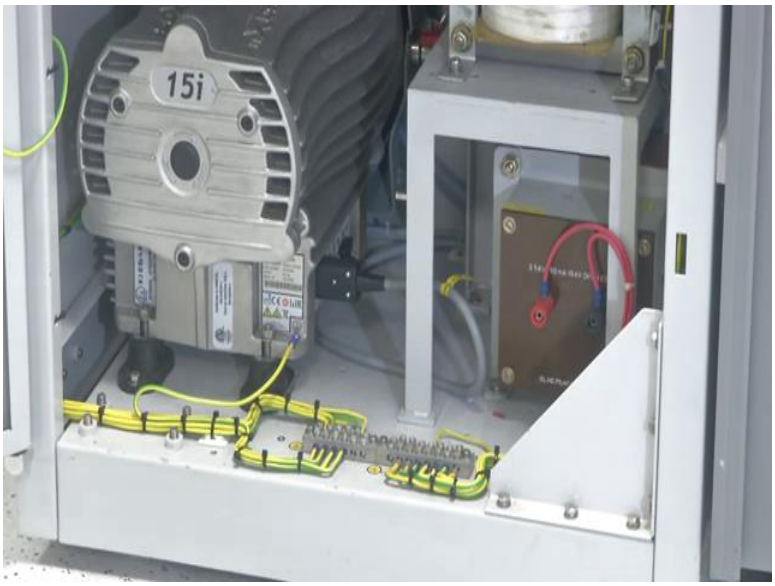
Yeah.

Ok.

This is the water cooling turbo molecular pumps. Once you switch on turbo molecular pumps wait turbo should ready, wait 20 to 30 minutes then turbo (Refer Time: 13:44). After (Refer Time: 13:46) is done, the compression valve and the (Refer Time: 13:50) position. Before opening high vacuum valve chamber should be the (Refer Time: 13:55).

Minimum.

(Refer Slide Time: 13:56)



Minimum, minus 2. Otherwise if you go direct atmospherically it should not go (Refer Time: 14:02). We have (Refer Time: 14:03), you should try to switching (Refer Time: 14:05) and not getting (Refer Time: 14:05).

So, the protection is.

Protection will be there. Switch on the close the vacuum valve and open the (Refer Time: 14:12) wait (Refer Time: 14:13) better than (Refer Time: 14:14) to manage tool in chamber. Then after reaching minus 2 close turbo (Refer Time: 14:20) valve and open vacuum then open high vacuum valve. Then open high vacuum valve the, after opening the high vacuum your turbo will be connected to chamber.

Ok.

Then it will start working.

Then they start high vacuum minus 5 minus 6.

So, this (Refer Time: 14:34) till minus 6 usually this system how much time it will take?

1 hour.

1 hour.

Yeah.

[FL] sir.

Actually, switch on mains first water; utility should be added. First switch on, water, power, pneumatic, then switch on mains, all the indication is coming, all (Refer Time: 14:55) safety (Refer Time: 14:57) on, see safety interlocks.

Water cooling.

Water cooling.

Source.

Source (Refer Time: 15:01).

Enabled otherwise, so water safety interlocks is not satisfied your system is not getting on.

So, system will do that checking.

(Refer Slide Time: 15:10)

Yeah. This should be (Refer Time: 15:10). This light should glow is on, then start rotary pumps. It is here.

No, you will (Refer Time: 15:19).

(Refer Slide Time: 15:19)

Yeah, it is (Refer Time: 15:20). No switches actually, you can operate with (Refer Time: 15:24) with touch screen like that.

Touch screen.

You can do the maybe (Refer Time: 15:29).

(Refer Time: 15:29).

Yes, correct. So, switch on rotary pumps, wait until there is minus 2 vacuum, then open braking valve, turbo on, after turbo is getting ready indication is coming, turbo ready indication is coming. After this then switch on turbo roughing valve, wait to until minus 12 milli bar then over to high vacuum, wait until minus 12 base vacuum. Minus 12.

(Refer Time: 15:59).

Then after reaching base vacuum can go for ion bombardment cleaning; you need a ion pump for cleaning your substrate. Before going into thermal operation do the introduce the gas or the inert gas, take the pressure some minus 2 level chamber, introduce a water, give the current (Refer Time: 16:21) will be coming. It will take around 10 to 15 minutes.

So, it is like a plasma cleaning.

Plasma cleaning, same plasma cleaning. After (Refer Time: 16:30) you can go for again high vacuum valve switch on LT, thermal evaporation. Before, before closing this (Refer Time: 16:39) your substrate and coating material and then you can also start the work. You have you have discussed in the smart class on NPTEL. During a coating will be shows what is the rate (Refer Time: 16:54)

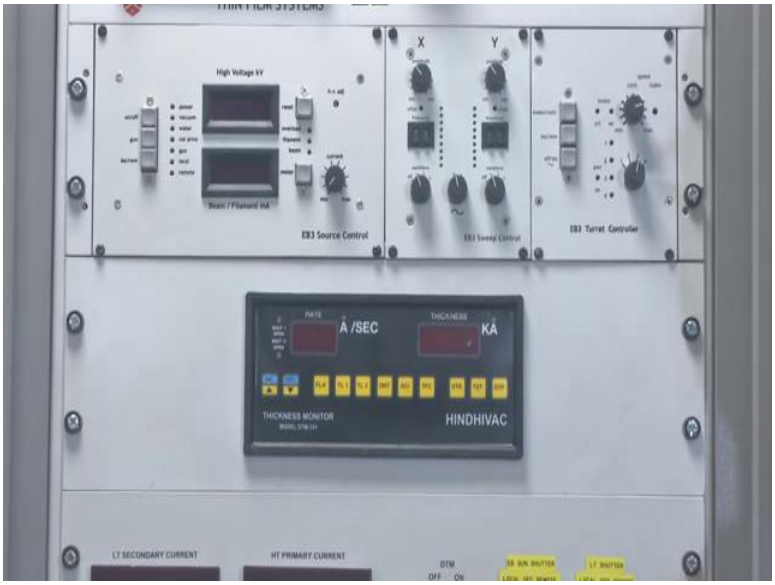
The thickness monitor quartz is inside.

The quartz is crystal, inside monitor (Refer Time: 16:59).

Ok.

It will measure the rate of deposition rate (Refer Time: 17:04).

(Refer Slide Time: 17:04)



Kilo angstrom per second.

(Refer Time: 17:07) per second

And the.

Thickness, rate and thickness separate.

It will measure the thickness. So, what is l 1, l 2, l 3 there?

(Refer Slide Time: 17:20)

This is line 1, line 2, line 3. This is three phase oh sorry, indication.

This is three phase line 1, all will be like that.

Ok, fine.

(Refer Slide Time: 17:28)

And the other bottom are all circuit breakers to see, we have to reset or something.

Yes.

In like MCB, we have to reset it.

Right.

After coating your valve wait just wait 10 minutes for cooling your substrate. Do not do (Refer Time: 17:42) sudden (Refer Time: 17:43), do not (Refer Time: 17:44) to the chamber immediately, otherwise your substrate is at still hot condition, you go for atmosphere is going inside sample will be black and (Refer Time: 17:52) that is why, otherwise you can do venting with nitrogen gas.

Substrate has to be cooled with vacuum condition.

Vacuum condition.

Or not in air gap; so, you like first the roughing pump will come, minus 2 will be go to the TMT.

Yes.

And once after roughing pump comes that valve will open, right, high vacuum valve, then turbo molecular pump will come in, and then it (Refer Time: 18:19) reaches some submission percept we can start the process.

Actually, we have instructions manually. It will be giving.

So, here in this system each of this switch is manual, right or automatic; they are manual we have to switch.

This is just touch screen that.

Ok, ok.

Earlier old model is just (Refer Time: 18:35) valve manually open, close like that.

So, here how do you switch between E beam deposition and thermal evaporation I mean?

Yeah, this is a LT, HT (Refer Time: 18:46).

(Refer Time: 18:47) local connection and remote connection.

Remote connection.

(Refer Time: 18:50) this means we have to operate manually. (Refer Time: 18:54) remote function you go for (Refer Time: 18:53).

(Refer Time: 18:57).

No, my doubt is there you can do E beam evaporation and thermal evaporation, right.

At a time?

No, no, differently.

Then, how do we select which one to (Refer Time: 19:06).

Source.

If we want LT source you will go to this, this direction, or if you want HT means you will turn you have to turn on this one.

Ok.

And the system has protectioning both or it should not work know, that protection is there.

Yeah, both cannot be.

Yeah, both should not go (Refer Time: 19:19).

(Refer Time: 19:23) circuit breaker will be there this is LT, this is HT.

So, what is a rotary (Refer Time: 19:28), that is for the (Refer Time: 19:29).

(Refer Time: 19:29), no, no that is for rotation.

Substrate.

Substrate rotation.

That rotation, right.

Yeah, that split the (Refer Time: 19:34).

So, just you can just some rpms.

10 to 15 rpm maximum. Which one is (Refer Time: 19:43) rpm values are written?

No, there rpm value is written no.

That will not be there. We can switch between that much range.

We can switch from 0 to (Refer Time: 19:55).

So, total (Refer Time: 19:58) how many the refer carriers will be there?

Refer carriers 4 into 4 into (Refer Time: 20:03) 4 numbers.

4.

Now, I think we can open the chamber.

Yeah.

That is the chamber, he is showing.

(Refer Slide Time: 20:17)

EB gun, electronic beam gun. Here we have EB gun shutter, this is a pneumatic shutter, this is a LT, this is therma (Refer Time: 20:30) shutter, like filament, boat or basket.

(Refer Slide Time: 20:34)

This is a (Refer Time: 20:35). This is quartz crystal.

Monitor.

(Refer Slide Time: 20:44)

Crystal, ok. Here (Refer Time: 20:44) dismantling it will be putting back. (Refer Time: 20:48).

Yeah, we will assemble and put it.

(Refer Time: 20:50) rotation (Refer Time: 20:51). This is where now if you flip (Refer Time: 20:54). Like your bulb, how you can fixing like that.

Oh, rotate and tight.

(Refer Time: 21:00), this is a new design.

Ok.

So, the boat is here.

Boat (Refer Time: 21:10). Here (Refer Time: 21:12). This is boat filament basket thermal evaporation. Here crucible is coming.

For your (Refer Time: 21:17).

Actually, this is 4 4 source crucible; can have can without varying a vacuum it can able to (Refer Time: 21:24) 4 (Refer Time: 21:25) without vacuum (Refer Time: 21:27). Now, that there (Refer Time: 21:28) are also will be there, it can the (Refer Time: 21:31) source 1, source 2, source 3, source 4 like that, have 4 source, 4 crucible inside.

Oh, inside, inside.

Yeah, this will be turns (Refer Time: 21:41) will be there. When select the (Refer Time: 21:43) source 1, this will be this will be rotating this will be exposing here. Beam is falling centre (Refer Time: 21:49).

So, we can only control this centre to (Refer Time: 21:50).

Yeah.

For to operate the shutter we are given (Refer Time: 21:58) called LT shutter.

LT shutter.

Lt shutter, EB gun shutter.

Oh, EB gun shutter is a there, that one inside.

This is EB gun shutter.

This is EB gun shutter, that is LT shutter.

Ok.

And I (Refer Time: 22:14). What is this light one, this one?

This is HT (Refer Time: 22:14)

(Refer Time: 22:19) HT.

That is, that will there for whole process.

Yeah.

First (Refer Time: 22:25).

Ok.

That cooling (Refer Time: 22:28).

This is plasma (Refer Time: 22:30).

From there cooling will come from in sides (Refer Time: 22:23). This is a water cooling for (Refer Time: 22:35).

You have water cooling for crystal, water cooling for EB gun, have chamber cooling.

(Refer Slide Time: 22:51)

Water chamber, chamber (Refer Time: 22:45).

For row also cooling will be here. This is row cooling channel.

Ok, (Refer Time: 22:51). And this is grounding.

Grounding.

Yeah, all safety (Refer Time: 22:56). No shorting, no (Refer Time: 22:55).

Rajannaji. What is this local off remote (Refer Time: 23:00) to?

Which one?

Shutter.

This is a local off remote.

Remote we can use operate to (Refer Time: 23:07).

We can select to local we can switch on open manually. If you select remote you can (Refer Time: 23:14) from (Refer Time: 23:15).

If I use, if use local here, how to operate (Refer Time: 23:4).

You use local means it will it will operate here only, if you press (Refer Time: 23:29). If you (Refer Time: 23:31).

This is (Refer Time: 23:32) this is off this is remote.

(Refer Time: 23:24), then you just touch the (Refer Time: 23:36).

So, if you put remote the (Refer Time: 23:37) operates from here, but if you put local then automatically it will (Refer Time: 23:40).

Yeah.

And some knobs is there to set LT current.

This is LT secondary HT primary.

HT there is no control, for LT we can give some set points like we need 20 Amps.

To much we can give?

To that transformer rating is up to 200 Amps.

200 Amps.

But we have to go with.

Depending on material (Refer Time: 24:10).

Depend upon our boat and filaments baskets that kind.

Ok.

Only material it should definitely not the (Refer Time: 24:19) provided up to 200 Amps rating.

(Refer Time: 24:22).

Yes, up to 200 Amps security will be there no problem.

But (Refer Time: 24:25).

Actually it depends upon your coating material whether the temperature melting points

Ok.

You can see the window.

So, a control current control will be here when, start the operation we can set.

That IO and reset buttons are?

Sometimes HMI will not turn on suddenly and that time we have to press reset. Suppose (Refer Time: 24:51) is there you press reset it will.

What is IO?

IO (Refer Time: 24:57) reset.

That time what happens sometimes power will go (Refer Time: 25:03).

(Refer Time: 25:04) simultaneously plus current.

(Refer Time: 25:07) that time this will be on.

Ok.

At that time you can press the reset button.

Ok, so I o is the status not (Refer Time: 25:13) button, but reset is the button.

Yes.

These three are all status there is no button here, no.

No here (Refer Time: 25:19).

This is (Refer Time: 25:20).

This is also button, this is (Refer Time: 25:22).

Only indication purpose

Only indication, this is water safety interlock, water cooling, source enabled.

Suppose, without a changing this indication we will not get power to switch on the sources, gas become drain then only it will move to operate the sources.

So, when we tell safety interlocks, what safety interlocks we mean.

Safety water power pneumatic.

All have you know.

In a shorting (Refer Time: 25:47) safety, without safety interlock no.

Process (Refer Time: 25:53).

No work, no working.

It will not work.

It is not working.

It is not able to process and all. So, when we do emergency stuff what happens everything is shutdown.

Everything should be shutdown.

But, what is process is going on I press emergency shutdown. So, like what is the protection for the chamber or something like that?

Nothing it is like a direct (Refer Time: 26:13).

It will be, it will be (Refer Time: 26:15).

Immediately high vacuum will be closing.

Close.

Close.

It will vent also.

No, not venting. Venting will not happen just close all the valve.

Ok.

Now, the high vacuum valve will close.

Yes.

Cut off.

Yes.

So, water (Refer Time: 26:27) now (Refer Time: 26:28).

(Refer Time: 26:34).

Ok.

(Refer Slide Time: 27:00)

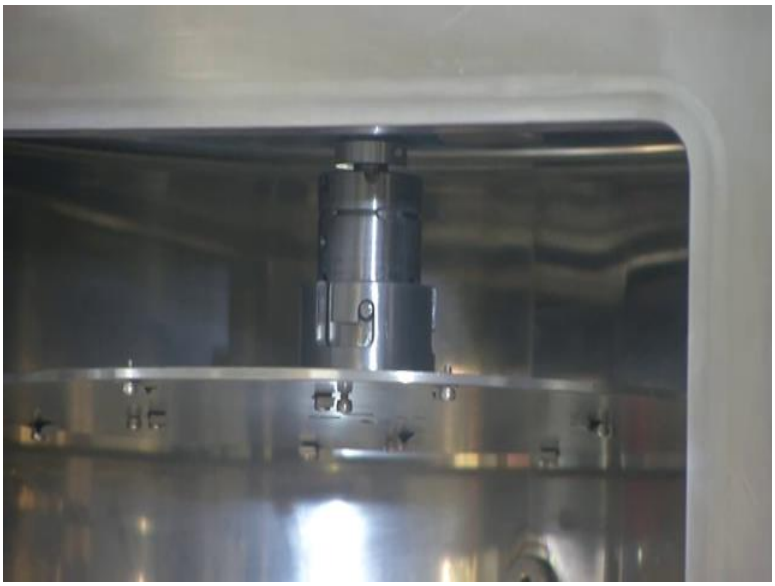
So, this is the substrate holder. So, the wafer will sit here. So, these clips you can see, usually people use either clips or caflon tapes. Caflon tape is like a special type of tape which is used inside the clean room to fix the fix and hold the wafer, but this is a better option because will come with SS clips. So, you can unscrew it and put the wafer and then screw it back. So, it will be tightened there. It will go like this, and this is where it will go and lock inside the chamber, it will show you he will he will fix it. And you can keep the wafer here.

Sir.

(Refer Time: 27:30). Sir connected.

Thank you.

(Refer Slide Time: 27:45)



So, yes. So, he has started it inside, you can see. It is locked also (Refer Time: 27:48) also. It is like you put the to bulb of bulb inside the socket the same way.

That is like a quick relief coupler, quick relief coupler. However, screw tightening (Refer Time: 28:03).

Ok.

So, one wafer at a time (Refer Time: 28:08).

No, 4 numbers at a time.

4 here (Refer Time: 28:10), ok, ok.

(Refer Time: 28:12). This is 1, 2, 3, 4.

Yeah, ok.

(Refer Time: 28:19) bigger size. This is maximum size (Refer Time: 28:21).

So, this key is for opening this one, right.

Yeah. (Refer Time: 28:43) shutters will be there, (Refer Time: 28:44) you can open, can reset and.

We can see the plasma from here.

(Refer Time: 28:50) or without this shutter coating will be done for main glass, slowly we use (Refer Time: 28:55). So, to avoid these (Refer Time: 28:58) close shutter (Refer Time: 29:00) shutter.

(Refer Slide Time: 28:58)

So, if we have a shutter like he told (Refer Time: 29:04) shutter, so you can see in the process (Refer Time: 29:07) wait. You cannot keep it always open because the glass will get associated with the material and over time you will not able to see anything. And so, that is why this metal shutter is put. So, that on the other side of the shutter things will get attached here as process happens.

And this is (Refer Time: 29:22) spares actually. Now, it is not required at all.

(Refer Time: 29:26).

(Refer Time: 29:26) spares.

Ok.

(Refer Time: 29:26).

Over a period of (Refer Time: 29:32) contamination. So, what we will do?

What does (Refer Time: 29:37) rating measure (Refer Time: 29:40).

Now, presently measure from one process to minus 3 milli bar; you know after managing can (Refer Time: 29:44) minus 2 to minus 6, 5.

So, already there a (Refer Time: 29:52) inside, so these are spares in case of it, if the gauge is very important because otherwise we will not be able to monitor the (Refer Time: 29:56) that is formed inside the chamber.

(Refer Slide Time: 30:01)

This is pirani gauge.

This is a pirani gauge. So, the (Refer Time: 30:07) actually it give barrier to the control panel know.

Yeah.

Yeah gauge.

Yes.

(Refer Slide Time: 30:19)

Probably a (Refer Time: 30:18), through this internet port the information will go over, gauging machine, vacuum level and through the internet information will transport to the control input.

These both are pirani, pirani 1, pirani 2.

Two pirani its spares (Refer Time: 30:29).

One is (Refer Time: 30:30), another one (Refer Time: 30:31).

Ok, both pirani.

Both pirani, and one is penning is gauge for chamber I think.

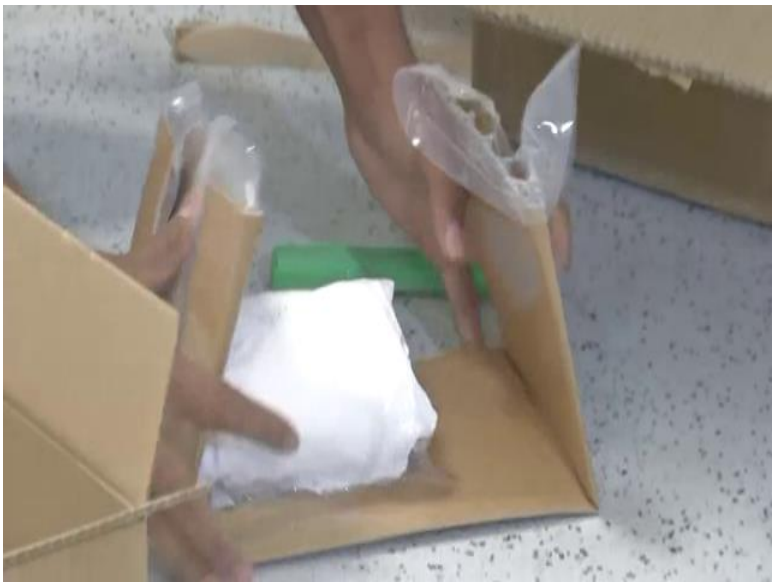
Ok.

That we made yeah actually normally we have to two pirani one penning, one pirani is made in from (Refer Time: 30:42) and chamber (Refer Time: 30:44) and then minus.

(Refer Time: 30:48). [FL]

(Refer Time: 30:55).

(Refer Slide Time: 31:17)



That is fine. So, we have a spare penning gauge, but we are not opening it because the contamination issues, because it is very important. So, it is there kept in again kept (Refer Time: 31:20) spare, other one gauge is installed already in the system, right.

Yeah.

So, after (Refer Time: 31:31) what is an intent for gauges? How often we have to replace it?

It has no (Refer Time: 31:37) we can do the recalibration.

You know many major problem or gauge is not working, you can replace it. See once (Refer Time: 31:49) clear it should be calibrated.

Calibrated. So, and he will come and calibrating know.

No, he will be sending back to our office.

Office. So, only the gauge value taken and (Refer Time: 31:57).

Yeah and now calibration facility.

So, you remove the gauge and send it to you (Refer Time: 32:01).

Suppose, if there will be (Refer Time: 32:04), otherwise it can be (Refer Time: 32:07).

Then how will we know error is there because I told that selling and services no.

To measure that (Refer Time: 32:13) is required no. Means to find out that errors we do not master gauge. But here (Refer Time: 32:22). You can identify easily that different errors.

Ok.

Certain times (Refer Time: 32:26).

Oh, ok. You do not have inner process after half an hour issue these discussion, now show you (Refer Time: 32:30).

That is not showing at pressure.

Sir, it is a crucible.

Ok.

Specimen (Refer Time: 32:35), crucible, this will also be a crucible.

(Refer Slide Time: 32:38)

So these are the crucibles where if we keep the material it can be (Refer Time: 32:39) deposit. So, this is tungsten crucible. So, why we have different materials, is depending

on the melting point and what is the process that we used according the we have to use the crucible.

Now, I am looking at (Refer Time: 32:50) crucible.

So, this is one.

This is one a molybdenum.

Molybdenum, this one molybdenum crucible, this is graphite crucible.

Molybdenum boards.

These are molybdenum boards, instead of crucible it will be like a board. So, you can see changes that board.

So, this will be for rectangular (Refer Time: 33:04).

This is using for thermal evaporation.

Yeah.

This is a thermal evaporation

This is a UV.

Crucible is not for UV, boards are for thermal evaporation.

Yeah.

This is a basket.

This is a (Refer Time: 33:15) basket. This again like a crucible board.

Yeah some different shapes.

Tungsten baskets.

It is baskets, there is a board shape (Refer Time: 33:23) is like this.

This is basket.

This is a crystal (Refer Time: 33:25).

(Refer Time: 33:26).

This is also a tungsten basket and (Refer Time: 33:33). Tungsten basket, graphite crucible, molybdenum crucible, and molybdenum boards.

Molybdenum boards.

Boards are also molybdenum.

Basket and boards for editing, crucible for the (Refer Time: 33:36).

Ok.

So, basket and the board two things are for carrying the material in the thermal evaporation basket. So, (Refer Time: 33:53) process. And the molybdenum and graphite crucibles are for the UV evaporation process.

This is a.

This is spare molybdenum.

Spare with providing.

(Refer Time: 34:04).

What about during discussion we discussion to providing minimum (Refer Time: 34:09).

Ok.

That is how we.

Ok.

(Refer Slide Time: 34:12)

These are crystals, so you can as we have seen inside there is a quartz crystal molybdenum inside, that is very critical because that measures the deposition rate and the thickness that is deposited. So, the thing is the crystal also makes deposited not in the process.

Yeah.

So, we will have to when offset change the crystal, otherwise our calibration of the thickness measurement is get affected. So, they are current spares. Then crystals are there which you can reduce.

So now, we have planted the power supply for the control panel, we have calibrated the substrate holder into the chamber. We have removed the batteries from the chamber, we have to seen the (Refer Time: 34:51) pump and the turbo molecular pump below the chamber as well as the transformer there. The next means things are connecting it is the gas plug gas flows, connecting the chiller unit, connecting the combustible unit as well as powering on the entire system. So, then we will be able to see the system turning on.

(Refer Slide Time: 35:08)

We have seen the control panel front side, but this is how the backside of it looks like. This is where all the electronics power supplied by MCBs everything will be there.

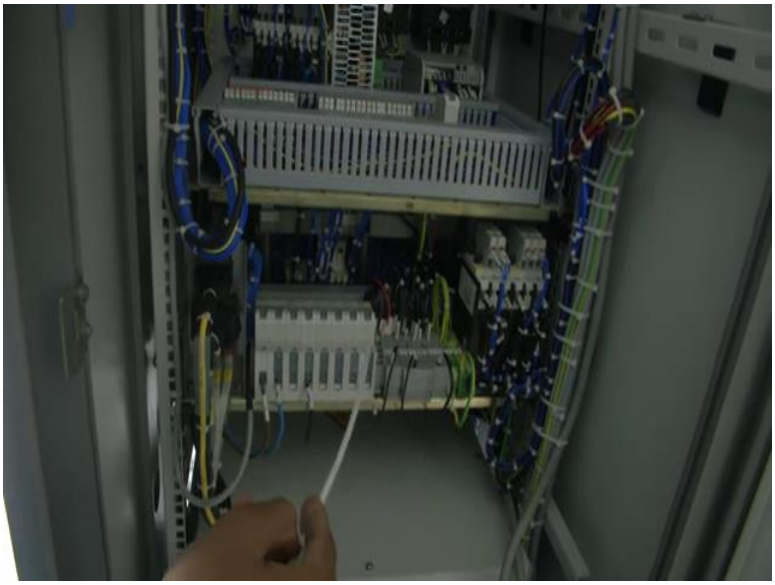
(Refer Slide Time: 35:18)

Whatever power supply we pushed is here sitting here. This is the connector for it, this will go outside to the socket that is not there on the valve. So we will asked the team to explain what is this. (Refer Time: 35:27) sir, can you explain little bit? Yeah.

So, instead when we turned on the system insulated this panel will come around the pull the all assets asses is like thyristor and we given on 24 DC power supply, for a control

circuit purpose, and also DTM also is there in inside the DTM one transformer is there. So, for all the accessories cooling purpose we were given one fan, and HMI is also there.

(Refer Slide Time: 36:02)



Then, see it is for sometimes if some selective switches will not be getting numb on that time, we have we have to troubleshoot. On that time we have to observe MCBs also. Suppose some MCBs are the tripped or what like the type. And this is called a contactor and thyristor 24 DC is supplied, this is for control circuit um. We given two numbers of control tray: one and two numbers um. Then there are also power supply.

So, where is will be the that intelligent like processor board and all where it will be control board; will be here only inside the HMI.

That is we already programmed.

So, these are all valves only, electric valves like switching for switching and all.

It is only.

Knob and all.

No.

Only controls.

Yeah.

The relay switches and all will be there, that is all?

Yeah, it is only control circuit.

Ok, no processor and all.

No.

Ok, some relays is there.

Ha.

By that we will.

Control.

By that we will control that is already programmed in.

HMI.

HMI screen.

Ok. Now this one is what actually?

(Refer Slide Time: 36:57)

This is to operate the EB source we are given three types: one is heating motorized turret to select the source of position is there nah in (Refer Time: 37:06) 4 source selective pockets is there.

Ok.

To operate that motorized turret drive it is.

Ok.

It is EB 3 beam (Refer Time: 37:14).

Direct controller, where controller safe controller.

In EB gun you will get x and y axis know to get that waveform.

Ok.

If we want we x form or y form we will go through this beams to open it to set that axis; x axis y axis and that control of the waveforms.

Ok, of the electron wave.

Electron wave.

And on the turret moment you have the first one.

Yeah.

Motor is turret moment.

Yeah.

That is on the control unit.

This is the DTM thickness monitor.

Ok,.

(Refer Time: 37:47) connection

So, that from the qcm it will come to this.

Yeah.

I mean the crystal it will come to this.

See here this UV motor.

Turret.

Turret indexer E beam sweep controller, this is the high voltage. Means to select beam EB 1 EB 1 power supply current and voltage; it is current one controller.

Ok.

By this controller we can now set the EB 1 current and voltage, we can monitor from this.

So from there through that connected it will go to the power supply only directly.

Yes.

Already inter connected with this cables.

So those cables we will connect to this.

We have to monitor from this controller.

Ok, that white colour is the DTM monitor, it will show the thickness.

Yeah.

Thickness monitor.

So, internally we have to switch it on also that will be on, no. So, it has a separate fuse it fixes own basically, ok.

That switch is it will come from outside of the front panel only.

Ok.