Advanced Neural Science for Engineers
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Lecture 17
Lab 05 E-Beam Evaporation: Demo

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DANGER
THIN FILM SYSTEMS
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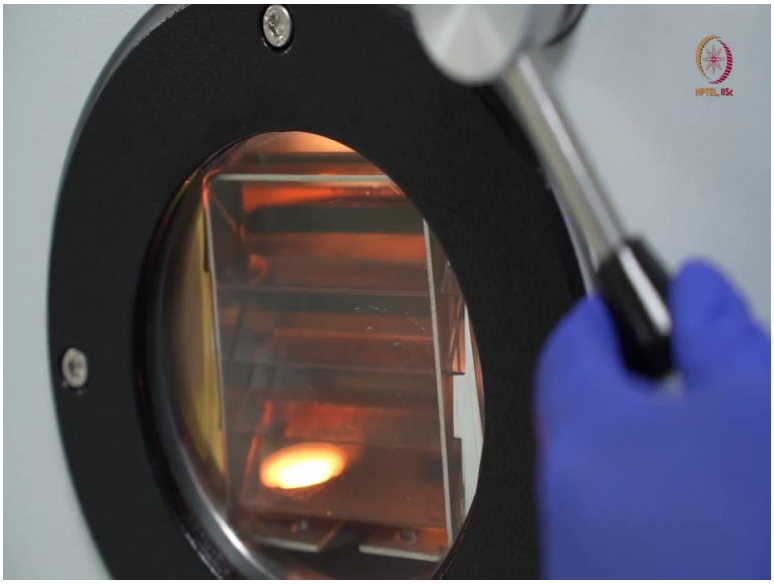
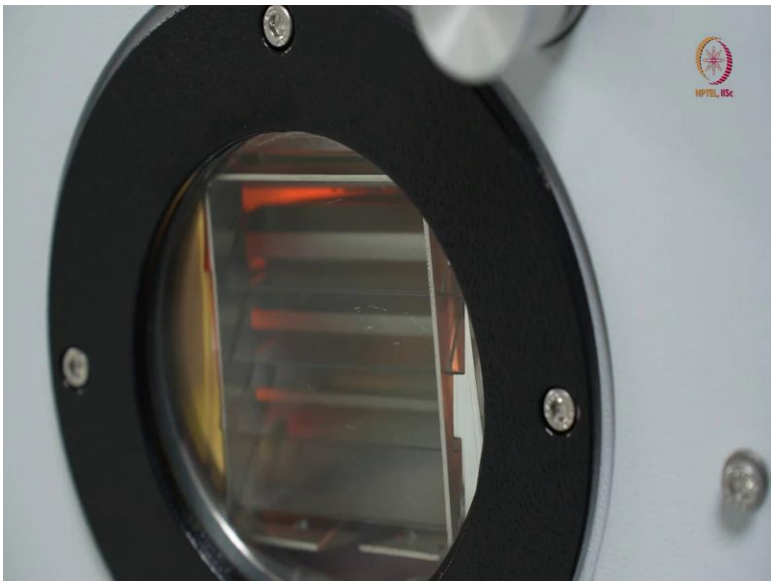

NPTEL IISc



After starting with the second cycle, we waited for almost two hours to reach this level. So, as I already mentioned, it took 2 hours because as per the pumps efficiency, if we could use liquid nitrogen that we have shown earlier that. So, if we could use liquid nitrogen, then they could be done within 45 minutes something like that, but that is not available in our lab right now.

So, here you can see the chamber pressure measured by the penning gauge it is 3.7 E^{-6} millibar. So, actually, as I mentioned earlier, like 3^{-6} milliliters or in millibar, it will come around $4E^{-6}$ or less than that pressure will be good enough for our base pressure. So, this is 3.7 E^{-6} millibar is good as like best pressure for any of the deposition techniques. So, here after this, we can just seal the chamber and start our process.

So, first, we will seal the chamber, if we seal it will stop the vacuum pressure process and now these many options are available. So, our goal is to deposit the material now, so we will press process here. So, when process is pressed, so it will go to the next pump down cycle before that it will go for throttle pumping.

So, that means in this time, if we have any argon connection, then this time could be useful for plasma creation and that plasma could clean the chamber but we are not doing that. And secondly, as we have photo resist coated on that if we do plasma cleaning, then photo resist will go that will basically hamper our whole process flow. So, we are not using that. So, you can see again, it leads to fine pumping too. But that is it.

So, now, let us start the deposition process. And we will start with switching on the electron beam main supply, then we will proceed, so let us switch on TBD power switch. We have shown you earlier. So, that is called now here we will switch on this transformer part when both are done then now we will focus in these area, because other purpose are, so we will focus only this area and this what we will see what is happening inner chamber.

So, as you can see it is in two mode so now the check 2.63, so this you can consider as the base pressure. Now, we will start as before starting only we can see here, the vacuum is going water is on, then root drive that is connected turn is off and power is off and obviously it will is look.

So, it will take some time so this will switch on the output from the after that it will switch of then it will you can see how much constant voltage is delivered. Here you can see 5 kV voltage supply and here we will change this filament power to get a different beat. Now, you can see here the power is also on and that is also on

Now, before switching on this gun, you should make sure that this current should be saved at minimum, because if it is at some higher then it will it can generate a thermal shock further filaments. So, as per the optimized recipe will go so usually we deposit titanium at 80 mille ampere current however we cannot directly reach 0 to 80 E concern. If we do that, then there is a fair chance that we will get a thermal shock and material may not be properly first and second crucible membrane.

So, we will go step by step and we will optimize the screen that way. So, here before starting, we will switch on the sweep controller and see, which possibly is forming so clear we can see EB3 is on. So, we know that we are going to deposit only hence all three now we will see different DTM deposit so from here we can see.

So, because titanium in our tool will have designated appear tool number 2 so let us, change in filled out of tool so now, you can deposit will be going on. The material will be considered as a titanium for based on the properties titanium so as you bring press you can so you can understand these values are actually getting varied.

Before starting with basically disturb. So here first will as per as of an SOP will follow whenever you can use any tool or whenever you are inside just make sure you do it really slow otherwise that is the observe current level and here before this or delivered. and the switch on.

So, that it will give us the actual pattern that will be did you could be adjusted as per the requirement. So, you can see some amount of detention that get started, now you will show to the report now, we know that is not the actual dimensional data and we can see the mechanism property.

So, after that we can start our process, so here before we move the stator going in just start this tradition vary so that it will give up put it in rotation mode and in rotation mode but the uniformity like expected uniformity will be better than this adjustment. So, as we are doing it for a sample and we are targeting to get some proper devices. So, we will do it in rotation mode only. 18 pm here will be the deposit the material so we can see that this happening so we can just see through the report now.

So, as you open the viewport you can see that that is a visible, it is kind of hard first of all and the shutter is also there. So, as per recipe button for the actual time required, so we will just open the shutter see this material has moved from that. So, now material will be deposited on the welfare. So, we will wait till it reaches some thickness that that is the expected thickness. After that we will close the shutdown till the end it will be deposited and we are not supposed to open this for long time because then it can deposit on that glass of this viewport.

So, that is where we just close it for the time being. So, as you can see, 0.3, so as a first step we will closed the shutter. So, as you close the shutter so no other material will go and deposit on that making sure that then we will start decreasing the current again slowly.

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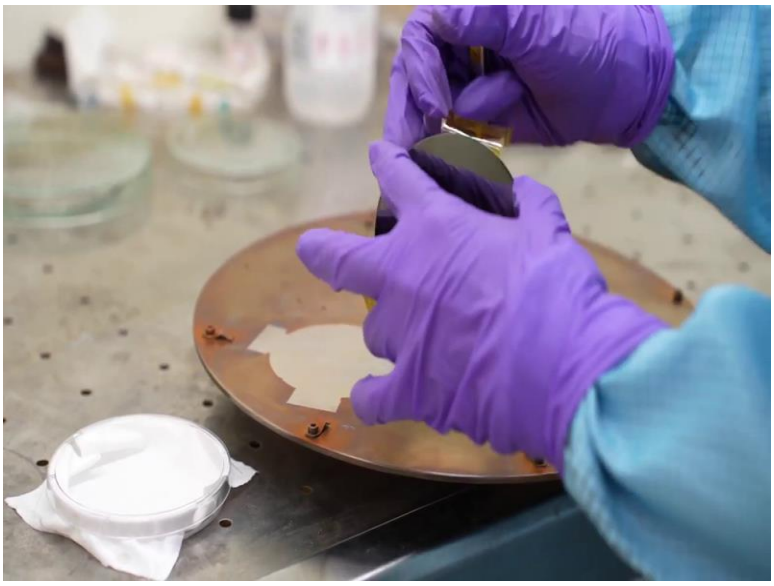
I/O
Reset
EMERGENCY
STOP
EMO
THIN FILM SYSTEMS
High Voltage kV
X
Y


AUTO 500



So, just confirm that it is at a minimum level these values will change so that at that moment whatever value we will get that it should consider here. So, now, we will supposed to change this crucible. So, before the new crucible we should switch off the gun otherwise you are this system.

So, now there is no connection, but we can switch on the big indicator after this way, so you can suppose to that let us go there first. And here are some other value is there, this is for Titanium. So, start the machine the receptor things, then number this set to one sort of corresponds to that.

We will save this and then we will start work again. So, let us see when it reaches this.here is off. So we can understand that this rotation is still going on and it is not ready. See here the rotation

varies on, who is really interested to hear it with them started process again similar steps worked for some time but never know the platinum will take much higher than that it can take up to 200 milliampere.

So, during that time, we need 200 milliampere LCR current level is higher we have to encounter many more steps or we should introduce more number of steps. So, that thermoscope will be minimize. So, let us see we will go for that. So, here we are just not here with this so this will be something different for your deposit so here you can see that we are done with the deposition, we did not want you to show the recipe because that was optimized in our lab.

So, we did not want you to share the recipe. So, that part we did not record. So, here you can see that the question was done we kept that current back to zero similar in the similar way for the titanium it was. So, now after that, I reset this DTM so here just press that will receive the DTM so that we did and other things are still on as of now. So these are the new way off.

So, after that we can switch off the gun so this will stop the heating, then here we can make it zero. And here to as I already discussed the platinum was in crucible to the still it is on. So we will switch off the current controller also because that is not required anymore and we can switch off this and as other things are done and deposition is already over.

So, we can stop the rotation and DTM also we can switch it off here the first thing after any electron beam evaporation you have to switch off the transformer. So, here after that transformer should be off. So, switch off the transformer because this can be one of your main safety hazards electrical hazard basically because it is giving you constant five kilo volt supply. So, after this the supply for electron beam gun should be off.

So, we will switch off that E-Bean gun power what will keep that actual system on because we have to do some other things we have to take that check out so it is deposited already. So, for that still fine pumping is going on. So, it is in process mode will seal it. So, after sealing the chamber, all these options are available.

Now, we can go for a cycle to like increase the pressure or sorry to increase the vacuum to decrease the pressure again, but here probably have noticed that it was in Ieper minus five range

after deposition because when evaporated materials are in the chamber, that will significantly result in falling the pressure or sorry, falling the vaccum or raising the pressure.

So, that is what it happened after this, we can go for weight so chamber is sealed now, if we went it then only chamber will be went but other lines to the pump or other things those will be on. So we want to keep the pumps on because immediately after taking it out, we will go for vaccum cycle again. So, we will press went here. So, chamber when sequence it we will see, see the status here the status is saying the chamber when sequence is going on.

Now and add, add medieval open for era when we show you the vent valve the mean while introducing to this tool, so it is going on. So, whenever it will be done, we can see the chamber from here, as we have told and we will open the chamber and see how is the deposition So, as you press seal so now we are about to open the chamber.

So, let us see how was the deposition the same way we loaded the chuck we took it out took that out. So, here if we see so last when we have shown this part was kind of clean. So after deposition, you can see the material got deposited on this as well as on the chart. So, where for got the deposition and this so here what is the structure as of now?

So, on silicon wafer as a support on top of it, there is polyimide on top of it photo resist layer is there that was patterned by lithography. So, on top of it, we have now deposition of titanium and platinum, this is that structure and so after each and every deposition as our chart will be like this, we have to clean it. So, before that first thing is we will remove this wafer and save it for the further processes.

So here again, we kept it on our solvent bench. So, we have to take it out. So, before taking it out. Just one thing you should keep in mind that this polyimide lead is very susceptible to come out with the things so be careful. We will just take the tips out and as we know that backsides were attached directly so it should not be any problem

So, here you can see this material was deposited and this was our actual effort. This was the condition before deposition however this became like this. So now we will remove the tapes and keep this wafer ready for next process. So, do it bit carefully, if you are practiced enough, then

good otherwise, do it carefully. So here we are keeping it in it here so these are our finally deposited wafer.

So, probably you can see the patterns as well. We will use this for fabricating the device. So, for further processes, we will send it for liftoff. So, now, we will keep the wafer safe in a petri dish, better to avoid touching the center parts because most of the devices are there only. So we already closed it. We will keep this in designated again. This part is done. So, our next thing is we have to clean this chart that we will do offline anyway.

So, we can save the file for our next processes. We kept in desiccator. So, next process will be liftoff where we will remove the unwanted part of the deposition and get the pattern. We will come back with liftoff process in the next module. Till then take care. Thank you.