Fabrication Techniques for Mems-based Sensors Clinical Perspective

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Lecture – 49
Introduction to Equipments: Oven

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Welcome everyone. Today we will see another important equipment that is used in a micro fabrication lab. This is a standard oven or oven, if you want to pronounce it correctly. This is a standard oven. We have Suman Chatterjee here with us to run you through the different knobs and features available in the oven. So, this oven can go up to whatever oven we are showing you today, it can go up to around 250 degree Celsius. So, what are these? What are its applications? It can be used for especially for micro fabrication, for say PDMS molding.

If you want to cure PDMS and make it hard. If you have a process cycle, where you have to heat your sample to a particular temperature, and cool it down to another particular temperature, keep there for a set amount of time, and again take it to another temperature. So, if you have some thermal cycling profiles and if you want to do that, then you can use the oven for this, ok.

The oven although a very simple equipment when compared to the other equipment we have seen till now. It is still a very, very fundamental part of any lab actually, not

necessarily a microfabrication lab, it is a fundamental part of any lab. So, what are the utilities? As I have mentioned, it can be used for curing materials like PDMS or let us say you have a biological application where you need to grow the cells at a higher temperature; say if 70 degree Celsius. Or you want to prepare some chemicals formulations at particular temperature, for all that you can you can instead of using a hot plate, you can use in oven.

So, there is another equipment that is available to do such thermal cycling is called the hot plate. So, that will be just a plate as a name suggest. It will just be a platform that can go to particular temperatures and come down. There the problem is the temperature is very localized, the temperature ranges happen only at the surface of this plate. That surrounding it will take lot of time for the surrounding to ramp up to this temperature. So, the sample if it is a 3 dimensional sample let us say, it is bulky and it occupies space, it would be difficult to heat such samples. In such scenarios an oven like the one that we are showing today we will become more useful.

So, Suman here will run us through the different I will he will show you and I will explain what are the different knobs that are available in this oven. To start off we have not switched it on. Let us just open the door and see what how it is arrangement inside.

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So, as you can see, there are trays where you can keep your samples. There are 2 trays where you can keep your samples. So, he can you can even take it out, because you need

to maintain this trays in a very clean manner ok. Frequently you have to take it out and clean it properly.

So, and at the back of it even you cannot you cannot see here, but at the back of it there are coils and fan arrangements that are used by the control system in this oven to maintain the set temperature. There is a small metal part care above that acts as kind of an exhaust for it to maintain the temperature. Let us say it gets heated up very much. Let us say we set the temperature of the oven 70 degree Celsius, but this is a physical practical equipment right.

So, it by in trying to reach to 70 degree Celsius it might go to 75 degree Celsius. And the control system will find out that it has reached at to 75 degree Celsius, and the control system has to come back to 70. That time what happens? If I would have to went out some heat. For that it will use these exhaust knobs to control the air inside or to take in new air so that the say temperature can be arrived at. Now, let us switch on the equipment. So, this is a switch. So, Suman is now switching on the equipment.

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So, as and when he switches on you will hear a tuck sound, that is the all the coil everything powering on. Now we have so, Suman will show you the where you will set the temperatures. So, we have a touch panel on top of the oven. So, there you see, if you see there is a green set button which he is pointing to. So, if you click the set button, you

can actually set your the temperature. You can actually set the temperature that you want to look at. Let us say we will keep it at 55 degree. So, Suman is adjusting it.

So, instead of decreasing the decimal place, you can actually shift the decimal place using the shift key, just show them the shift key. So, this is the shift key that is available. If you click that, it can shift the decimal place which you want to decrease. Now because he has to go to 55 he has change 6 to 5. Now he will change, he has set it to 55 degree Celsius. Let us see what is set value, it is 55 degree Celsius. SV is set value, PV is present value. Because we had closed it at the temperature, it has already ramped up to the temperature.

Now because the temperature is higher, as you can see this temperature is higher it is slowly settle down to a lower temperature. That is a set value. This will take some time, as a control system has it is sends the present temperature make a decision after comparing it with the set value and then reduce the temperature.

And then over time this will set conclude that to 45. Now let us say we increase it to 70 degree Celsius. Yes, now the set value is 70 degree Celsius, and the equipment is running. Now it is slowly ramp up, it will go to see now once it starts telling that out signal will start going. Now it is slowly start ramping up to 70 degree Celsius.

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If you can see there is another display that is shown above this touch panel display. So, that is a control system from another point within the oven. So, basically the oven will have sensors at different points inside the chamber ok.

So, and then form those sensor points this control system will sense the temperature inside, and it will accordingly change the temperature so that it will go to the target temperature. So, these 2 are from different sensors within the oven, and they work together to give you that your target temperature, that is a whole idea. Now we can even so, let us switch it off now. Means, once we switch it off it will ramp down to a normal temperature. So, Suman switching it off, before we open or close the oven, you should switch it off.

Now, we cannot you should not now the temperature inside they set very high temperature. Now 60 degree Celsius is ok, you can still opened it is not a problem, but if he set that like a temperature call temperature like 200 degree Celsius, do not just go ahead and open the door. Weight for the system to settle down, come down to a normal temperature and then open it. So, let us wait for few minutes, and then we will open the door ok.

Now, we think that the inside temperature is manageable now. It has come down to a normal temperature. Now Suman will open the cage door, he will insert a sample which he wants to heat. See that the sample is put inside Suman can you show the sample inside.

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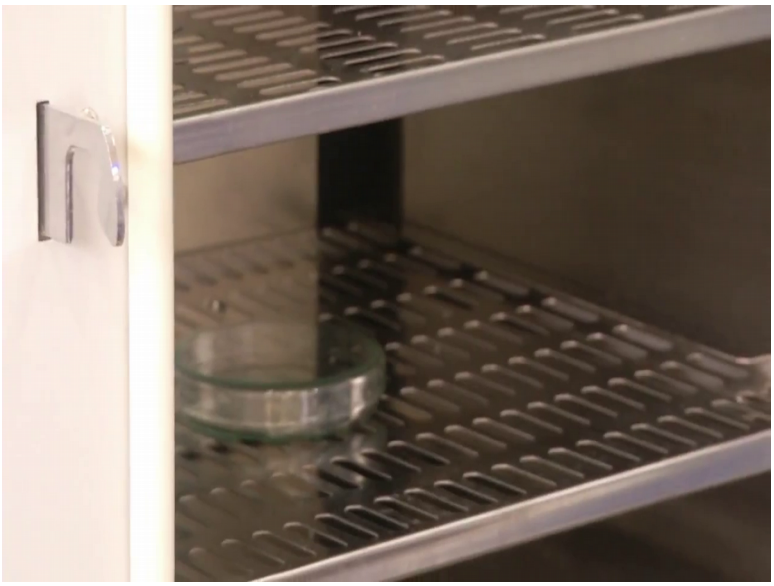

So, that is a PDMS membrane that is kept inside, and it is put in a glass, glass dish, why we are using glass dish? Because glass dish can withstand very high temperatures and your sample inside can be cured properly without affecting the container which is a.

Now, Suman has kept the sample inside sufficiently inside so that it gets soaked in the environment to; never try to keep the sample very close to the gate entrance of the oven. Keep it inside so that it gets properly soaked within the environment in the oven. Now he has kept the sample inside, now he will close it. Now we will switch on the oven, that sound came, and the set value is 70 degree Celsius as we had set it before.

So, it will retain the memory from the previous power on. And it will try to ramp up to the 70 degree Celsius inside. Let us just give it 2 minutes. So, while is ramps up, we will discuss a few precautionary measures that we should take care. See now we have put the sample in a glass Petri dish as we had seen.

Let us say the dish reaches 70 degree Celsius, and suddenly you think that you are something is happening to your sample. Something is happening to your sample. Then you think something is happening to my sample I need to take my sample out immediately. Please do not do that. If you directly open and take the a sample out, what will happen if your glass your Petri dish is made of glass right, the glass Petri dish will undergo something for thermal shock.

Because your outside membrane it might be an air conditioner lab, it might be said 20 degree, 22 degree Celsius, inside the oven it is 70 degree Celsius, you are suddenly opening the door and taking your glass Petri dish out it will simply crack. That is called thermal shock. Please do not give thermal shock to your equipment ok. Your something might have happened your sample; that means, you did not do your homework properly or something unexpected happened. You can always try your experiment again.

In your last which efforts to save your sample, do not do something you can actually term as immature in the lab. Please do the homework properly and do follow good lab practices. These are also part of good lab practices. Now if you can see the control system is slowly slowly ramping it up, it has reached 59.7, it will slowly become 60 and it will ramp to 70 degree Celsius.

So, these are guys these are the main things that you should worry about while using an oven. And we have seen what are the different applications for an oven, how an oven at many instances is better than a hot plate and why it is a very important and necessary equipment in a laboratory setup.

Thank you, see you next time.