

Sensors and Actuators
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Lecture - 09
Introduction to cleanroom

Let see where they are actually fabricated and where are they tested. conventional cleanrooms are classified based on ISO standards. there is class 1, class 10, class 100, class 1000, class 10000 cleanroom and it goes on. the classification that talks about the classification are the number of particles the count of particles present per cubic meter is what counts in a cleanroom.

here in the facility in DESE the Department of Electronic Systems Engineering in IISC Bangalore is, we have a class 10000 cleanroom. In class ten thousand cleanroom approximately it should be around 20,000 particles of size greater than 5 microns should be limited for the given cubic meter area now that we have understood cleanroom has been classified based on the particle size it is count in the given area. This is a class 10000 cleanroom and there is a certain protocol that needs to be followed, mainly because not want to contaminate, there are stringent rules on the particulate count in a cleanroom.

In order to limit this in order to limit the amount of contamination in a cleanroom follow gowning procedure Initially you see may having a lab coat, let see in sequence what is the gowning procedure which has to be followed even before you enter the cleanroom and start working or you know characterizing or understanding how your devices have to be fabricated or tested.

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initially wear shoe covers.

Initially like you see I have shoe covers on top of my shoes, even before you enter the room it is mandatory to wear shoes to the laboratory., that just so that you are protected as well as you do not contaminate just to follow a certain hygiene procedure while you in your work environment. It is always suggested to wear shoes that completely covers your feet, one set of once that you see that I have shoes and then on top of it we have shoe covers., the shoe covers are placed outside the cleanroom door, even before you enter you wear them on top of your shoes and then enter the cleanroom. Next is your lab coat.

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you can choose based on the size choose the right lab coat from here to pick up and wear your lab coat. Next move to the other bench where I wear the hairnet facemask and gloves.

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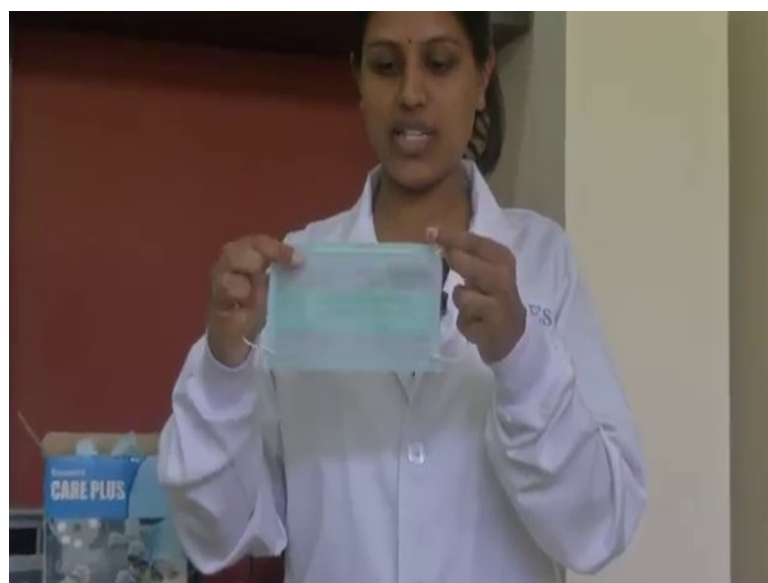
there are three sets of gloves based you ideally you should choose the size according to what fits you this was a small-large and XL. choose the right size of gloves, so that when you are working and you have you do not have the right size and then that would be

difficult for you to handle devices or tweezers or you know while I am taking devices from one station to the other. it becomes important to choose the right size of gloves.

what is the type of gloves you are wearing? assume just doing some characterization at workstation not handling any chemicals just a study under the microscope. in that case, prefer going with nitrile gloves, so this here is the nitrile gloves., you choose to wear nitrile gloves when you are not dealing with any wet bench or dealing with chemicals or something external when you are just doing a basic study. you could always choose this just to prevent any sort of contamination that can go from you know the hand your hands to the device.

you do not want any sort of oil or skin flakes which would just contaminate your device. Like you should always keep in mind we are talking about micro-engineered devices or micro-engineered sensors., even while you fabricate these devices you should keep in mind that the dimensions of these devices are a few nano and micrometers and even a small amount of particulate contamination can hamper the working of your devices. keeping all this in mind it is very you know important to follow these gowning procedures as a fundamental need and then you can go ahead to understanding more about the devices and study more about how fabrication can be carried out. now that I have now that I am just demonstrating to you.

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Let me wear the nitrile gloves and even before I touch the gloves, what I am doing now is I have this set of face mask as you can see it has strings on both ends and then a thin white strip here.

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this comes on the top side and this at the bottom. the need for having this is there is a metallic strip., it bends according to so that fits rightly into your nose.

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, now I have my face mask, make sure the face mask covers your entire mouth. Again, you have to protect yourself from inhaling any sort of aerosols or airborne contaminants,

because we are talking about integrating biology with micro-engineered devices. when we are talking about studying cells and tissues you should always be aware that that could be aerosols that are emanated from these tissues or cell culture samples. And again, the advantage of having the face mask is twofold, protect yourself from these aerosols which are the priority and on the second hand, you do not want to contaminate the environment.

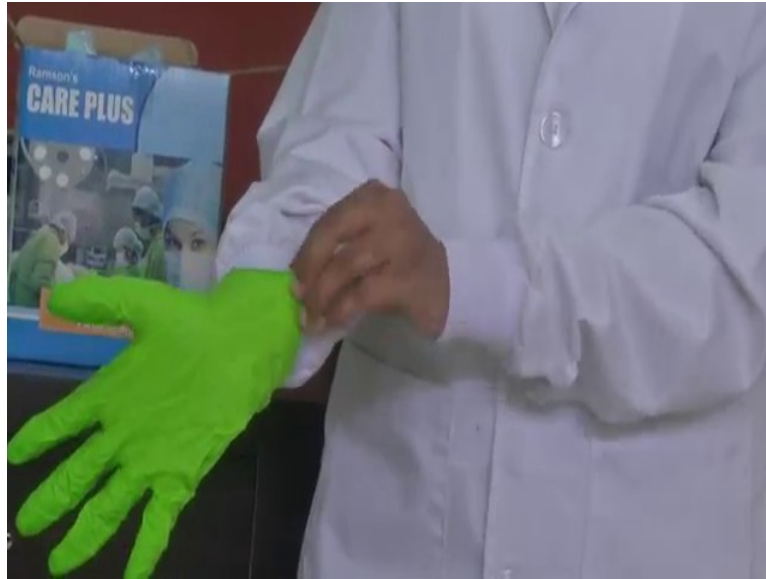
even the smallest cough or sneeze could contaminate the air which is surrounding us. that we have understood how stringent the gowning procedure is or has to be followed in order to maintain the environment in a class 10000 cleanroom. After I have worn the facemask the next thing that I am doing is I have the hairnet.

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Here like you can see if you have long hair always ensure you put it up and then you do not want any sort of dangling earrings or makeup none of that scorch should be allowed. Because even that they could contaminate the environment. now that I have tied my hair, I have the hair net which goes covering my complete hair and the head.

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now that you have seen I have a face mask and a hairnet, what I would do next is use the gloves. what happens is what if I just use the pick up the gloves and then wear my face mask. So, what happens is the gloves while you touch your skin or hair there could be contamination, there could be oil or sweat which could contaminate your gloves and then when you are handling your devices with the same contaminated gloves, that could hamper your the characterization of the working of your device.

finally, what I do is wear the gloves after wearing my face mask and hair net. And then another thing that you have to observe is while you are wearing your gloves make sure this comes over your cuff of the sleeve. that it is completely covered if it is below and then your skin could be exposed and there could be penetration of chemicals or fluids which could enter through this. it is always followed that the glove would go just above the cuff of your the gown sleeve and this what I am wearing now is a simple nitrile glove.

Like I mentioned if you are working on a wet bench and your and you are doing some sort of wet bench activity. you will understand more about what wet bench is and what is it used for you would understand that you would be using chemicals like HF, which is the most dangerous chemical the man has ever known and it could penetrate as through your skin and even into the bone.

a wet bench is that you need to follow gowning procedure very stringently while you work, in wet bench and then the type of gloves that you choose in a wet bench is you wear the thick silicon or the Mapa gloves. again there is a different set of classification for the type of gloves which has to be followed depending on your workstation understand what is the type of work what you would be doing and what is the type of you know the gloves or the equipment which you have to wear which would suit your work environment.

Now, that I have my gloves and the remaining thing, assume I would be working with a light source that has high intensity. assume there is laser source and I would be working using that to do some sort of characterization. When you are it is again it is important to understand that when high-intensity light falls it could harm your skin or it could even damage your retina or your eyesight.

Another important thing which has to be followed while your gown in the cleanroom is wearing the glasses. it is there on the other end of this bench. let me go there and show you how those glasses have to be used in case you are dealing with high-intensity lights or wavelengths of lights which could affect your eyesight.

following all this let see how the glass, the glasses could be worn and then you are ready for your workstation and then you can go on working safely. that you neither contaminate the environment as well as you are protected you are completely protected from any sort of you know the primary danger that could affect you. now let see the glass wear which is on the other end.

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here at this end are the glass wears which are just to protect your eyes, while you are doing while you are in your workstation. this is one such eye gear and then you can see there is another I gear here, again you have to choose the type of I to gear what you would be wearing and while after your work always make sure you do not touch the surface always ensure you hold it from the sides. Because your hands could be contaminated, and it is not visible to your naked eyes. always ensure the practices which are clean and safe to you and as well as the next user who would be using these while he works here.

now when you are just doing with high-intensity lights you want to protect your eyes from all of that you could use these type of glasses and then when you are working at wet bench, then maybe you do not want any sort of liquid we just fly and then it could sputter and then fall onto your eyes. In order to protect it completely from all sides, you have an eye gear something like this.

make sure you have it properly fixed onto your eyes, in case you have specs or you are using assistant then you could always wear your specs on top and then use these gears on top of your specs so that your vision is not hampered. this was the entire gowning procedure that has to be followed in a proper sequence, even before we go into fabricating our devices. Now, just to get a clear picture in short let see how this how we follow this entire procedure from the beginning again in a very quick note.