Glass Processing Technology
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Lecture – 06
Glass Coating Technology

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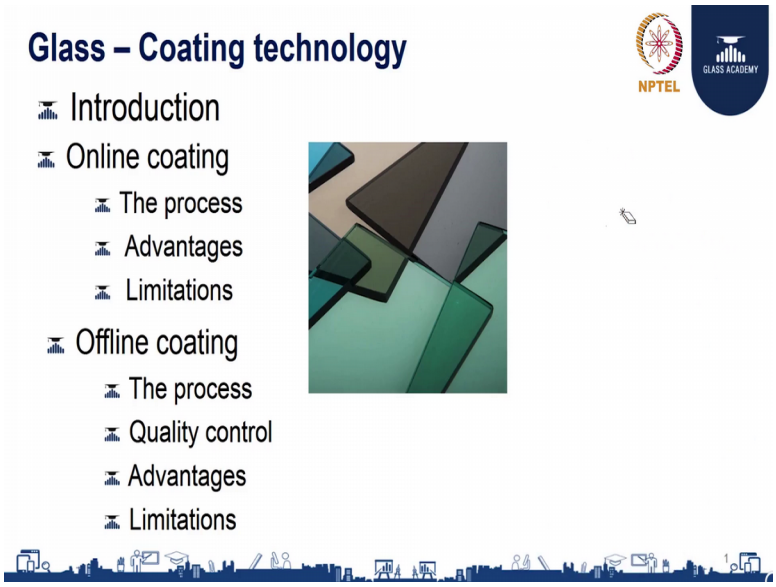

Hello, in today's session we are going to see about the Coating Technology on Glass. I am Swaminathan, I am associated with the (Refer Time: 00:28) for the last 13 years. I am in charge for the coating operations in the Chennai plant. The topic was today will be basically the introduction on the need for coatings on glass and how do we add value on glass by coatings and the different process of coating.

First the online coating, we will study about the process, its advantages and its limitations. Then the offline coating process we will detail about the process, the quality control methodology, the advantages and the limitations of the process.

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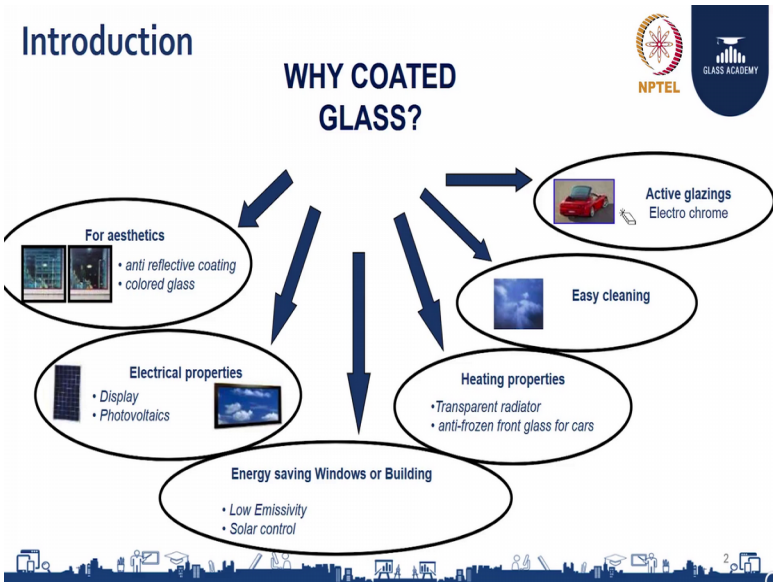

Why coated glass? What are the value additions on the glass that is achieved by coatings? Let us basically have a overview. First functionality can be in terms of energy savings, in terms of for building and exceeded glazing applications. Second could be on for better aesthetics, for anti reflective and also for colored glass and we can achieve good electrical properties in terms of display and photovoltaic applications.

And, glasses are also easy to clean. So, that is that will be an adder functionality by coatings and there can be heating properties where we will have no anti for anti froze and anti fog applications on that and last could be active glazings where we will have the glazing which will respond to the atmospheric conditions. So, these are the functionalities achieved by coatings on glass.

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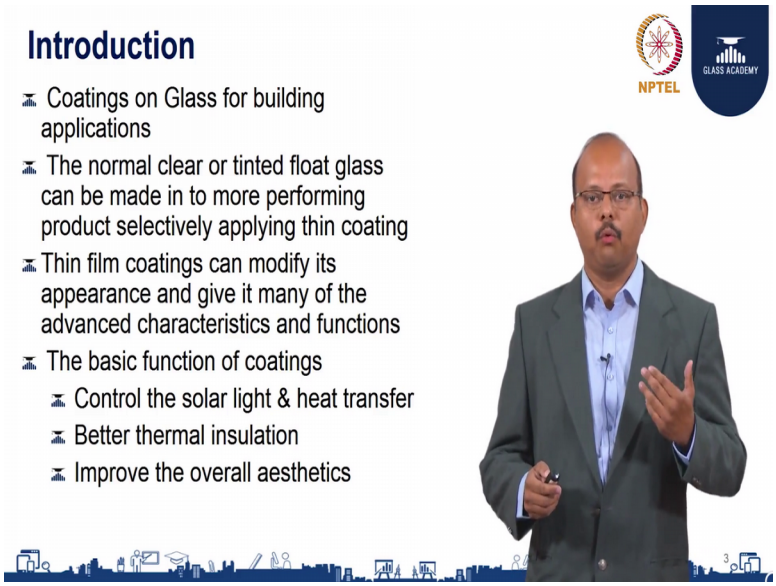

Now, going forward let us understand specifically the coatings for exceeded glazing applications for buildings. A normal clear tinted glass can be made to be more performing by adding selective thin film coating on the glass. The thin film coatings can modify the appearance and gives it a advanced characteristics and functions.

The basic functions that can be added on the glass could be the below; one could be in terms of solar control and control of light and heat transfer and better thermal insulation and improve the overall aesthetics of the building.

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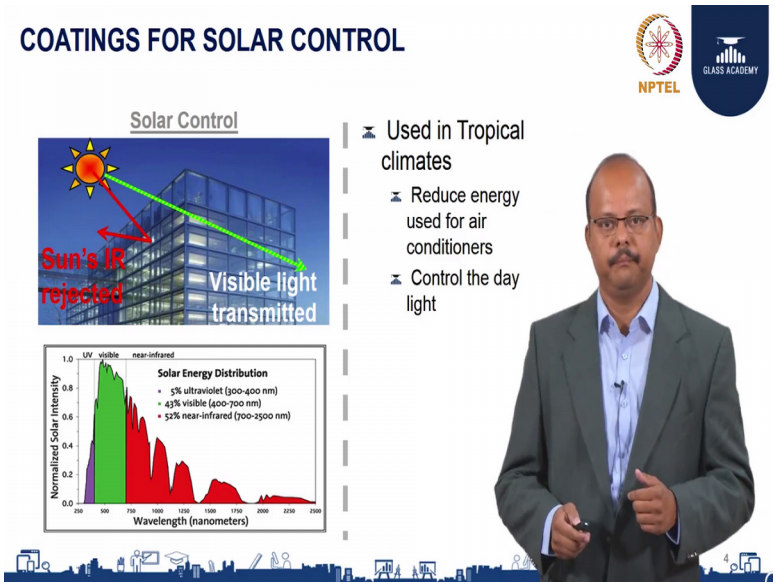

So, the main functions of the coatings in terms of basic thermal insulation and solar control we will see in detail here. So, internal solar control what we have here is the solar spectrum where we will the complete solar spectrum in with the solar wave wavelength.

Here in terms of the overall energy distribution the idea here is to let the maximum sunlight inside the building and cut the solar heat outside. So, the coatings achieve this functionality and the applications is mainly in terms of tropical climates where we will have the added advantage in terms of reduced energy for air conditioners and controlling the daylight entry into the buildings.

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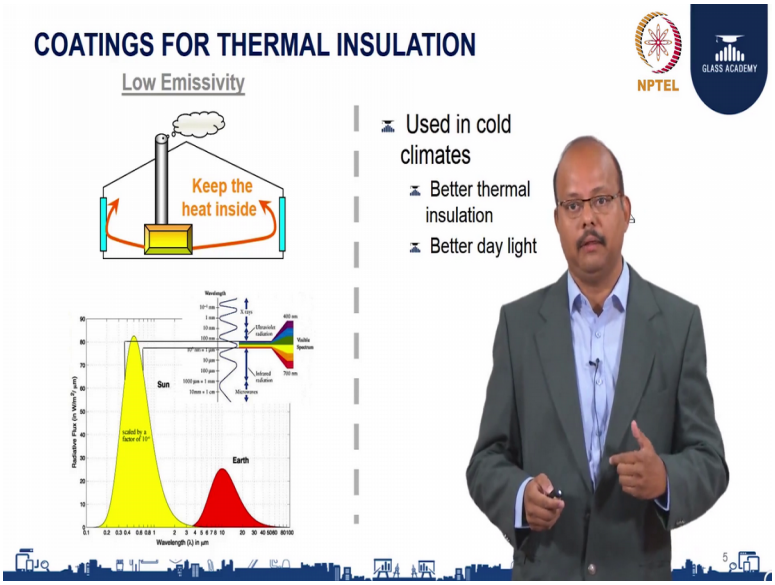

The second applications is in terms of low emissivity where the interest is to keep the heat inside the building. Here the major you know the major focus is on the controlling the emissions from the black body emissions that is within the building. So, here the glass acts as a insulation complete insulation material.

So, the applications here is in terms of mainly in coated cold climates, where we will have for better thermal insulations and we are having daylight entry into the glass into the buildings.

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So, basically these functionalities achieved by the major the processes which can be categorized into two major functionalities; one is online coatings and second is offline coating. We will see each of this in detail in the coming slides.

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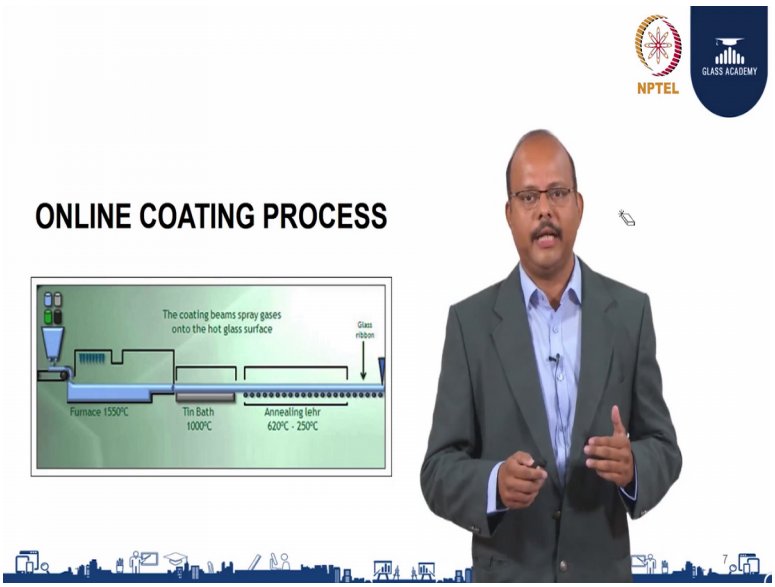

First we will cover the online coating process.

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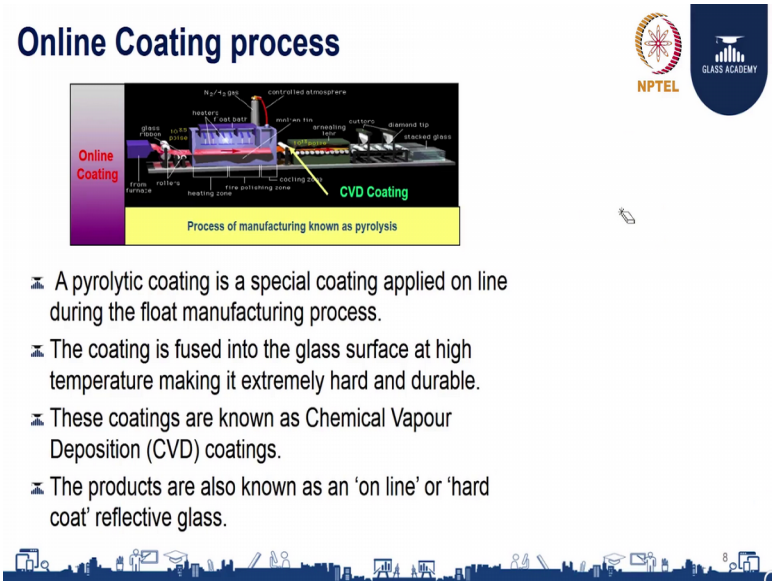

The online coating process, it is traditionally a pyrolytic coating process which is applied in the float glass manufacturing process itself. Here the coating is fused on to the glass at high temperatures mixing it making the actual coating extremely hard and durable. These coatings are generally called as CVD or Chemical Vapor Deposition coatings. These are also known as online coatings or hard coating reflective glass.

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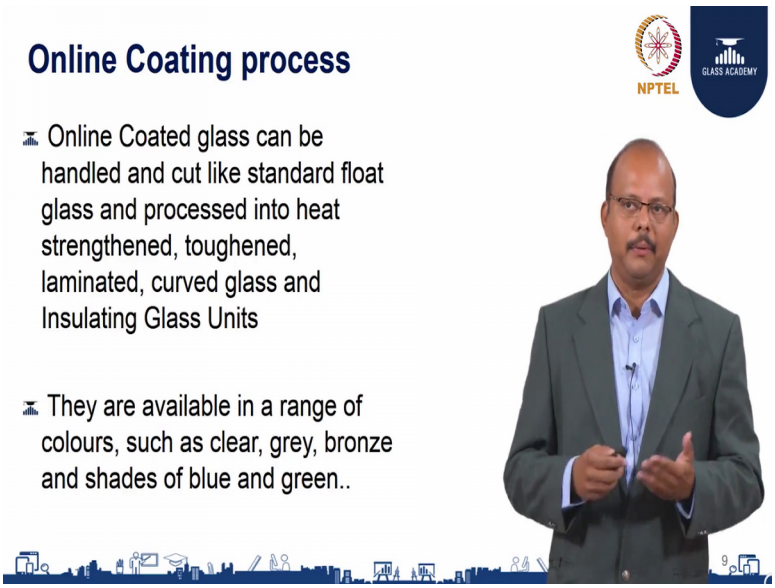

These online coated glass can be processed in terms of standard float glass process they can be heat strengthened, toughened, laminated, curved and can be used in IGUs. These

you know a online coated glasses available in the clear and also in all the available tints that is produced by the major float glass manufacturers.

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Now, let us move on to see the advantages of this online coating process. This online coating process by virtue of its scale of processor it is a large production runs are possible and this is by the by it is scale, it is highly economical and also the process is quite simple in into it is not very complex and it is easy to install, maintain and manufacture. So, these are the major advantages of online coating process.

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Let us now understand the limitations of this online coating process. So, first we have only yes, limited number of layers that is possible in terms of this online coating process. By virtue of limiting the number of layers we are also have the limits on the performance that is achieved by this online coatings. So, either in the forms of limitation in terms of the energy saving that could be achieved or in terms of aesthetics that could be that is the limitation here.

And, by since it is large scale process we have limitations that it is not flexible. So, it cannot meet the customers demand in terms of varied sizes and small production requirements or small volume requirements and it is not scalable to meet the emerging marketing needs. Any new functionality that is needed by the market we do not have the technology which can which can respond to these needs. So, these are the major limitations in terms of the online coating process.

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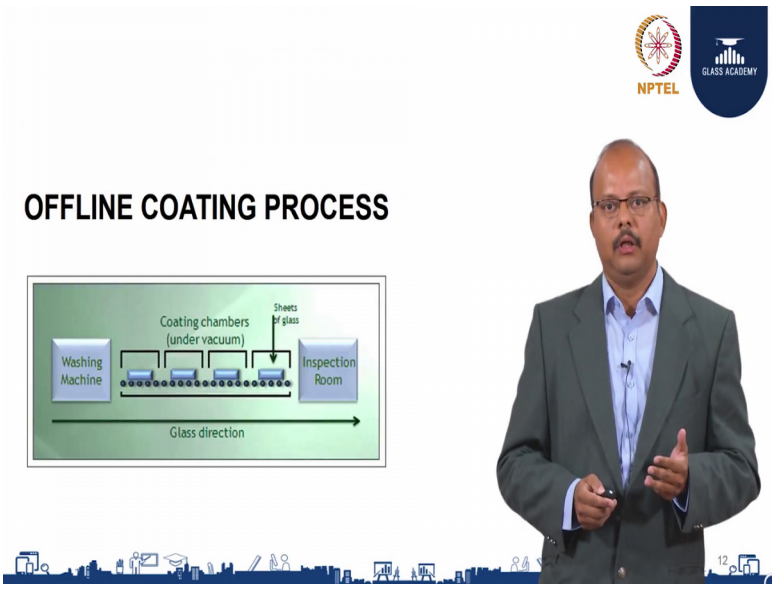

Now, let us understand the offline coating process in detail.

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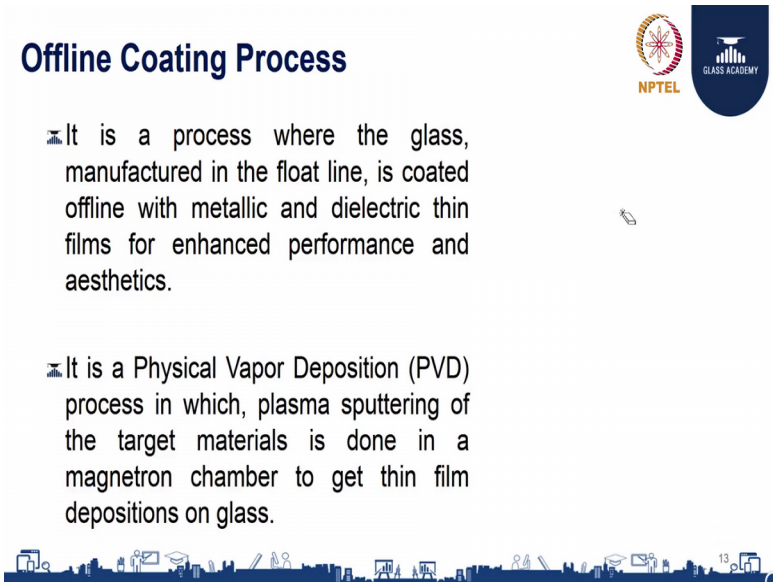

The offline coating process is it is actually a process which is happens outside the float glass nope line where the class from the float line is coated with thin films that is metallic and dielectric thin films wherein we will achieve enhanced performance and aesthetics. It is generally a PVD process in which plasma sputtering of target materials is done in a magnetron chamber to get the thin film deposition in the glass. So, there are several thin film layer that is a deposited on the glass to achieve this enhance performance and aesthetics on the glass.

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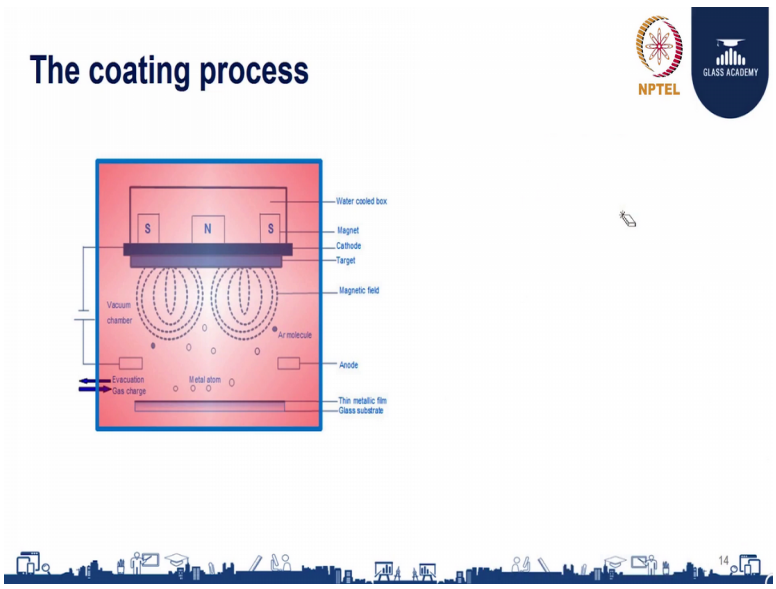

How is the coating process is done? We will see it in more detail in coming slides.

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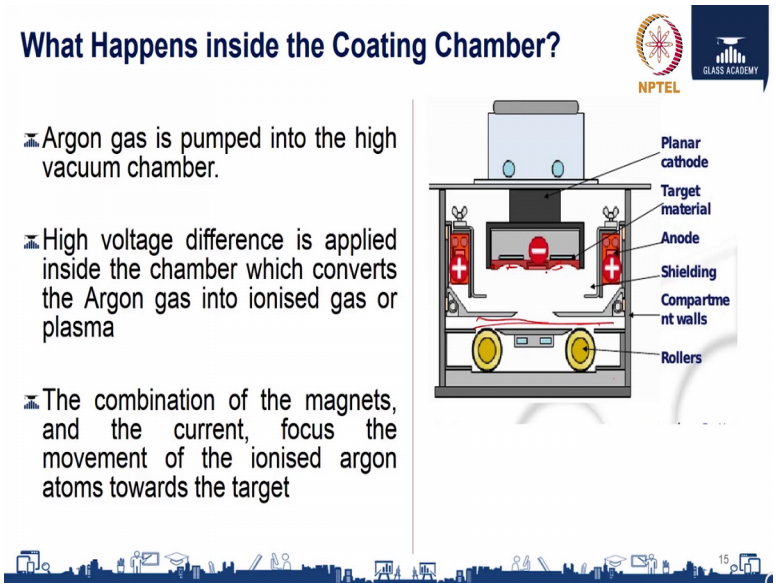

This is the typical cross section of a sputtering chamber. You can see here we have this chamber this entire chambers is kept under very high vacuum. The vacuum level could be in the range of 10 power minus 6 millibar range. Here we have in this sputtering environment in on the these are the rollers in which the glass the glass will be moving on the surface at a fixed line speed. The material that needs to be deposited on the glass is fixed here as a target material. This is the target material and the glass will be moving on the top of the rollers at a fixed line speed this entire chamber is kept under ultra high vacuum.

Now, so, in this vacuum environment we now have the process gas which is normally an argon gas is pumped into this high vacuum chamber. What happens here is the and on top of this we also have a high voltage potential dip which is applied between the chamber and the body as chamber and the cathode. In this high voltage environment the argon gets ionized and no it gets converted into argon ions and it forms the plasma around the material that is the target material that needs to be deposited on the glass.

So, moving on so, this is also the entire plasma is concentrated on the surface of the targets by its combination of magnets and current. So, this is and we have also have the kinetic energy transfer taking place from the you know argon ions which is hitting on the surface on the target here.

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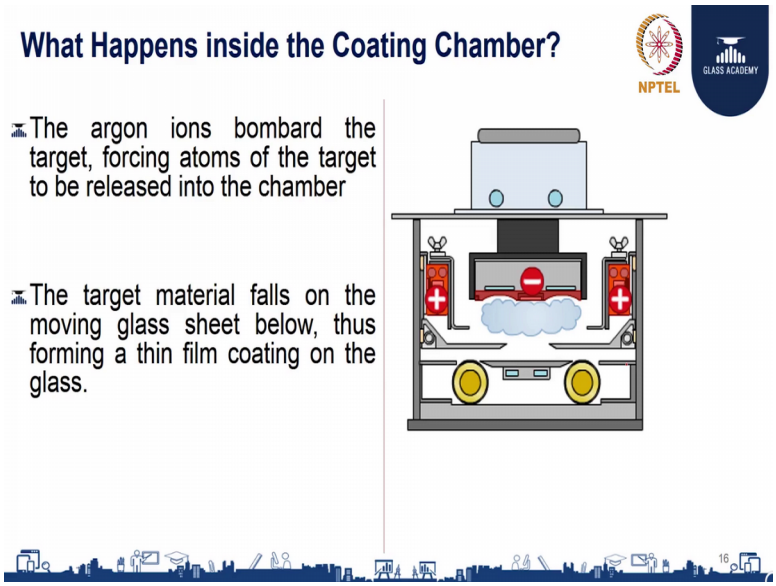

So, the argon ions bombard on the target surface forcing the atoms of the target to be released in the chamber and these target materials as a no from the surface of the target it falls on the glass sheet below and forming a thin film coating on the glass. This is how a thin film layer is coated on the glass like in a coating typical coating chamber we have no series of chambers wherein we have one layer on top of the other coated as per the needs of the product.

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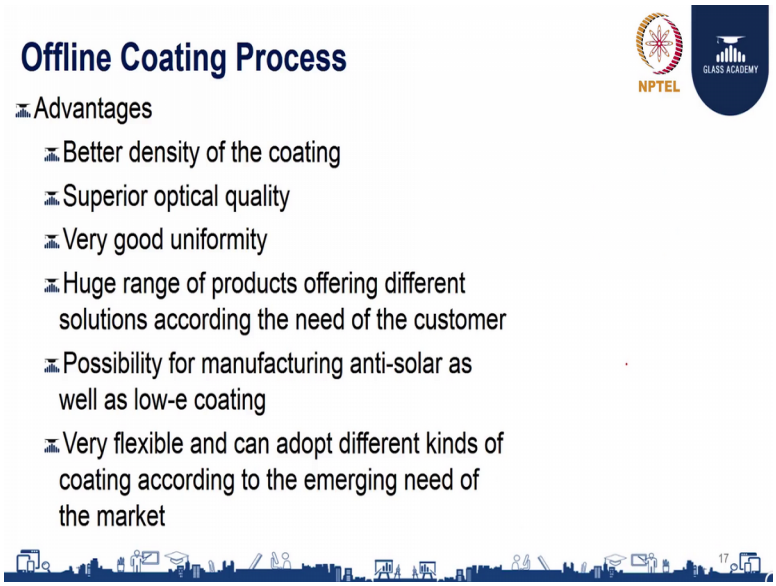

So, let us know understand the advantages of this coating process. So, the main advantages are in terms of better density of coating and we by this thin film coating we also up achieve superior optical quality. And, we will have very high uniformity in terms of very good uniformity across the width of the, you know glass layer. And, huge range of products is possible as per the needs of the customer. We can manufacture both the as we saw earlier the both anti solar and low-e range of products in this offline coating process.

And, this process flexible and it can also adopt to a different needs of the coatings that is can be emerging needs of the market can be addressed by new technology is that is you know possible from this offline coating process.

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The limitations of this coating process is it needs capital investment and since the process is quite complex it needs expertise in terms of both process management and also in terms of product development. So, we need deep process expertise here to manage this.

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