Glass Processing Technology
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Lecture - 73
Glass Processing-Applications, Innovations and Futuristic Trends

Friends, today we will be discussing about Glass Processing Applications, Innovations, Latest and Future Trends. My name is Cornel Shailesh Pathak and I am from Art in Glass. Before we start this lecture proper, let us recapitulate what all we have learned before. I take it that you all know a basic types of glasses based on their manufacturing process; like Float glass, Rolled glass, Figured glass, Tinted, Coated glass and Extra clear.

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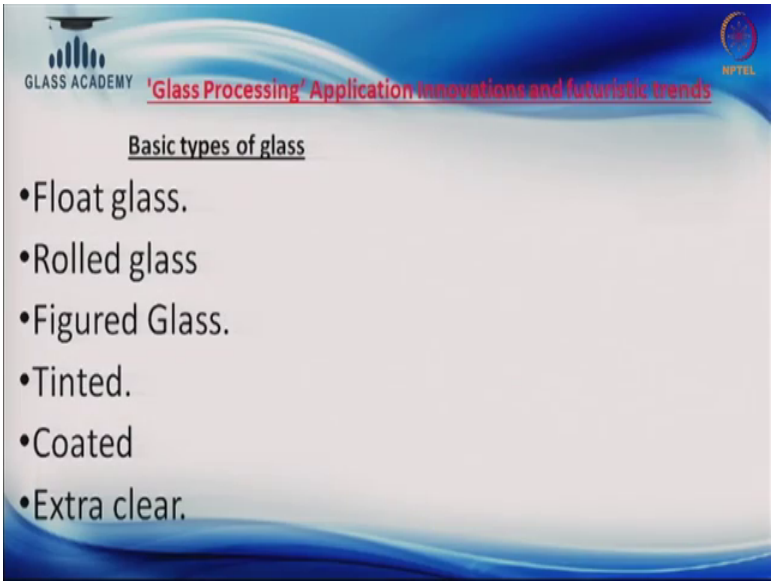

They all have the separate requirement; they have separate applications. You all must understand, but today we will not be discussing on these points.

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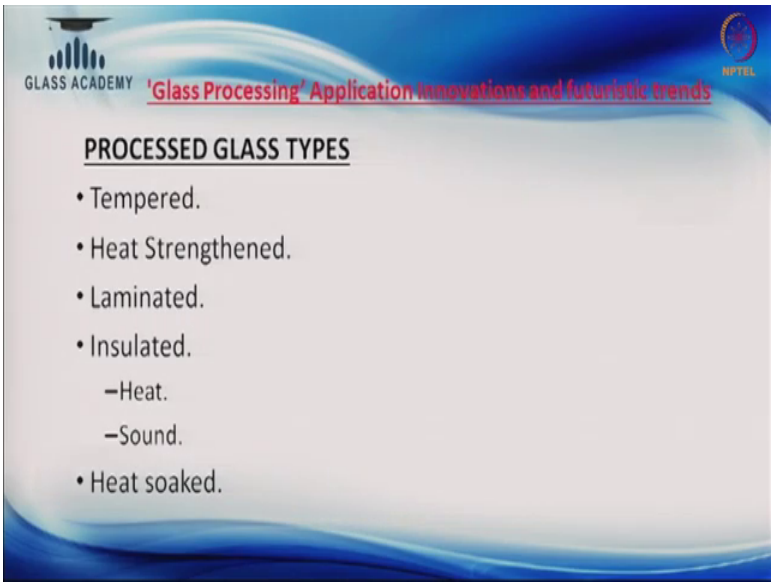

Next you all have understood about glass based on processing. So, tempered glass, it is also called toughened glass. Another variant is Heat Strengthened, Laminated glass, Insulated glass. Insulated glass provides insulation from heat as well as from sound. And then another type of glass based on the processing is called Heat Soaked.

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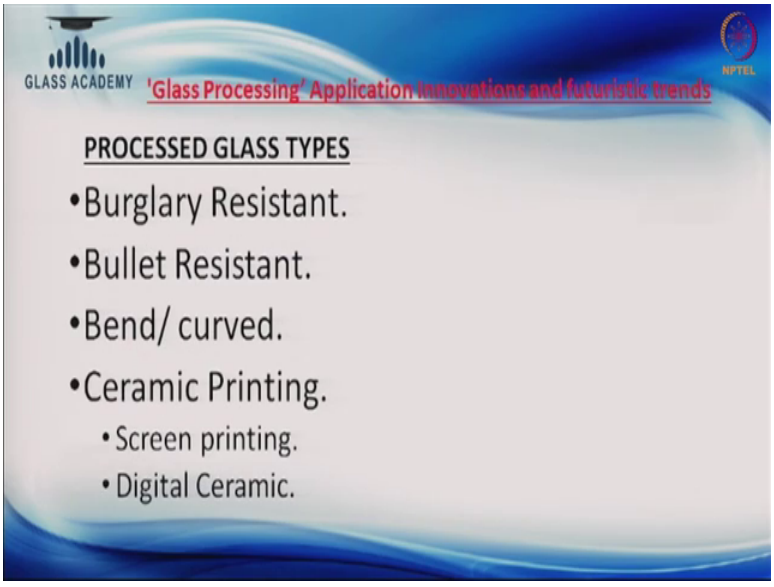

Based on application we also classify glasses. So, one is burglary resistant glass. This is one type of laminated glass; where based on the threat we laminate number of layers of glass with material in between. Similarly, another application is bullet resistant glass.

These glasses are based on the threat level; which we have designing glass for. There are many specifications, NIJ specifications, British specifications.

So, before selecting a bullet resistant glass we want to know what is the threat visualize. We will be studying later on all these topics. Then based on our applications is bend glass. Generally, we use this type of glass for some staircase or some decorative purpose also, or in very prominently in furniture. Another glass process is ceramic printing. Ceramic printing is done by 2 means. One is silk screen printing and another is digital ceramic printing.

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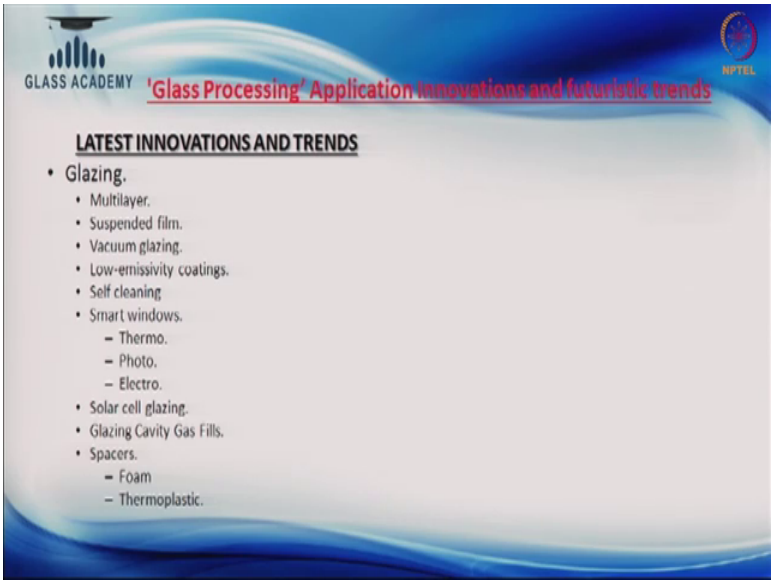

So, this was a recapitulate what we all have learned in previous lectures. Now, we will be learning about latest innovations and trends in glazing technology. First of all is multilayer glazing.

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So, multilayer glazing you have a double glaze and triple glaze. Generally, as in when energy is becoming a scarce as well as expensive resource, so we want to reduce cost on heating, air conditioning and climate control. So, we use double glaze, but wherever we have an extreme temperature and our requirement is more then we also use triple glaze glass. Next we will be discussing it is a futuristic trends, but some amount of this material is available for quite some time, it is suspended film.

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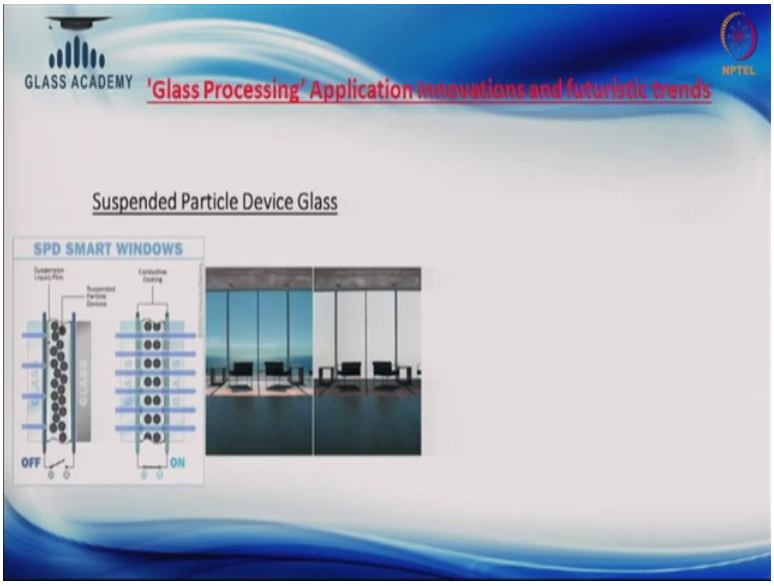

So, we call it a PDLC. If you see on a view foil these are used in a smart windows. The glass is laminated with a special film which is called suspended particle film and when there is no power given to this glass, it looks like a frosted glass. But when we supply power this glass becomes clear. If you see on a image, you see when power is not there the glass liquid crystals or a suspended particles are displaced in a random fashion. But the moment we supply power, they acquire a linear fashion or some order in which it allow light to be passed through the glass.

So, on the image also see when we have a off you see a totally frosted glass and when we switch on the glass it gives a clarity. Though it clarity is not 100 percent, it is something like 70 percent transparency. There various usage we will be discussing in the due course of time.

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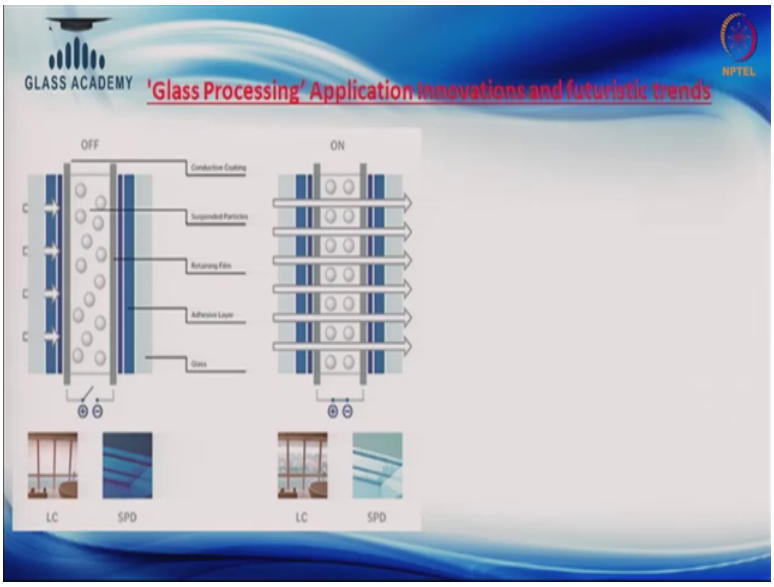

It is a replication of the same technology with the other somewhere you have a suspended particle; somewhere you have a liquid crystal dispersal.

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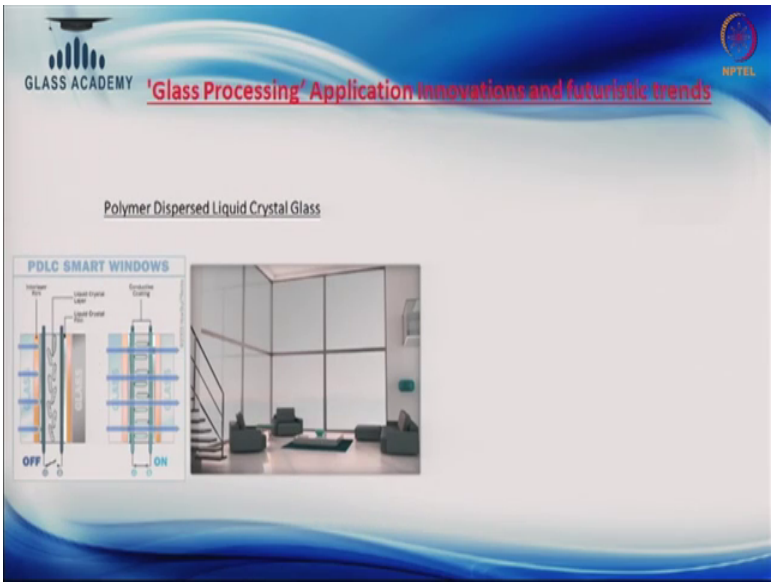

So, polymer dispersal liquid crystal glass; the working principle is nearly the same. And output is also same, when there is no power, the glass looks like a frosted or it is a it is a translucent glass.

So, light it allows light to pass and it does not allow view image or a privacy.

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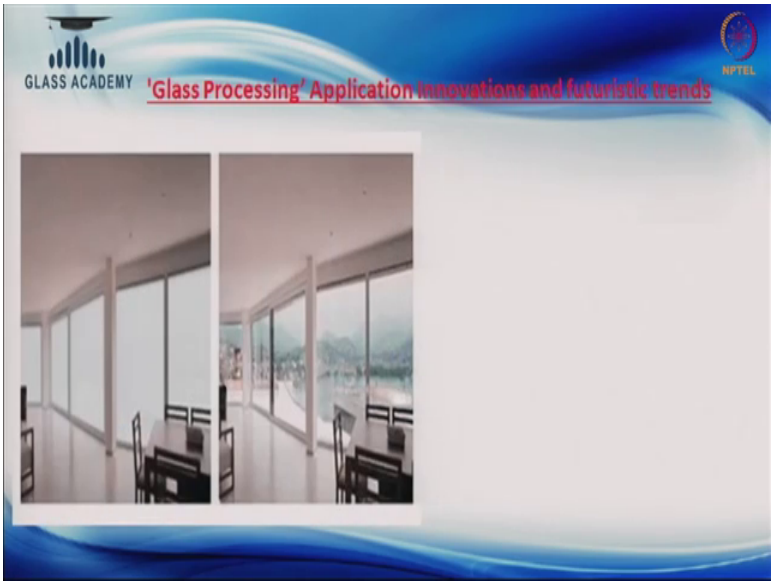

Few example, you can see on the view foil.

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If you see the left window, you will realize that it is not 100 percent clear. There is some kind of a opacity or something like this. This is a problem, I will not call it a problem, it is the characteristics of the system.

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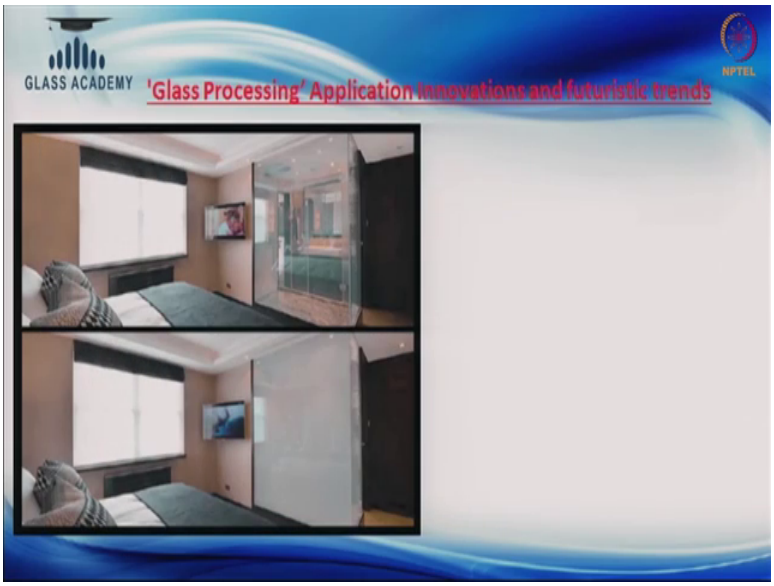

Uses outside India; you have seen people use partition between bathroom and room, specially, in hotel a glass partition. And they are using it certain people use a curtain, but in a modern and a new setup they use this technology or with the flick off switch one can make it clear and if it is not power is not supplied, it will look like a frosted glass.

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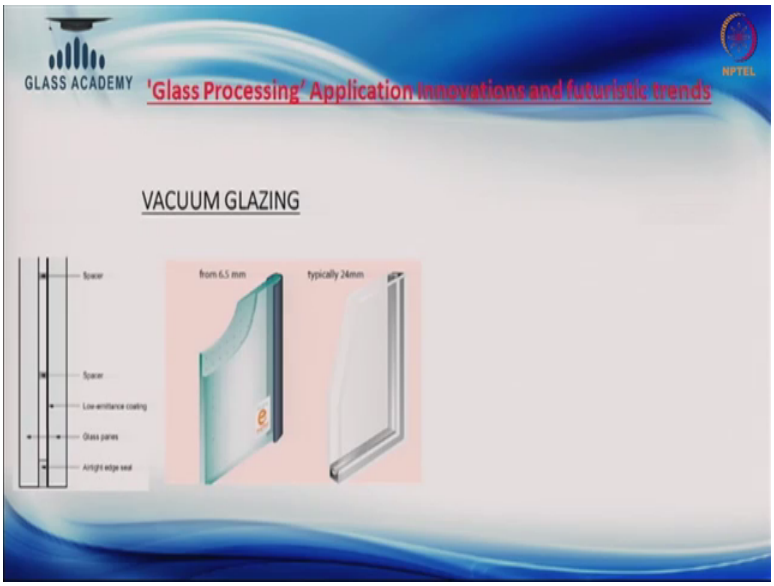

Another is vacuum glazing. What is happening? To control temperature we have to make a double glaze glass. But this double glazing based on our various parameters some time glass becomes quite thick. Spacer width, glass width, everything works out to be the glass here it becomes a quite wide.

So, this technology is still under process under evolution. So, in this it is like a vacuum flask. In vacuum flask we remove the air between the 2 layer of the glass and that becomes a bad conductor of heat. So, here also, for a architectural purpose if we remove the air, both the panes of the glass may come and touch each other. So, to avoid that touching there is a small spacer in between. The main purpose of this technology is to provide a thinner glass a lighter glass so that we can make we can save on resources; we can save on material. This technology is still under prototype. It is being developed in Japan as well as China, but commercial production is not available, but we visualize in due course of time this will be available.

So, in future we can make a lighter buildings, we can make a slimmer windows, we can make slimmer doors. So, we all are looking very earnestly towards this development. Next is low emissivity coating. Though it is a quite a long time they are available. But sometimes we feel that architects or a low people are not aware and they only aware that it is a very expensive glass. But what happens when we control energy? We want to reduce our energy spending on lighting and we want to reduce energy spending on air

conditioning. The common method of reducing the radiation transfer of heat by radiation is by controlling or creating adding a tint to the glass. Or let us go to the foil.

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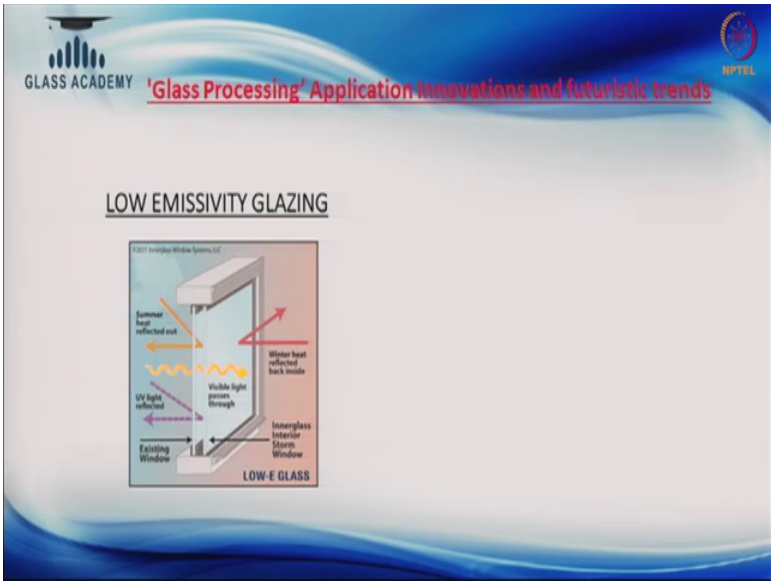

So, if you see on the view foil, there is a 2 layer of glasses, the outer layer and the inner layer. So, in low emissivity glass, the inside layer of one glass is coated with metal oxides, which are working on energy spectrum.

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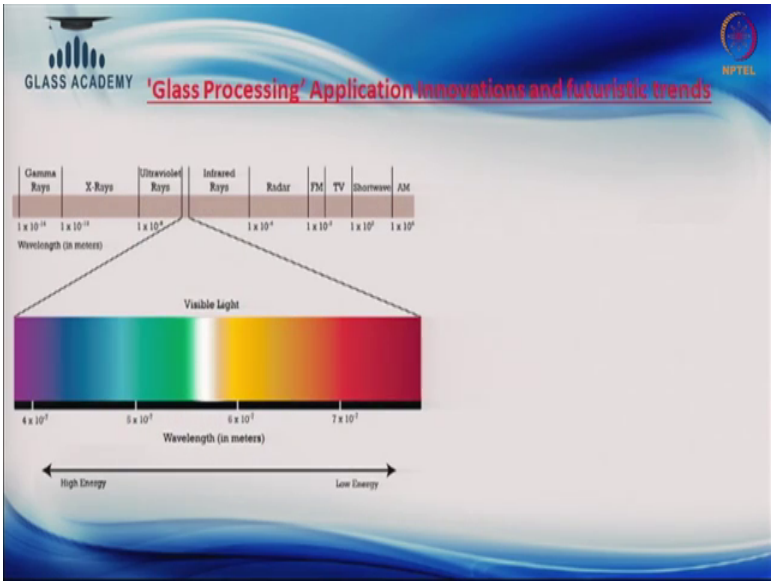

Or I think I do not complicate the issue, but still I want to explain. You all understand the color of rainbow or a color of light; which is VIBGYOR; so, the violet, indigo, green,

yellow, orange. So, violet side is cooler side and red, orange, yellow, this is a hotter side of energy spectrum. When we stop heat by adding tint we also cut the light. But in low e glasses, what we do? We cut this energy spectrum the red and yellow part of the energy or a red orange, yellow part of the energy spectrum.

So, we cut nearly 30 percent of light. So, 70 percent light we receive. And as far as heat is concerned it is other way round. We nearly cut the 70 percent of heat. This is a very basic term though it is much in detail, but I think for right now for my lecture this is enough that without reducing the light we reduce the heat and these are the low e glasses. There measurement is u value.

A lot of lectures you will receive in this course where people will be talking about u value and how to calculate the glass how to select the glass, but just to understand that low e glass is a; I will not call a futuristic trend it is a modern trend. It is regularly being used in commercial building, but in household people have not adopted in such a fashion because of the high cost.

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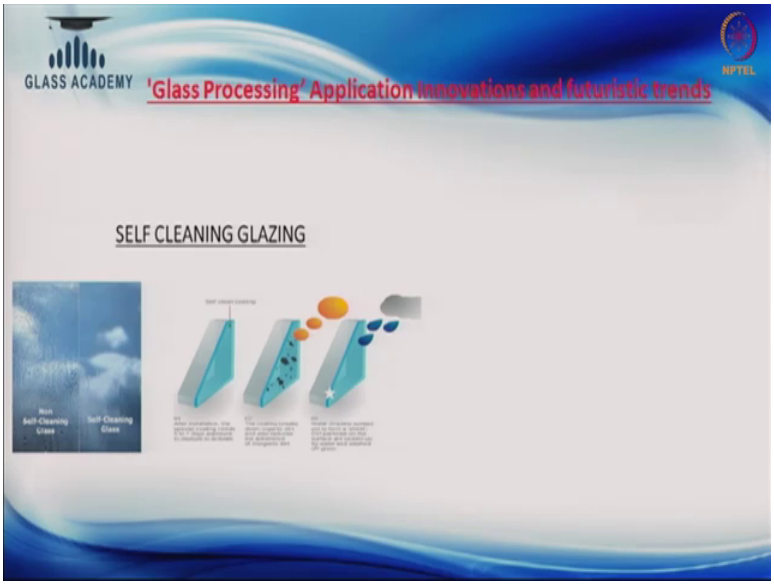

Next we talk about self-cleaning glass. This is a Indian context this is very popular questions, is it a self-cleaning glass. Thing is on a clear glass a hydrophilic coating is applied.

So, when there is sunshine a strong sunlight, the glass becomes some kind of a hydrophilic in nature. So, the dust does not stick to that. So, surface tension is reduced to a certain level and does not stick. But actually when in India when we have a rain and mud and something, it really does not self-cleaning. So, I am not saying it is not effective, I am simply saying lots to be done before it actually represent self-cleaning properties.

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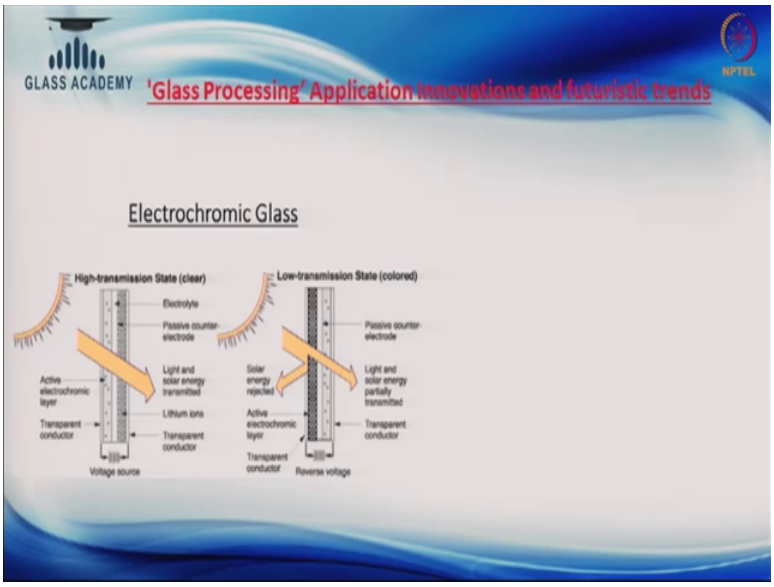

Smart windows or a smart glass; so, smart glasses are based on temperature or a light, we control the color of the glass. You all have seen photo chromatic glasses, I know optical glass specially spectacles. This is based on same technology. Photo chromatic glasses are for such a large application, doors and windows are expensive. But as the technology is progressing this will also become cheaper. So, it is a there are 3 4 system. Right now the view foil you are seeing the electro chromic, when we supply power based on certain electronics, you can control the transparency or shade of that particular glass.

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Here you can see the left part of the image is quite clear, but during summer or afternoon time when sun is totally on our head it is a very warm.

So, we can control the tint of the glass by electric means.

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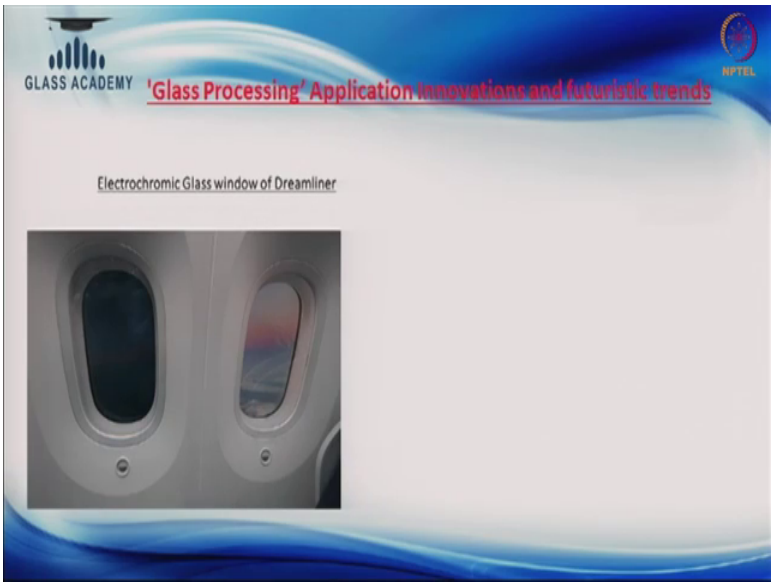

All those who enjoyed traveling in a aircraft. So, the latest aircraft of dream liner aircraft; all the windows are electro chromic glass, the same thing has been shown on view foil.

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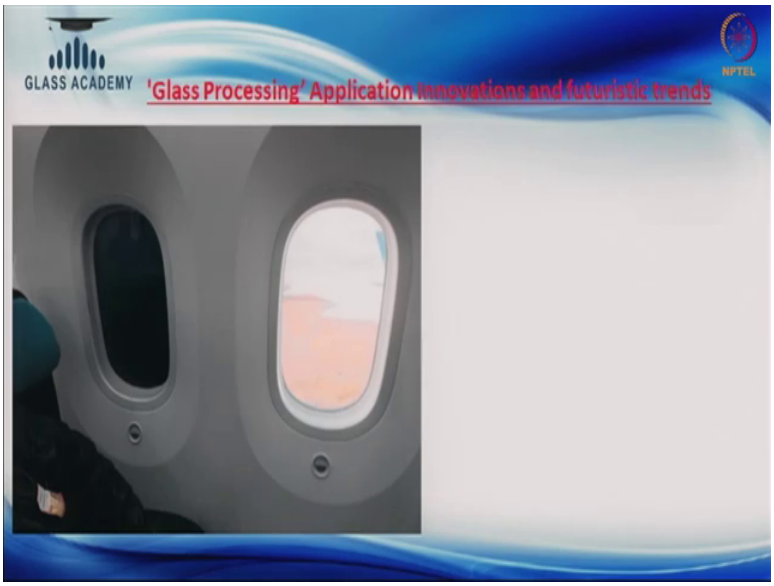

So, you can totally black it out or you can make it quite clear. So, there is a electric switch. By pressing that switch you can change the color.

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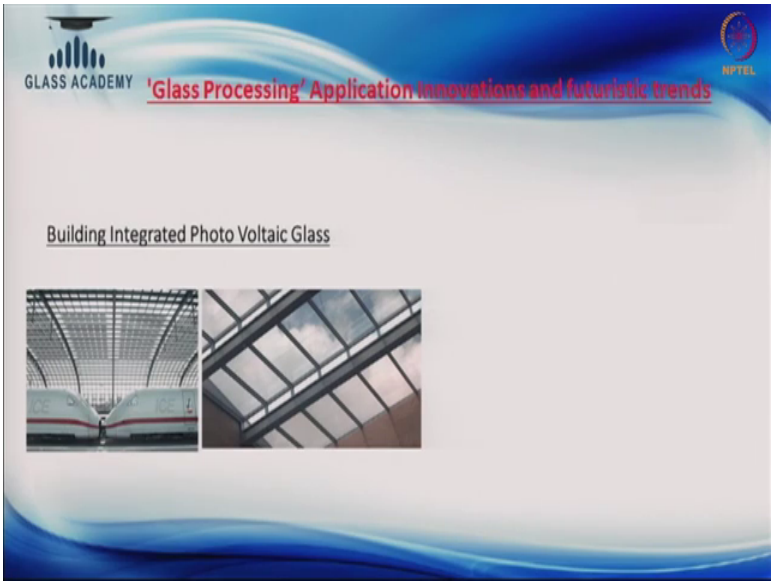

So, as I said before so, this smart glass or smart they are by one is using the light that is called photo chromic, another is by temperature and third one is electricity; so, electro chromic, photo chromic and thermo chromic. Next to generate electricity we are using solar cells.

So, right now we all are installing solar power generators on our roof. But we have a facade we have all walls of the building which is a big area and it receives lot of sunlight. So, building integrated photovoltaic solution, in Europe it is popular. In India, it is catching up, so it is a latest trend. And I am sure as invent cost will of photoelectric of photovoltaic panels will reduce this application will increase. All architects in a civil engineer must plane in their future building, because rate of price of photovoltaic cells are reducing drastically.

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So, in this they have used the roof or a portico or of a mall where they have installed; a photovoltaic along with the clear glass.

So, if we receive a clear we receive lot of light and then it generates energy as well.

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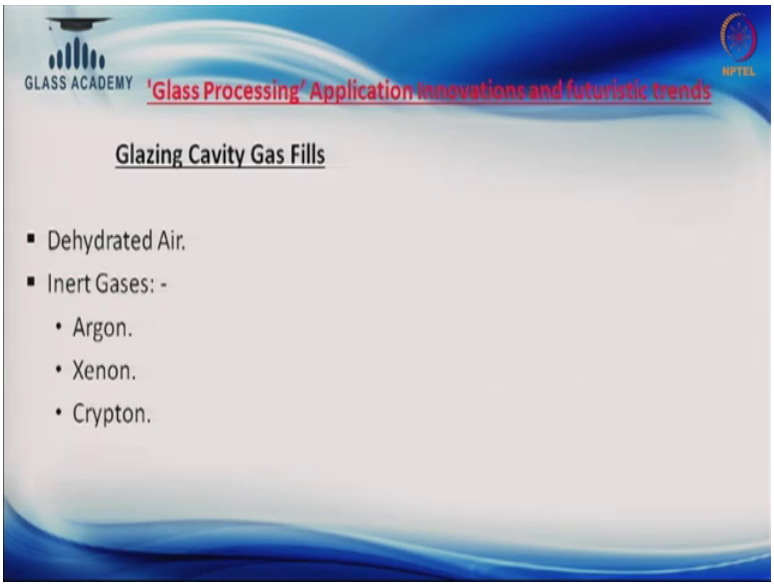

Glazing cavity gas fills. We all understand insulating glass where we fill argon gas. But in latest trends or a futuristic trends are they are apart from argon there another 2 gases. So, a cheapest of insulated glasses dehydrated air or a hot air or a dry air, between 2 panes of glass. And then we add inert gas between these 2 panes of glass.

So, right now whatever insulated glass are being sold in India they are with argon gas. Argon is a inert gas naturally occurring in a air which is extracted from the air only. Argon is a quite popular, if there is a budget issue we add dry air. There is a performance difference is there between argon and the dry air. Futuristic trend is crypton as well as xenon. So, xenon presently is being used in light source, but as people start demanding this and a glass companies will start producing. So, we will have a xenon base. The efficiency of argon xenon is better than argon and the third gas which is crypton, it is efficiency is much more than xenon as well as.

So, right now they are not popular, because they are very difficult to extract from air, they are expensive to extract from air, that is why it is not being used, but in future we do not know. Next we talk about the spacers.

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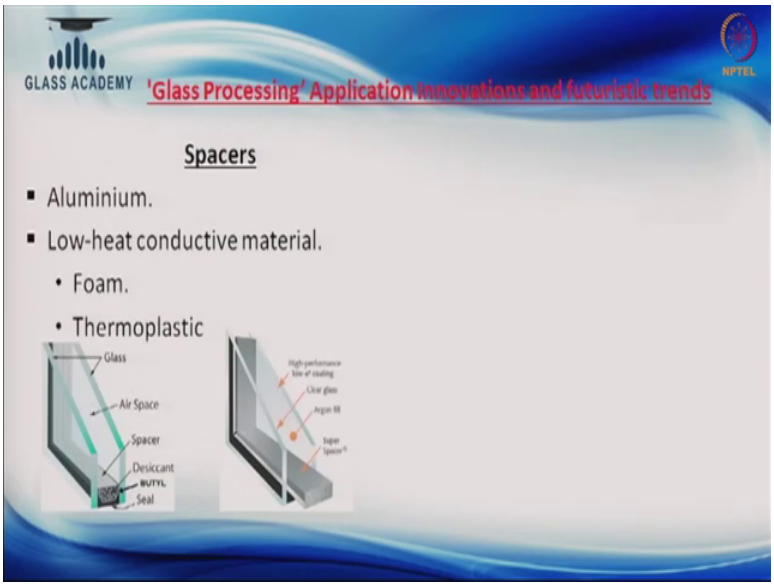

Look into that in the view foil. You see a double glaze a cutout of a double glaze unit. So, you have a one pane outside, there is a another pane inside. And these both the panes are separated by a spacer. Presently a common spacer is aluminum spacer. Inside that aluminum spacer we fill a desiccant, in our business language it is called molecule receive. So, if there is a temperature difference between the inside and outside, so condensation of air does not spoil the visibility of the unit.

So, this desiccant is filled. Though this aluminum spacer as you all know aluminum is a good conductor of heat. Though we separate this aluminum with the material called butyl, but still it is a good conductor of heat. So, another spacer is called thermoplastic or in a common parlance is called super spacer. Super spacer is a bad conductor of heat. So, the insulated glass unit becomes a bit more advanced, or a bit more insulation property increases a lot if we compare it with the aluminum spacer.