Innovation by Design
Dr. B. K. Chakravarthy
Department of Engineering Design
Indian Institute of Technology, Bombay

Module – 04
Start of section 5
Lecture - 25
More experiments: Insights into materials and processes

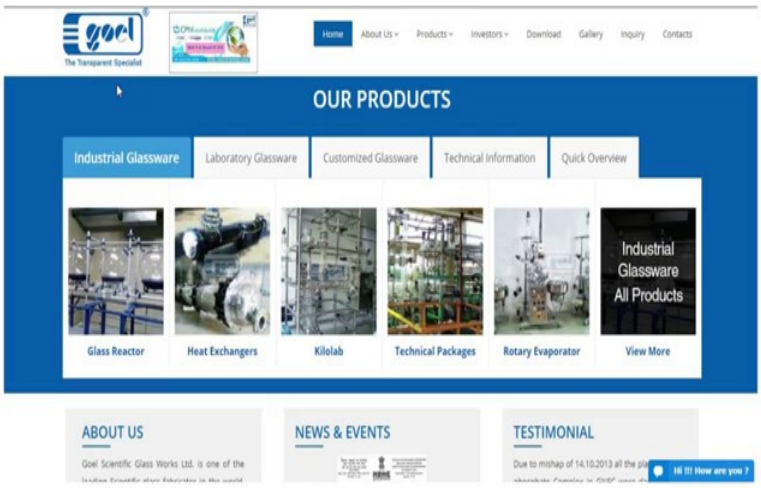
So, let us see we will move to the next stage. Then Avinash luckily went and joined a company in Delhi which is a solar based company.

(Refer Slide Time: 00:12)

(Refer Slide Time: 00:16)

They work on making instruments for companies and schools and you know to make solar education. So, then I said Avinash used a plastic bottle.

(Refer Slide Time: 00:23)

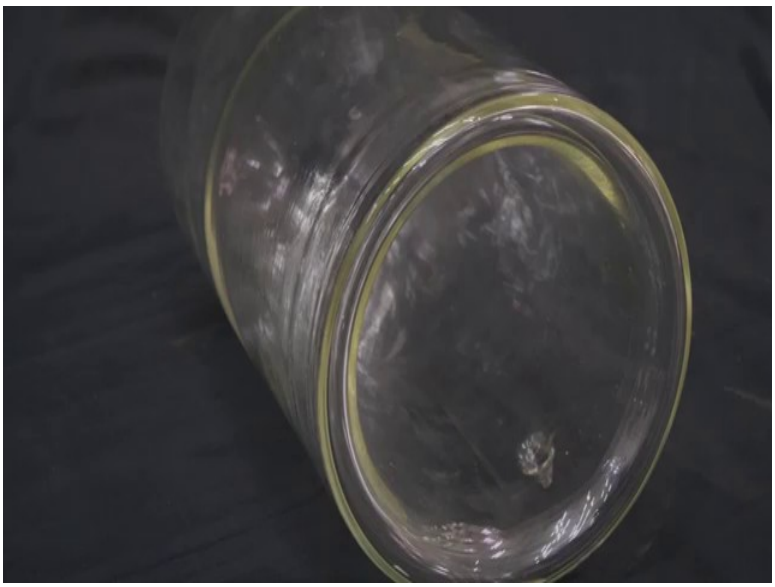


Let me go to the best manufacturers in the country who make glass shells.

(Refer Slide Time: 00:26)

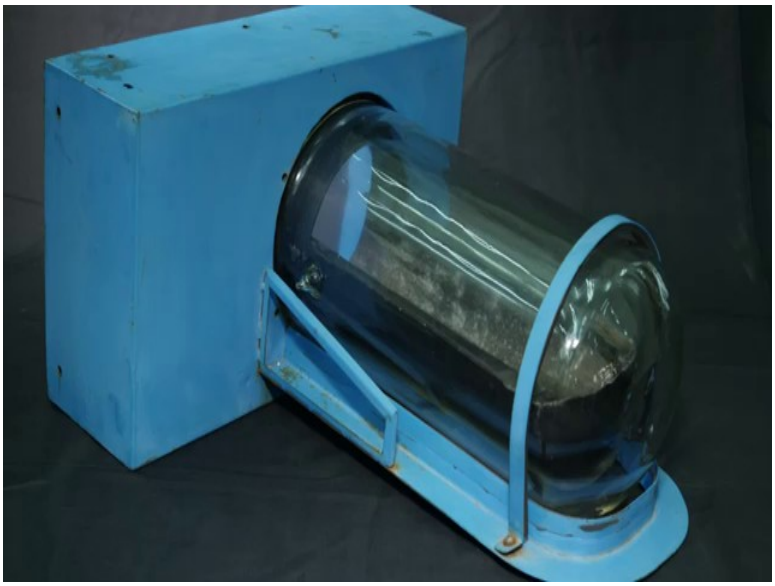
So, we went to them and we said we want a double walled vacuum flask at that time we did not even know that then it was mentioned those thicknesses.

(Refer Slide Time: 00:35)

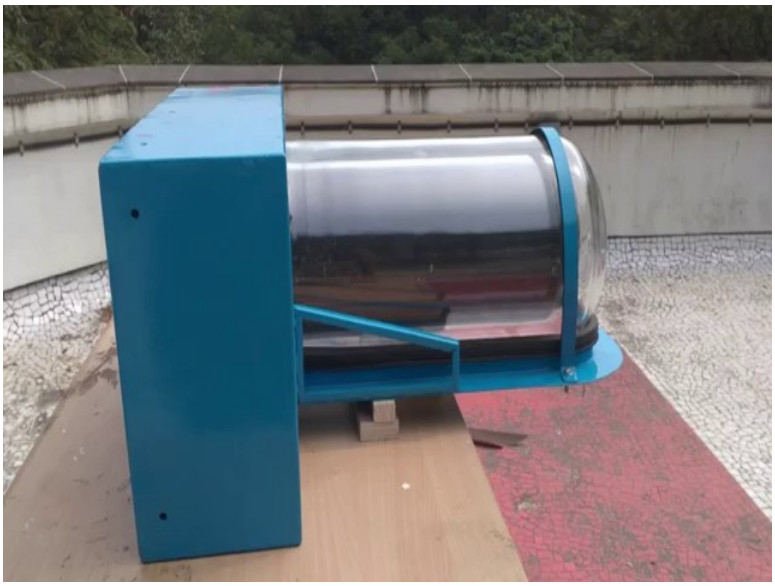


(Refer Slide Time: 00:39)

(Refer Slide Time: 00:43)

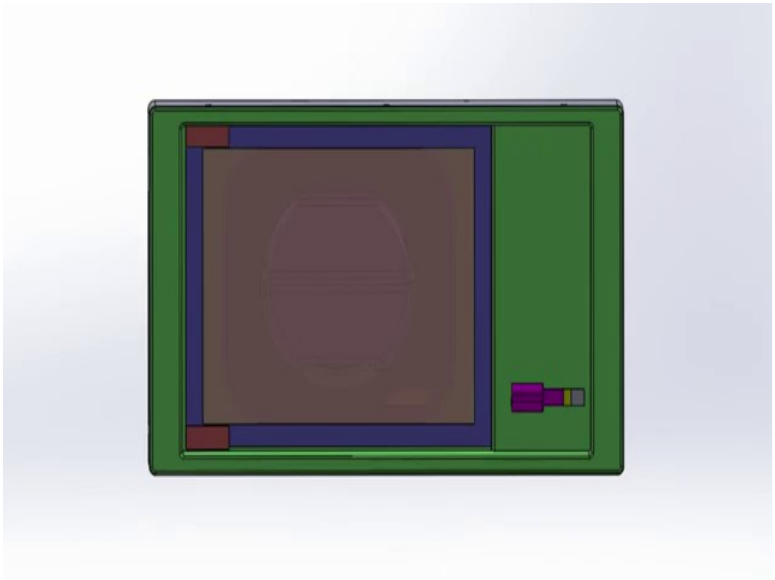


(Refer Slide Time: 00:46)

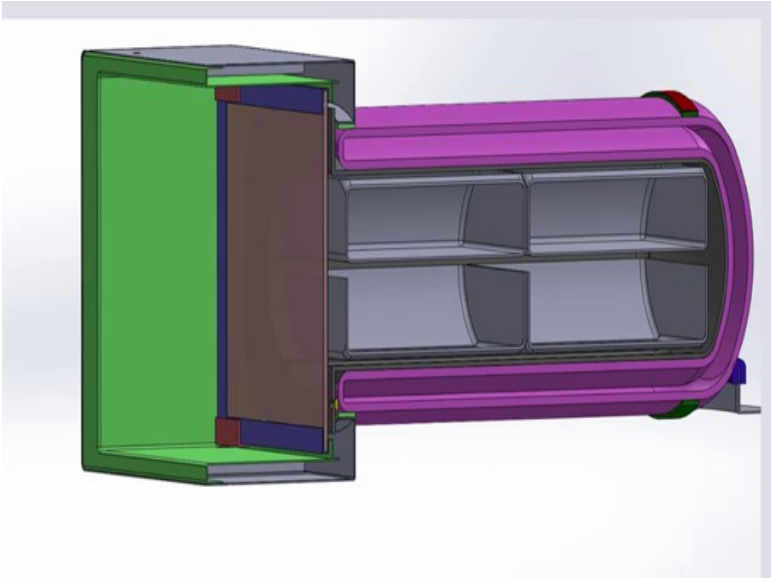


Thicknesses are very critical in this, because if I have more thickness my you know the heat transitivity losses a much larger. We got this glass and we conceived this window mounted solar oven, we founded a lot of issues then I called up Avinash; Avinash what is this you work in a solar company, please help us not working and I work very hard it took 8 months to manufacture this glass jars, vaccumize them.

(Refer Slide Time: 01:00)



(Refer Slide Time: 01:02)



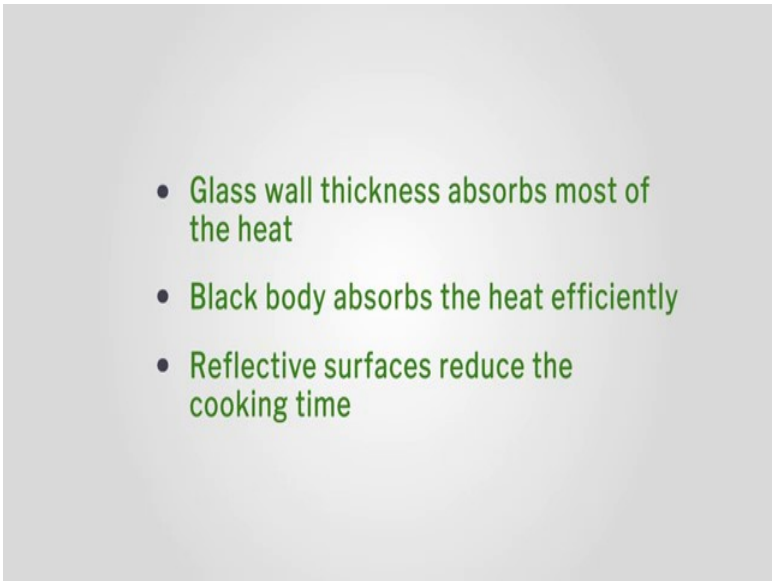
Then build all the cad models to make the prototype and it is not working. So, he came back and then he said '*sir aap log toh Bombay me heat bohot kam hota hai'* [FL] (Translation: Sir, the heat is very less in Bombay). I'll go to my hometown Aurangabad and I will show you what happens.

(Refer Slide Time: 01:11)

(Refer Slide Time: 01:15)

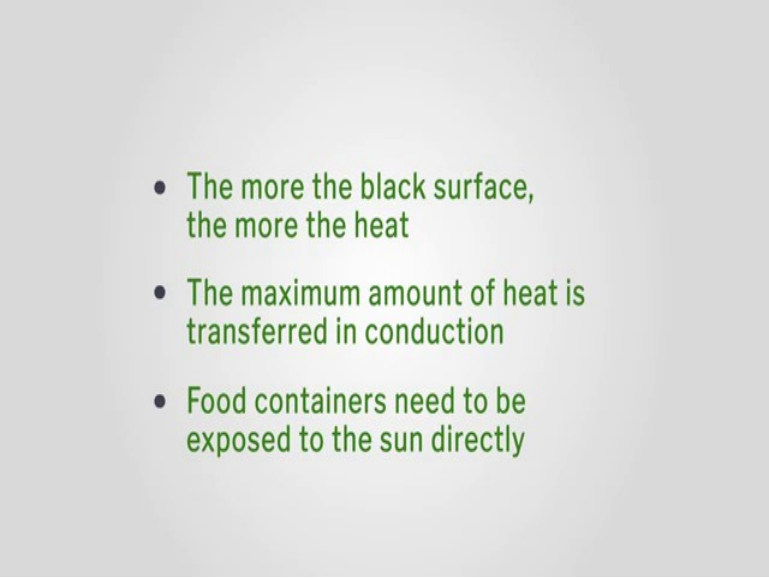
So, he took this glass jar in the bus to Aurangabad and he baked cake in that and it is working. So, now, the issue is that we need to understand the various important engineering aspects in this. What are the issues of thermal engineering in this, what are the issues of solar you know conduction and convection issues in this and it is really really very very high you know technology and understanding which need to go in. So, now, what are you will learn from this case.

(Refer Slide Time: 01:49)



We clearly learnt that there is a very serious issue about the glass wall thickness absorbing most of the heat in Bombay; whereas, he went to Aurangabad the temperature was so high that he could cook very easily. The black body absorbs the heat efficiently that was very clear. So, if my container inside is reflected like I put a stainless steel container inside will it cook, it is not rocket science people say that you matte black vessels inside it will absorb all the heat; so, its basic science.

(Refer Slide Time: 02:12)



More the black surface more the heat, maximum heat is transferred through conduction process, food containers need to be exposed to the sun directly. So, these are the insights we got. So, when that again to the conception first idea, let us check let us make poly carbonate boxes.

(Refer Slide Time: 02:30)

(Refer Slide Time: 02:32)

So, these are two walled polycarbonate boxes. So, we have to always design in the difficult circumstances rather design for best circumstances, if you design for difficult circumstances you will get very good design.

(Refer Slide Time: 02:44)

Avinash put this reflective surface on the door he made this double walled fish tank design one in glass, because fish tank manufacture are there they quickly may give us in glass and we made one in polycarbonate we tested both of them.

(Refer Slide Time: 02:56)

And we had a put up a whole set up on the terrace to check to temperatures to measure.

(Refer Slide Time: 03:02)

We found out that the polycarbonate one was much better, because the losses with conduction were less in polycarbonate.

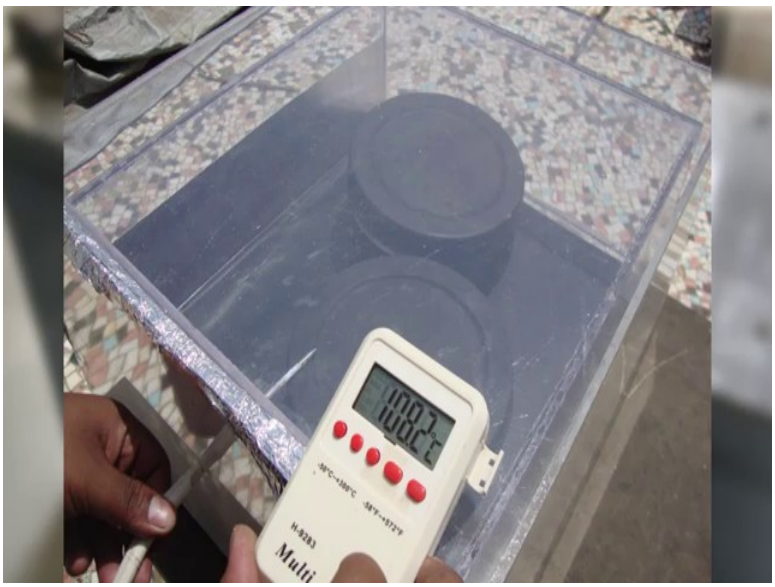
(Refer Slide Time: 03:07)

And we started using the, you know tiffin boxes which came from the box type solar ovens which are in the market. And to a surprise these tiffin boxes were very thin made up of aluminum and painted black matte outside.

(Refer Slide Time: 03:20)

So, we copied the design, we took the same boxes and they start working well we started making dal chawal.

(Refer Slide Time: 03:28)



And then we measure the temperature to a shock, it was 108 degrees; this is a great sort of leap for us and then from here you know we started cooking rice we said that if you have a product you need to experience it yourself first. So, we start cooking every day in this oven before lunch and sometimes we would eat 'kachha chawal' [FL] (Translation:

raw rice) then there is no sun, but you know we said we have the feel the pain of anybody using a solar oven you know passionately.