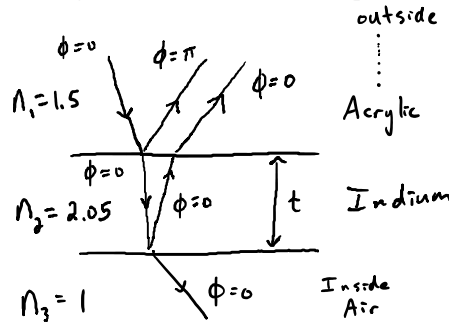


Week 3 Quiz

Monday, April 19, 2021 10:45 AM

Aircraft windows are complex structures made from glass, acrylic, interlayers, and electrical devices. The interlayers in the windows are used for anti-fog and de-icing purposes. It turns out that these interlayers are thin materials (typically Indium tin oxide) which are thin enough that interference patterns can be seen when sunlight (white light) shines on the windows as seen in the image. Let's simplify the construction of the aircraft window as follows: the layer on the inside of the plane is a thin layer of Indium tin oxide (index of refraction of about 2.05), and the second layer which is directly connected to the first layer and exposed to the outside of the plane is a thick piece of acrylic (index of refraction of about 1.50).

(a) Using this simplified model, what would be the second thinnest layer of the Indium tin oxide in the region of the windows that is brightly reflecting blue light ($\lambda_{\text{vacuum}} = 430 \text{ nm}$)? Assume the sunlight is always perpendicular to the surface of the window. The sunlight is coming from the outside of the plane, and you are viewing the window from the outside as well.



π -relative phase shift
 Constructive Int.
 $2t = (m + \frac{1}{2}) \lambda_2$
 $\lambda_2 = \frac{n_3}{n_2} \lambda_3$ } $2t = (m + \frac{1}{2}) \frac{\lambda_3}{n_2}$
 2nd thinnest $\Rightarrow m = 1$

Rubric

<p>Part (a) 1 pt - physical representation 1 pt - pi relative phase shift 2 pt - constructive int. equation 1.5 pt - lambda in the film equation 1.5 pt - 2nd thinnest - m = 1 0.5 pt - combining eqs and algebra 0.5 pt - correct answer and units</p>	<p>Part (b) 0.5 pt - correct answer 1.5 pt - reasoning</p>
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So, $t_0 = \frac{3\lambda_3}{4n_2} = 157.3 \text{ nm}$

(b) Is the layer of Indium tin oxide a uniform thickness? Use the image to justify your answer.

No, the rainbow of colors show that blue is not always constructively interfering. Sometimes the thickness is just right for red and other colors.