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Study the Effect of Colours on the Absorbance of Imported Glass

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Abstract:
Several models were selected from imported glass in different colors (transparent, blue, bronze, green), and with a thickness of (6) mm, the intensity of the penetrating beam was measured to determine the optical properties (absorption) and calculating the energy gap for direct and indirect transmission permitted, and it was found that The absorption coefficient for clear glass is lower than the absorption coefficient for the rest of the types of stained glass, so transparent glass has greater permeability compared to the rest of the types, and the hardness has also been calculated

***Keywords**: imported glass, different colors, absorption characteristics.*

Introduction

Glass is one of the important materials in our world, as it has taken great interest in the scientific and technical field, and it is almost the most used material in various fields since ancient times. [1].The applications of glass are numerous and appear through multiple uses in the fields of applied and industrial research, such as solar and nuclear energy, in addition to their uses in the field of insulators, optics and electronics. Glass has mechanical properties similar to the properties of the same solid materials, but it differs in its irregular composition, and the properties of glass, mechanical, physical, or chemical composition change from one shape to another with the addition of different oxides at special rates for the primary components of the glass. [2]. Glass is an important material in our daily life, so we cannot do without it. It is produced by rapidly cooling the molten viscous material below its glass transfer temperature in a rapid damping manner. Glass is a biologically inactive substance that can be formed on smooth surfaces. Under tension, the glass is brittle and will split into sharp fragments. Under pressure, pure glass can withstand a great deal of strength. The properties of the glass can be modified or changed with the addition of other compounds or heat treatment. Most glass formulations contain about 70-72% by weight of silicon dioxide (SiO_2). The most common form of glass is lime soda glass, which contains approximately 30% sodium oxides, calcium or carbonate [3]. The main raw material for glass is sand that contains approximately 100% of crystalline silica in the form of quartz. Although it is almost pure quartz, it may contain a small amount (less than 1%) of iron oxides that would stain the glass. [4].

The practical side

Initially, our selection of samples was different from imported glass of different colors from the Iraqi market. Then we cut the samples with a special device to cut the glass so that they were cut in the form of circles with diameters of 3 cm, and finally the samples were cleaned in three stages

1- The glass was placed in the cleaning liquid for 3 minutes in a bowl.

2- The glass was taken out and put in pure water for 15 minutes.

3- The glass was placed in acetone liquid for 10 minutes.

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Then it was dried with cotton fabric and air blower. After cleaning all the samples, the measurements started. We measured the optical properties of the representative samples (absorbance, reflectivity, and permeability) for all samples.
Where the permeability was calculated using the following relationship[5].

$T= I_t /I_0$ ………...(1)

Where: T: permeability, I: penetrating ray, I_0: falling beam Calculate the absorbance using the following relationship:

$$A = \frac{I_A}{I_o} \quad \text{………..} \ \mathbf{(2)}$$

If that A: absorbance, I_A: Absorbed beam, I_0: falling beam

From the absorbance we calculate the absorption coefficient:

$\alpha=2.303\frac{A}{t}$ ……… (3)

As: α: Absorption coefficient: α, t: thickness

And through the relationship between reflexivity, permeability and absorbance:

T+A+R=1 ………. (4)

Where the reflectivity was calculated:

R=1-(T+A) ………. (5)

The energy gap for all permissible direct transfer glass types was also calculated using the following equation ('Tauc' S relation)

$\alpha\, h\nu=B_o\,(h\nu - E_g)^r$ …….. (6)

Where r: exponential coefficient determining the type of transition, B_o: A constant that depends on the type of material, hv: incident photon energy in eV units, E_g: power gap in eV units.

Results and discussion

Absorbance:

Figure 1 represents the change in Absorbance as a function of the wavelength with the same thickness of 4 mm glass and of colors (transparent, green, blue and bronze). Absorbance was calculated according to equation (2). We note that absorbance decreases as the wavelength increases. Where we note that in Figure (1), which represents the change in wavelength with respect to absorbance of thickness (4 mm), where the greatest absorbance of the glass (blue, transparent) at the wavelength (300 nm) where their values are (0.854,0.785) respectively and that the glass Bronze has its greatest value at the wavelength (310 nm), where its absorbance is (0.632), while green glass has its highest value at wavelength (315 nm) when absorbance is (0.88). At the wavelength (355 nm) we notice that all types of glass start with corrugation . This result is consistent with the results of researchers in the source [6].

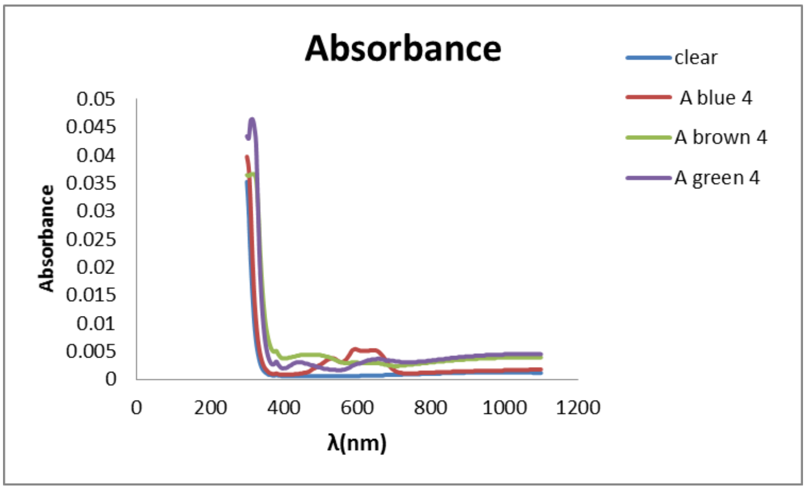

Figure 1:The relationship between wavelength and **Absorbance** for 4mm glasses

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Figure 2 represents the change in **Absorbance** as a result of a change in the wavelength from 300 to 1100 nm for glass samples of various colors and measuring 6 mm.. For blue glass, absorbance is at the wavelength (300 nm) (0.845), where its greatest value is at the wavelength (310 nm), which is (0.9775), while for glass (bronze, other and transparent) the greatest value for them is at the wavelength (320) nanometers) whose absorptivity is then (0.989,0.363,0.8875) respectively and then we notice a gradual decrease with an increase in the wavelength of all samples until they reach the wavelength (370) that ripples with the continuation of the rise in the wavelength.

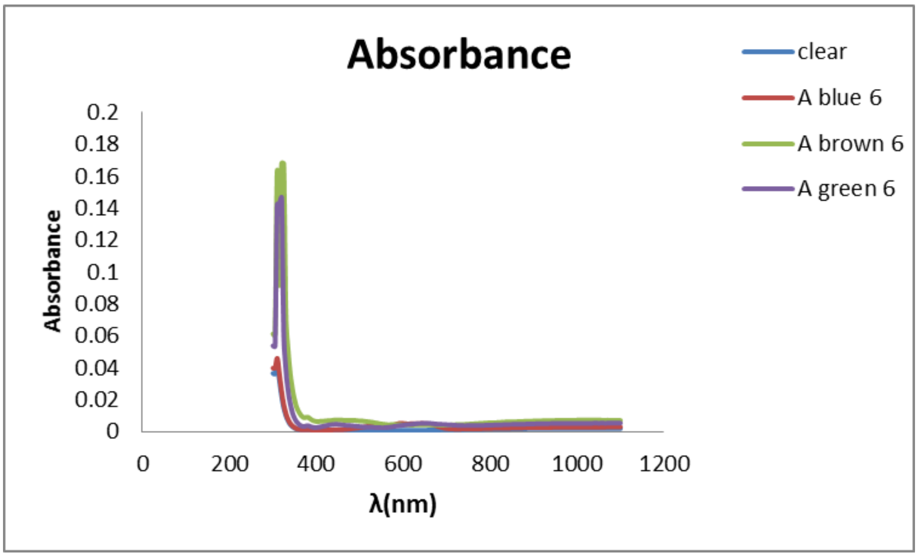

Figure 2: The relationship between wavelength and **Absorbance** of 6 mm thickness

Figure(3) represents the relationship between the wavelength and the **Absorbance** of glass with a thickness of 10 mm.Where we note that the blue glass, which has the greatest value for it at the wavelength (310), and then there is a gradual decrease of the absorbance with increasing wavelength and at wavelengths between (370-730) the absorbance is undulating after which it is somewhat stable after the wavelength (735 nm) Meters) that have absorbance (0.05), while clear glass has the greatest value for it at the wavelength (300 nm) whose absorption is (0.875) and we note that the absorbance remains constant with an increase in wavelength between (395-585), while green and bronze glass We note that they have almost the same behavior as there is a height and low absorbance curve at the length of the t And J (300-320 nm) and they have the greatest value at the wavelength (320 nm) and then gradually decrease with increasing wavelength as they do not contain ripples as in blue glass.We note that the transparent color has the least absorbency in relation to the rest of the colors.The results also showed above, and from the aforementioned forms, that the effect of thickness on the samples in terms of absorbance is a logical result when increasing the thickness, the absorbance increases.This result is consistent with the results of researchers in the source [7-8].

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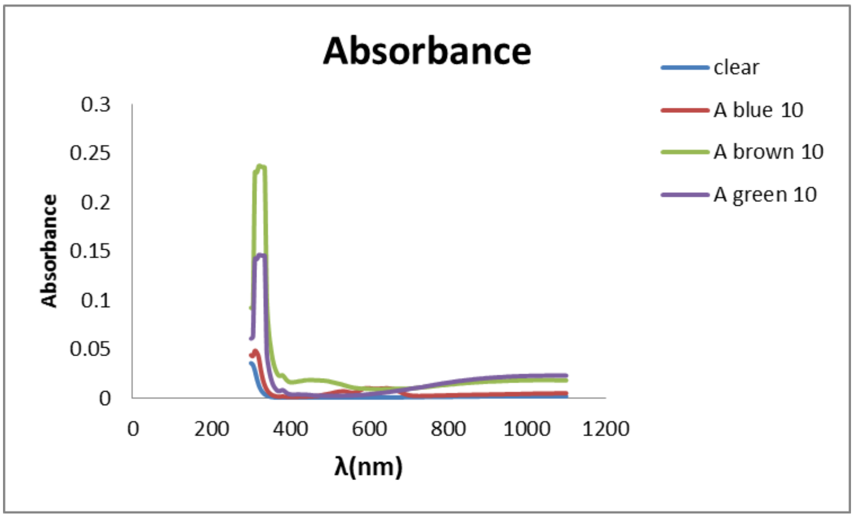
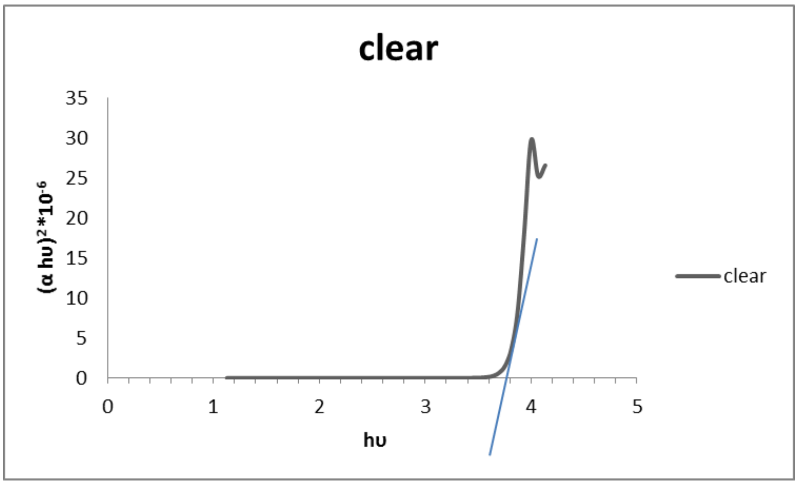
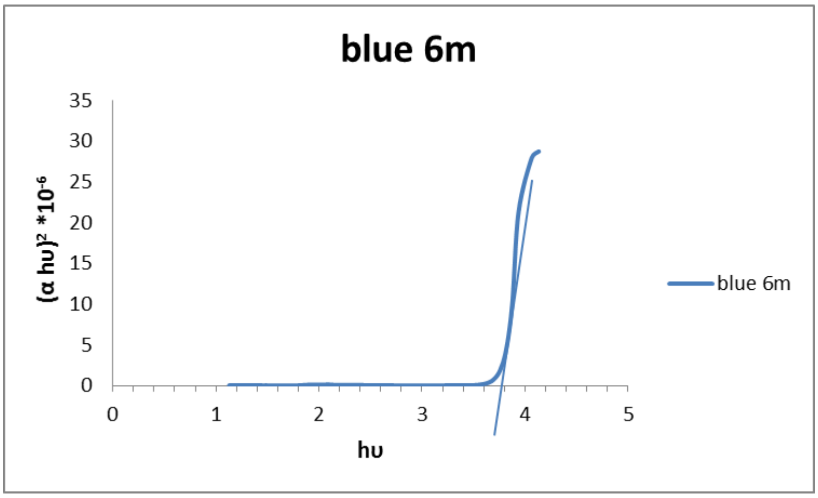


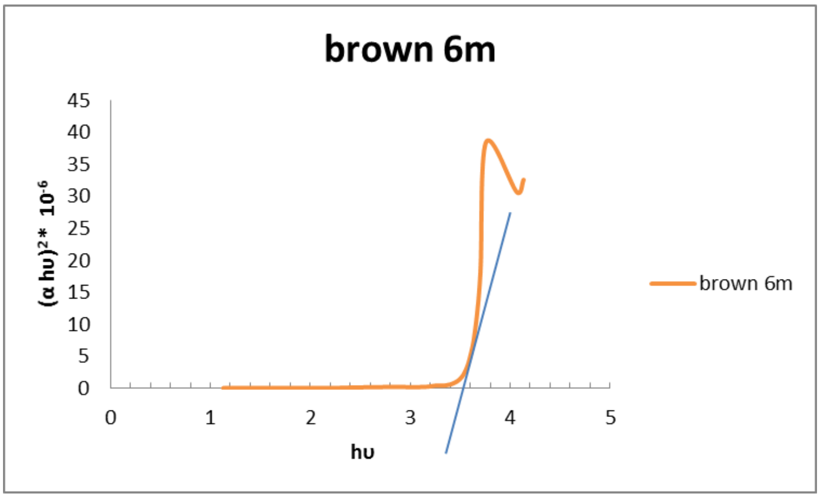
Figure 3: The relationship between wavelength and **Absorbance** for 10 mm glasses

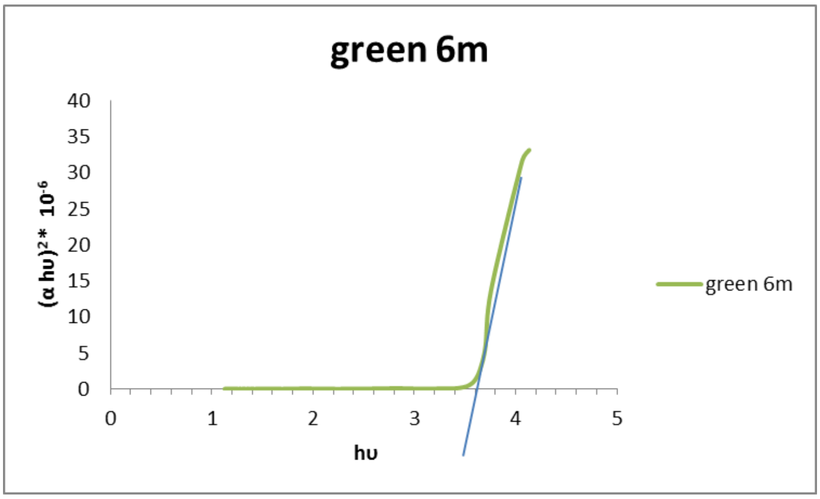
Energy gap

The energy gap gap is one of the most important physical constants for optical properties and is based on determining the value of this constant in the manufacture of many electronic devices such as solar cells and detectors. The energy gap for permissible direct transmission was calculated by plotting the graphical relationship between $(\alpha\ h\upsilon)^2$ and photon energy (hυ), as we get a graph showing the straight line span that crosses the axis (hυ).



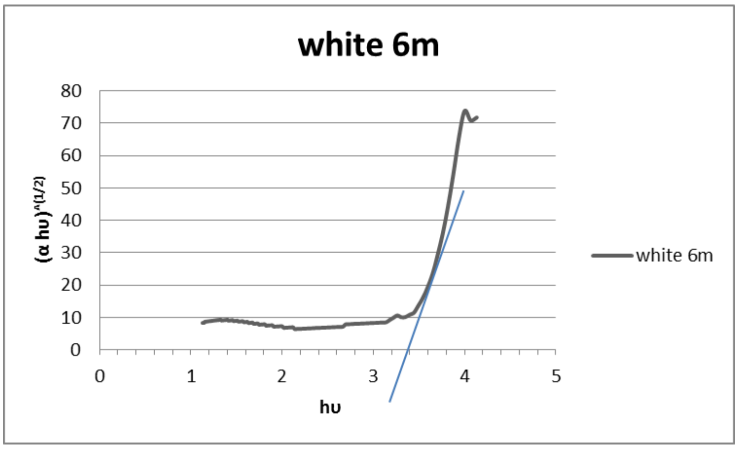






Figure(4) represents the energy gap for the permissible direct transmission of clear, blue, green and bronze glass of 4 mm thickness

The energy gap for the permissible indirect transmission was calculated by plotting the graphical relationship between (αhυ) $^{1/2}$ and the photon energy (hυ) as we get a graph showing the straight line span that crosses the axis (hυ).



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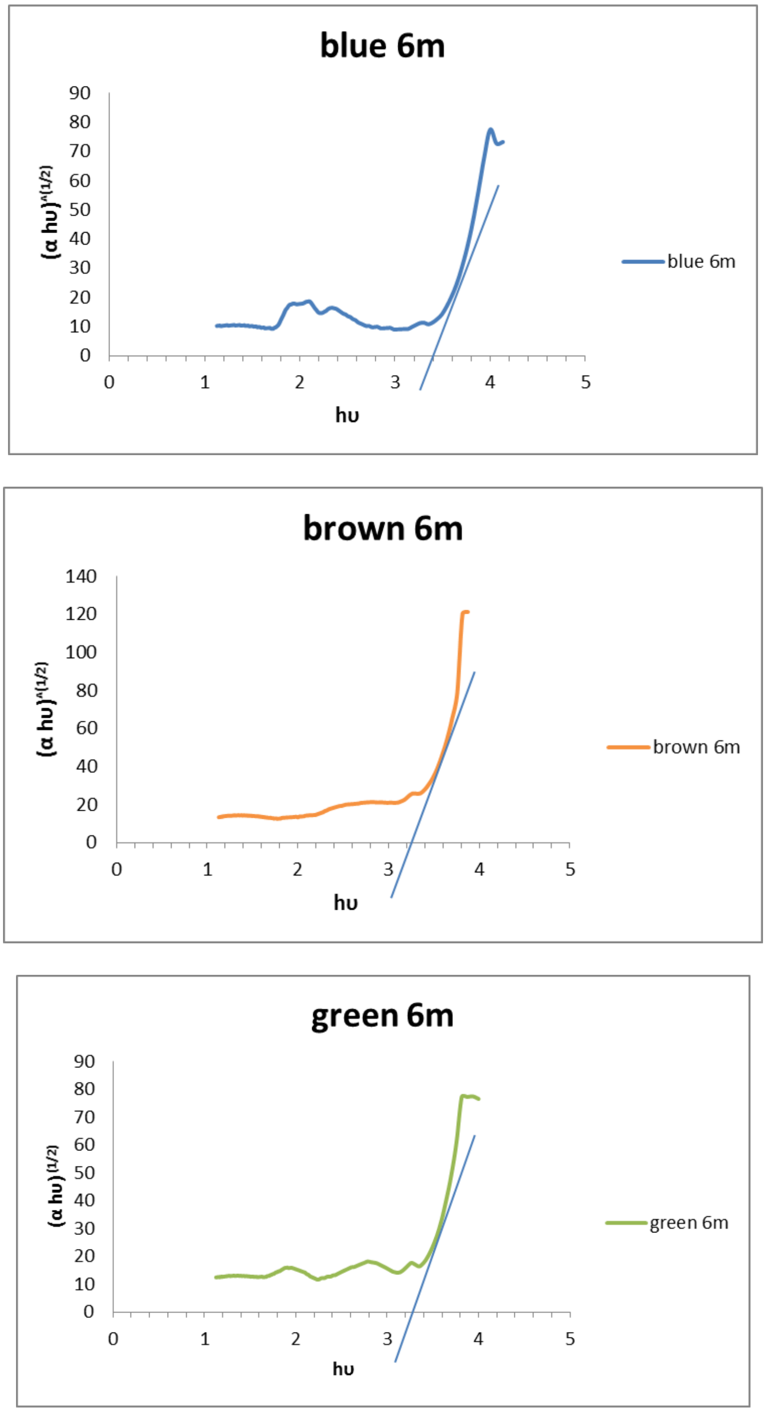

Figure 5: represents the energy gap for the permissible indirect transmission of glass in different colors

Through the results of the samples in the previous forms of the energy gap values for the permissible and forbidden direct transmission, we note that the transparent, bronze, blue and green color have varying values of the energy gap that may be due to the random composition of the atoms as in Table 1, this is due to more electrons traveling from a beam Parity to the conduction beam, which leads to a decrease in the value of the energy gap, and this result is consistent with behavior in terms of change in values. [9,12]

The table represents the energy gap values for electronic transitions

colors		Allow direct	

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	Thickness mm	transmission	Indirect transmission is permitted
Clear	**4**	3.8	**3.**4
Blue	**4**	3.8	3.4
Green	**4**	3.5	3.2
Bronze	**4**	3.6	3.3

Conclusion

In this work, the optical properties of imported transparent glass have been studied and compared with 6mm stained glass types. Absorbance changes with color change and with difference in values and different behavior in some curves. As for the energy gap values for permissible and forbidden direct transmission, the results showed that the transparent and bronze color has varying values of the energy gap, As for blue and green, the gap value decreases.

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