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A STUDY SOME OPTICAL PROPERTIES OF COMPOSITE MATERIAL (GYPSUM - GRAPHITE)

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ABSTRACT

This studies concern about optical properties of composite material, In the first, powder of material was taken as grams and projecting light from a distance and change the grams with changing of the distance of the projecting light for many times and thus got results by assistant of photocell and multimeter to calculate change of the voltage. Then find different changed of light properties like absorption, transmission and reflection on the bases of available results.

I. INTRODUCTION

The interdisciplinary field of materials science, also commonly known as materials science and engineering, involves the discovery and design of new materials, with an emphasis on solids. The intellectual origins of materials science stem from chemistry, physics, and engineering to understand ancient, phenomenological observations in metallurgy and mineralogy. Materials science still incorporates elements of physics, chemistry, and engineering. As such, the field was long thought of as a sub-field of these related fields. In recent years materials science has become more widely recognized as a specific and distinct field of science and engineering. Many of the most pressing scientific problems humans currently face are due to the limitations of the materials that are available and, as a result, breakthroughs in materials science are likely to affect the future of technology significantly.[1][2]

Composites are one of the most advanced and adaptable engineering materials known to men. Progresses in the field of materials science and technology have given birth to these fascinating and wonderful materials.[3]

Composites are heterogeneous in nature, created by the assembly of two or more components with fillers or reinforcing fibers and a compactable matrix. The matrix may be metallic, ceramic or polymeric in origin. It gives the composites their shape, surface appearance, environmental tolerance and overall durability while the fibrous reinforcement carries most of the structural loads thus giving macroscopic stiffness and strength [4] A composite material can provide superior and unique mechanical and physical properties because it combines the most desirable properties of its constituents while suppressing their least desirable properties. At present composite materials play a key role in aerospace industry, automobile industry and other engineering applications as they exhibit outstanding strength to weight and modulus to weight ratio. High performance rigid composites made from glass, graphite, Kevlar, boron or silicon carbide fibers in polymeric matrices have been studied extensively because of their application in aerospace and space vehicle technology . Based on the matrix material which forms the continuous phase.[5]

Maxwell's Equation

Static electric charge generated electric field of flux density D, where

$$D = \varepsilon E \qquad (1)$$

With stands for electric permittivity of the medium and E is the electric field intensity .when this charge moves it generates magnetic field flux density B, where

$$B = \mu H \qquad (2)$$

Where stands for electric permittivity of the medium and is the magnetic field intensity
Maxwell's equations related electric field to magnetic field. According to the relations:

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$$\nabla . D = \rho \quad (3)$$

Where represents to the charge density

$$\nabla . B = 0 \quad (4)$$

$$\nabla \times H = J + \frac{\partial D}{\partial t} \quad (5)$$

Where J is the current density

$$\nabla \times E = -\frac{\partial B}{\partial t} \quad (6)$$

1- Reflection, Refraction, Transmission and Absorption

1.1Reflection

The Reflection is when waves, whether physical or electromagnetic, bounce from a surface back toward the source. A mirror reflects the image of the observer.

$$\varepsilon = \frac{E_r}{E_i} (7)$$

Where Γ is reflection coefficient, Incident energy

1.2 Refraction

The Refraction is when waves, whether physical or electromagnetic, are deflected when the waves go through a substance. The wave generally changes the angle of its general direction.

1.3Transmission

Transmission is the passage of electromagnetic radiation through a medium.

$$T = \frac{E_t}{E_i} (8)$$

Where T is Transmission Coefficient and is transmitted energy

1.4 Absorption

Absorption is the transformation of radiant power to another type of energy, usually heat, by interaction with matter.

$$\propto = \frac{E_a}{E_i} (9)$$

Where α αis Absorption coefficient and is absorbed energy.

By using some useful physical laws and equations .the Transmission , Reflection and Absorption coefficients (T,Γ and α respectively) satisfies the relation :

$$T + \Gamma + \alpha = 1 (10)$$

With conceder incident energy (E) as intensity (I) the relation:

$$\boldsymbol{I = I_0 e^{-\propto d}} (11)$$

Where I is stands for transmitted intensity, I0 is incident intensity and is thickness of the material .there Absorption coefficient can be :

$$\propto = \frac{\ln \frac{I_0}{I}}{d} (12)$$

And transmission coefficient can be:

$$\mathbf{T} = \frac{I_0}{I} (13)$$

II. MATERIALS & METHODS

Materials have always been an integral of human and social development .the selection of Materials and most appropriate manufacturing process depends on several factors, but the most important considerations are shape complexity and properties of Material; however the properties of Materials are ultimately linked with microstructure and processing.

The Materials used in the experimental work for this research are Graphite (C) and Gypsum (CaSO4.2H2O).

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2.1Materials Samples

The Materials used in this experiment are selected according to the several criteria on which the final decision is normally based, beside their abundance. The Materials selected are:

2.1.1 Graphite

Graphite is a mineral composed exclusively of element carbon. Graphite has the same chemical composition as Diamond which is also pure carbon, but the molecular structure of Graphite and Diamond is inertly different this causes almost opposite characteristics in their physical properties. Graphite is rather common mineral ,but fine crystal are rare ,most Graphite mining areas produce enormous quantities from a single or several large Graphite veins , but collector specimen is good are commonly uncounted .

2.1.2 Gypsum

The mineral gypsum precipitated 100 t0 200 million years ago when sea water evaporated from a chemical point of view it is calcium sulphate Dehydrate (CaSO4.2H2O) deposited in sedimentary layers on the sea bed. Under high pressure and temperature gypsum turns into Anhydrite (CaSO4).In the nature gypsum and Anhydrite occur or nodular masses up to a few meters thick. The content of gypsum in sedimentary rock varies from 75% to 95 % the rest being clay and chalk.

2.2 Photoelectrical cell

2.3 AVO Meter

2.3 Laser and white Light Source

2.4 Slice of Glass

2.5 Methods and Experimental Procedures

Graphite and Gypsum are mixed together (0.25) weight units from Graphite and (1) weight units from Gypsum. This mixture with different masses ranging from 0.5 mg up to 2.5 mg in steps of 0.5 mg is exposed to laser first, and then light. The optical properties like absorption, transition and reflectance are recorded by using advice consisting of AVO meter, light detector and glass substrate for putting the mixture powder. The results are shown in tables (3.1) and (3.2) and are displayed graphically in figures (1, 2) and (3,4) .

III. RESULTS & CALCULATION

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Table (3.1) optical coefficients of gypsum and graphite mixed with the ratio (1: 0.25) by using laser

Mass$\pm$**0. 1mg**	Absorption	Transmission	Reflection
0.5	3.04	0.047	2.087
1	3.38	0.034	2.414
1.5	3.60	0.027	2.627
2	3.89	0.020	2.910
2.5	3.89	0.020	2.910

Table (3.2) optical coefficients of gypsum and graphite mixed with the ratio (1: 0.25) by using white light

Mass$\pm$**0. 1mg**	Absorption	Transmission	Reflection
0.5	1.875	0.153	1.028
1	2.245	0.105	1.350
1.5	2.568	0.076	1.644
2	2.733	0.065	1.798
2.5	2.900	0.055	1.950

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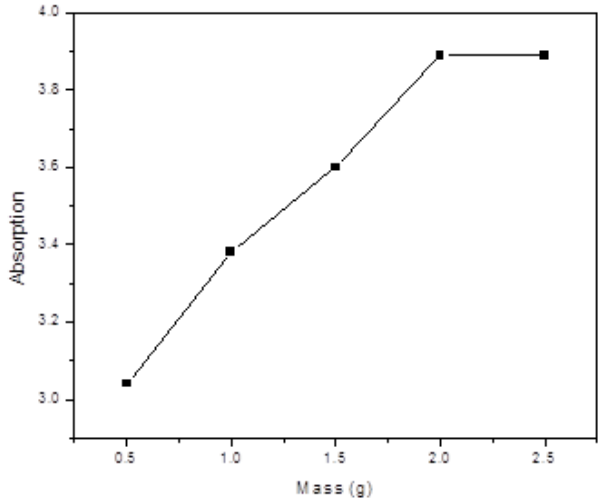
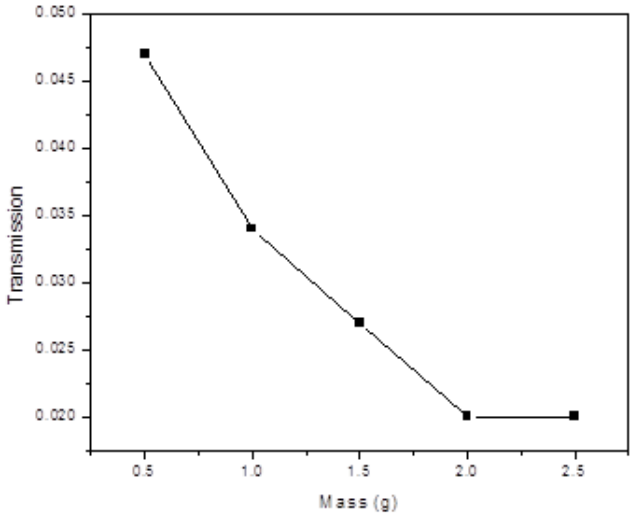


Fig(1) Mass Versus Absorption of Laser By Gypsum Graphite Composite



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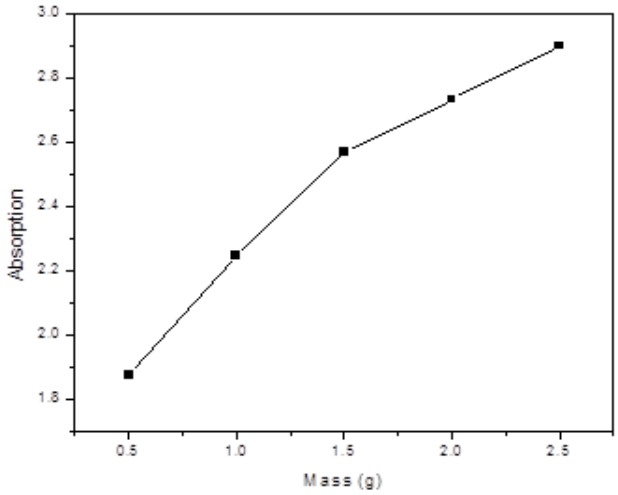

Fig(3) Mass Versus Absorption of White Light By Gypsum Graphite Composite

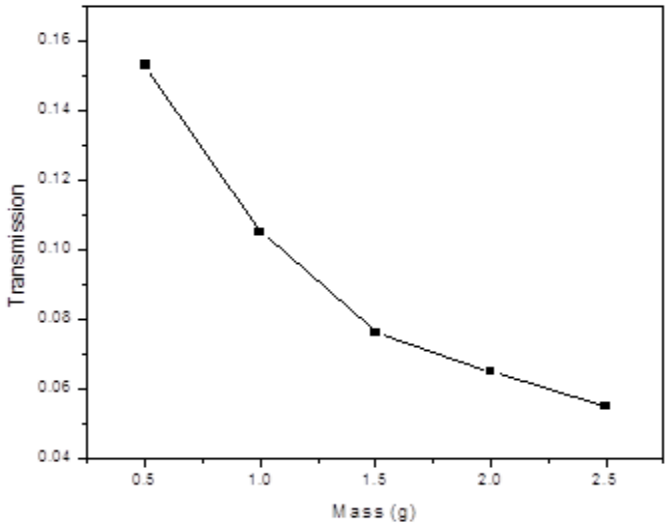

Fig (4) Mass versus Transmission of white light through gypsum graphite composite

IV. DISCUSSION

Composite materials being making of many substances have different indexes of refraction this causes light to scatter a lot, making it different to measure the material overall refractive indexes.In this work shows that the speed of light decreases when the mass of material is increase as well as the wavelength these changes according to the change of voltage of the light (energy or intensity) is inversely proportional with the mass($\cup \alpha \frac{1}{m}$) .

Absorption of light the experimental shows the greatest amount at the maximum amount of mass these means absorption is increases with increases of the mass table (1) for laser and table(2)for white light show relation between absorption and mass as well as the figures represent to that relation to see fig (1) for laser and (3)for white light .

Transmission through gypsum- graphite composite the experimental shows that when the mass increases the amount of transmission decreases there is inverse proportional between transmission and mass the fig(2) for laser and fig(4)explain the relation between mass and transmission.

V. CONCLUSION

The experimental work indicates that light properties are changed with the change of masses of material the change created different relation between mass and properties of the light as speed of light like any wave is dependent upon the properties of the medium through which it moving .

For gypsum –graphite data and process requirement for stable composite according to the stander to the composite quality assurance.

The results show that both gypsum and graphite are effective to improve properties to the best.

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