Sudan University of Science and Technology

College of Graduate Studies

A Study of The Behavior of White Light and Laser wavelengths of Powder Sodium Chloride and Quartz

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الصوديوم- كوارتز

A Thesis Submitted for Partial for The Requirements of The Degree of Master In Physics

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بسم الله الرحمن الرحيم

قال تعالى

:(وقل اعملوا فسيرى الله عملكم ورسوله والمؤمنون وستردون إلى

عالم الغيب والشهادة فينبئكم بما كنتم تعملون)

صدق الله العظيم

سورة التوبة الآية (105)

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#Dedication

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To My Parents ,my family, Colleagues ,Sudan University Of Science and Technology To Everybody Helped Me To Achieve This Work I Say God Bless You All.

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#Acknowledgement

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I would like to thank and appreciate every kind of help I have received to this work in particular I would like to thank my supervisor doctor AmelAbdallah Ahmed Elfaki to her patient and assistant to all periods of this project may ALLAH reward you his Gardens , also I would like to thank any one for valuable advice and guidance thank for all my friends ,colleagues and any one loves me.

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Abstract

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In this study the required tools had located and taken amount from a materialto the purpose to know effect of light on that material . In the beginning, powder of material was taken and extruding white light and laser from different distances every time had calculated the value of the energy of incident light against the distance and mass the material this step was repeated may many time with two or more different materials. For specific materials used as composite for this study are sodium chloride and quartz in same steps had repeated on sodium chloride - quartz composite energy of light from different distances versus different amount of composite material .

Calculated result showed that velocity and wavelength were decreasing together with increasing of the mass of materials separately and as they were composite . Also results showed different relationships between wavelength and optical properties like absorption , reflection and transmission coefficients all of the those coefficients are increasing with decreasing of wavelength except Transmission decreased with wavelength in addition refractive index and momentum are increased with decreasing of wavelength.in addition of that all results calculated correspondence with physical relations.

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Chapter one

Introduction

1.1 Matter Physics

Materials scientists emphasize understanding how the history of a material (its processing) influences its structure, and thus the material's properties and performance[1,2]. The understanding of processing-structure-properties relationships is called the materials paradigm. This paradigm is used to advance understanding in a variety of research areas, including nanotechnology, biomaterials, and metallurgy. Materials science is also an important part of forensic engineering and failure analysis - investigating materials, products, structures or components which fail or which do not operate or function as intended, causing personal injury or damage to property. Such investigations are key to understanding, for example, the causes of various aviation accidents.Recently attention and interest in composite materials increased considerably[2]. Composites materials are formed by combining one or more elements to form bulk matter[2,3].

The composites are broadly classified into metal matrix (MMC), ceramic matrix (CMC) and polymer matrix (PMC) composites. Of these, polymer matrix composites are much easier to fabricate than MMC and CMC. This is due to the relatively low processing temperature required for fabricating polymer matrix composite. PMC's generally consist of synthetic fibers like carbon, nylon, rayon or glass embedded in a polymer matrix, which surrounds and tightly binds the fibers. Typically, the fibers make up about 60 % of a polymer matrix composite by volume. The structure, properties and applications of various composites are being investigated worldwide by several researchers . The fibrous reinforcing constituent of composites may consist of thin continuous fibers or relatively short fiber segments. When using short fiber segments, fibers with high aspect ratio (length to diameter ratio) are used. Continuous fiber reinforced composites are generally required for high performance structural applications. The specific strength (strength to density ratio) and specific stiffness (modulus to density ratio) of continuous carbon fiber reinforced composites can be superior to conventional metal alloys. Also depending upon how fibers are oriented within the matrix, composites can be fabricated into products that have structural properties specifically tailored for a particular use. Polymer concretes are increasingly being used in buildings and other structures. They represent a new type of structural material capable of withstanding highly corrosive environments. The high strength to weight ratio and non-corrosive characteristics of these materials like fiber-reinforced plastics can be utilized to build innovative structures, which are, desirable and economical [4,5]

1.2 The Problem The Work

The selected materials are naturally founded abundance and very cheap for these purposes they must studied their characteristics and then used in appropriates applications to contribute the human beings civilization .

1.3 Aim of The work

The aim of this work is study relation between wave length and some physical quantities of powder Sodium Chloride – Quartz composite.

1.4 literature Review :

different materials can be formed to get new properties here are some former attempted to study about composites:

the first study was done by Jonathanp. Icenhower ,etal USA(Received August23, 1999;accepted in revised form June29, 2000) in that work The kinetics of amorphous silica, SiO_2(am), dissolution was quantified in deionized water and$NaCl$ solutions. By using two sources of pure SiO_2glass (fused purified quartz and pyrolyzed $SiCl_4$), rateswere measured at 40°C to 250°C by applying three types of reactor systems to assess kinetic behavior overthe full temperature range. Dissolution rates of thetwo materials are similar within experimental error.Absolute rates of amorphous silica dissolution in deionized water exhibit an experimental activation energy,Ea,xp, of

81.963.0 and 76.466.6 kJ/mol for the fused quartz and pyrolyzed silica, respectively. These valuesare similar to estimates for quartz within experimental errors. Absolute dissolution rates of SiO2 (am) indeionized water are;103 faster compared to quartz. Amorphous silica dissolution rates are significantlyenhanced with the introduction of NaCl to near-neutral pH solutions such that 0.05 molal sodium ion enhancesrates by 213compared to deionized water. The new kinetic data are combined with previous measurementsof SiO2(am) dissolution rates in 'pure' water to evaluate the temperature dependence of dissolution. Thecomprehensive data set spans 25°C to 250°C and yields the Arrhenius expression logk150.8219123892.3/T(K) to give an apparent activation energy for dissolution of 74.561.4 kJ/mol. These findings steptoward the larger goal of understanding silica polymorph reactivity in the complex fluid compositions ofnatural systems[6].

The second study had been done by SusanWernerKieffer , etal.That work shown

The thermal diffusivity of Teflon, sodium chloride, quartz, and silica glass was measured at 40° C to pressures of 35, 18, 30, and 36 kbar, respectively. A transient line source method was modified for use in a piston-cylinder high-pressure cell. Pressure gradients were determined by experiments with bismuth foils. The pressure dependence of the thermal diffusivity at 40°C for the substances studied may be represented as follows (κ in square centimeters per second, P in kilo bars): for the low-pressure phases of Teflon, Teflon I-II, $P < 5.5$ kbar, $\kappa = 0.0012 + 3.6 \times 10^{-5}P$; for the high-pressure phase, Teflon III, 5.5 kbar $< P < 35$ kbar, $\kappa = 0.0012 + 8.0 \times 10^{-5} P$; for polycrystalline halite, $P < 18$ kbar, $\kappa = 0.0031 + 9.5 \times 10^{-4} P$; for quartz, perpendicular to the c axis, $P < 30$ kbar, $\kappa = 0.031 + 5.3 \times 10^{-4} P$; for silica glass, $P < 36$ kbar, $\kappa = 0.0068 — 6.7 \times 10^{-6} P$. The diffusivity of silica glass decreases with pressure, in contrast to the diffusivity of its crystalline counterpart, quartz, which increases with pressure. In addition to the diffusivity the thermal conductivity of Teflon was determined by measuring the power applied to the heater wire. The thermal conductivity of a Teflon I-II mixture is approximately constant at 0.0075–0.0078 Cal/cm s °K to 5.5 kbar. Above 5.5 kbar the conductivity of Teflon III is given by K = 0.0062 + 4.0 × 10−5P. The specific heat of Teflon decreases with pressure and decreases discontinuously by 15% across the Teflon II-III phase change, in good agreement with the decrease predicted from thermal expansion and compressibility data[7].

1.6 Thesis Presentation:

The thesis consists of four chapters : chapter discusses about general introduction of materials , chapter two about electromagnetic theory and laser properties , chapter three about materials and composites chapter four about materials samples methods and experimental work with results and discussion.

Chapter Two

Electromagnetic Theory

2.1 Introduction

Electromagnetic fields are caused by electric charges at rest and in motion. Positive and negative electric charges are sources of the electric fields and moving electric charges yielding a current is the source of magnetic fields. Time-varying electric and magnetic fields are coupled in an electromagnetic field radiating from the source. This chapter is concerns with the properties of electromagnetic field [8,9].

2.2 Electromagnetic Equations

$$\nabla . D = \rho \qquad (2.1)$$

where D is electric field of flux density and ρ is the charge density[9]

$$\nabla . D = 0 \qquad (2.2)$$

$$D = \varepsilon E \qquad (2.3)$$

Where ε stands for electric permittivity of the medium and E is the electric field intensity

$$B = \mu H \qquad (2.3)$$

Where B is magnetic field flux density,μ stands for electric permittivity of the medium and H is the magnetic field[9,10]

$$\nabla \times H = J + \frac{\partial D}{\partial t} \qquad (2.4)$$

Where J is the current density

$$\nabla \times E = \frac{\partial B}{\partial t} \qquad (2.5)$$

2.3 Interaction of Electromagnetic field with mater

Consider that wave moves in z direction is described by electric compound [9,10]:

$$E_x^{+} = E_{x0}^{+} e^{-\gamma z} e^{-i\omega t} \quad (2.6)$$

In some way magnetic compound represents intensity of magnetic field moves in z direction

$$H_y^{+} = H_{yO}^{+} e^{-\gamma z} e^{-i\omega t} \quad (2.7)$$

When there electromagnetic wave moves in negative direction of z the intensity of electric field described by the function:

$$E_X^{-} = E^{-}_{XO} e^{-\gamma z} e^{-i\omega t} \quad (2.8)$$

$$H^{-}_{y} = H^{-}_{Y\,o}\, x e^{-\gamma z} e^{-i\omega t} \quad (2.9)$$

The resultant of electric waves in two direction will be :

$$E_X = E^{+}_{x} + E^{-}_{x} \quad (2.10)$$

In some way The resultant of the compound of magnetic field:

$$Hy = H^{+}_{y} + H^{-}_{y} \quad (2.11)$$

Propagation of electromagnetic wave in some medium we must know formula of medium coefficient(γ):

$$\gamma = \sqrt{jwt(\sigma + jw\varepsilon)} \quad (2.12)$$

It can be written as real part to express of absorption of the medium to the weave. and imaginary part considers as wave number[9,10] :

$$B = K = \frac{2\pi}{\lambda} \quad (2.13)$$

$$\gamma = \alpha + JB \qquad (2.14)$$

Transmission Coefficient (T):

$$T = \frac{E_t}{E_i} \qquad (2.15)$$

Where $E_t$transmitted energy and $E_i$incident energy.

ReflectionCoefficient (Γ):

$$\Gamma = \frac{E_r}{E_i} \qquad (2.16)$$

Where $E_r$is reflected energy .By using some useful physical laws and equations .the Transmission , Reflection and Absorption coefficients (T,Γand αrespectively) satisfies the relation :

$$T + \Gamma + \alpha = 1 \qquad (2.17)$$

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

$$I = I_{0e^{-\alpha d}} \qquad (2.18)$$

Where I is stands for transmitted intensity , I_0 is incident intensity and d is thickness of the material .there Absorption coefficient can be :

$$\boldsymbol{\alpha = \ln\left(\frac{I_0}{I}\right)/d} \qquad \mathbf{(2.19)}$$

transmission coefficient will be:

$$T = I/I_0 \qquad \mathbf{(2.20)}$$

The Reflection Coefficient will be :

$$\Gamma = 1 - T - \boldsymbol{\alpha} \qquad (2.21)$$

2.4 The Basic Principles of Lasers

The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. Similar to the way in which transistor systems are available to generate andamplify electrical signals, with the advent of lasers we have at our disposal devicesthat are able to generate and amplify coherent light.The essential elements of a laser device are as follows:

Anactive medium, consisting of a collection of atoms, molecules, or ions in agaseous, liquid, or solid state, which generates and amplifies light by means ofappropriate transitions between its quantum energy levels.Apumpingprocess, to excite those atoms (molecules, ions, etc.) up to higher quantum energy levels to producepopulation inversion. Anoptical resonatorsystem, which provides theoptical feedback.

Both the active medium and the resonator determine the light frequencies generated.The light–matter interaction process that takes place in the active medium constitutes the essential key of laser radiation. On the basis of phenomenological considerations, Einstein developed a theory that permits a qualitative understanding ofthe processes related to light absorption and emission by atoms. Three basic light–matter interaction processes can be considered:absorption, spontaneous emission,andstimulated emissionof photons[12,13].

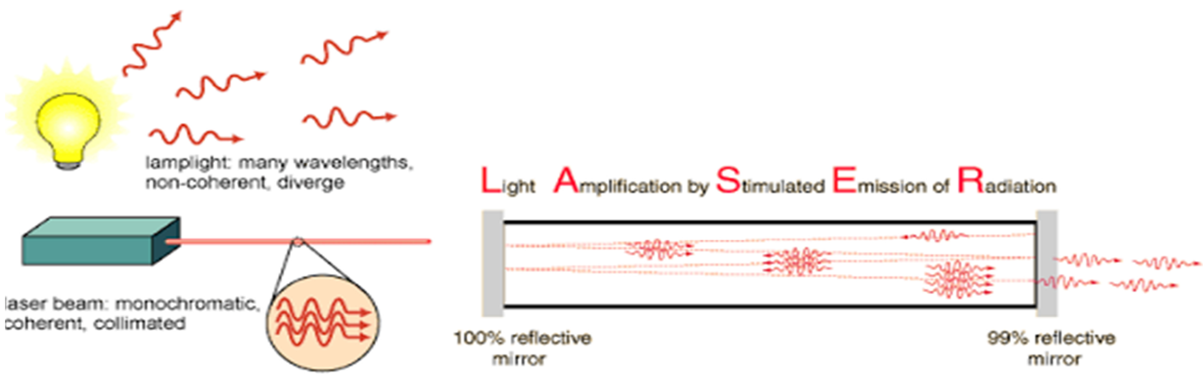


Fig (2.1) laser properties and it's different with Wight light

The Energy of The Light Wave Length :

$$\lambda = \sqrt{\frac{h}{2mqv}} \qquad (2.22)$$

where: v ≡velocity, λ≡ **wavelength**, h ≡ plank's constant q ≡ electric charge and m ≡ mass

$$v = \sqrt{\frac{2Uq}{m}} \qquad (2.23)$$

$$I = E = \frac{hc}{\lambda} = qU \qquad (2.24)$$

Where : U ≡ voltage ,**I≡intensity and c ≡speed of light**

$$p = mv = \frac{h}{\lambda} \qquad (2.25)$$

$$n = \frac{\lambda}{\lambda_0} \qquad (2.26)$$

Where : p≡ momentum, λ≡ Wavelength of first medium , λ_0≡Wavelength of second medium and n≡Refractive index

Chapter Three

Composite Materials

3.1 Introduction

Composite material is a multi-phase combination material of two or more component materials with different properties and different forms through compounding processes, it not only maintains the main characteristics of the original component, but also shows new character which are not possessed by any of the original components. Composite materials should have the following characteristics[14,15]:

Microscopically it is non-homogeneous material and has a distinct interface. There are big differences in the performance of component materials. The formed composite materials should have a great improvement in performance. The volume fraction of component materials are larger than 10%.

3.1.1 Natural composites

Natural composites exist in both animals and plants. Wood is a composite – it is made from long cellulose fibers (a polymer) held together by a much weaker substance called lignin. Cellulose is also found in cotton, but without the lignin to bind it together it is much weaker. The two weak substances – lignin and cellulose – together form a much stronger one. The bone in your body is also a composite. It is made from a hard but brittle material called hydroxyapatite (which is mainly calcium phosphate) and a soft and flexible material called collagen(which is a protein[16,17].

3.1.2 Constituents of Composite Material

composite material consists at least two basic materials they are :

Matrix material could be continuous and Reinforcement material - discontinuous- stronger - harder .fig (3.2) shows composite material [16,17].

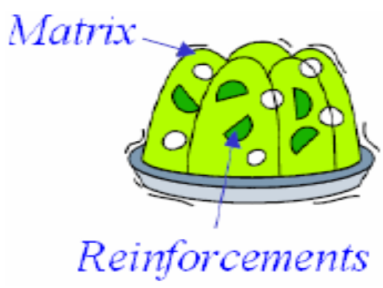


fig (3.2) shows composite material

3. 1.3 Functions a Matrix Material

The main functions of the matrix material like Holds the fibers together ,Protects the fibers from environment ,Protects the fibers from abrasion (with each other)Helps to maintain the distribution of fibers and Distributes the loads evenly between fibers[18,19].

3.1.4 Functions of a reinforcement

The main functions of the matrix material Contribute desired properties ,Load carrying and Transfer the strength to matrix .

3 .1.5 Composite Material Structure

The structure of a composite is commonly such that one of the components is the matrix while the other components are fillers bound by the matrix, which is often called the binder. For example, in carbon fiber reinforced polymer, which is important for lightweight structures, the polymer is the matrix, while the carbon fiber is the filler. In case of a structural composite, the filler usually serves as a reinforcement[20,21]. For example,

3.2 Classes Of Composite Materials.

These materials have low specific gravity that make their properties particularly better in strength and models Composite materials are constructed from two or more elements to provide a material that has different properties from the individual elements Composite materials that exist today can be categorized into five major classes are :

3. 2.1 Polymer Matrix Composites (PMCs)

Polymer Matrix Composites (PMCs) are the most common composites, and are also known as Fiber Reinforced Polymers (or Plastics) FRP. These materials use a polymer-based resin as the matrix, and a variety of fibers such as glass, carbon and aramid as the reinforcement. Matrix materials are thermosetting thermoplastic, elastomer, and rigid rod plastic, thermoplastic plastic polymers. Reinforcing fibers are either continuous or chopped. In general, polymer composites processing includes contracting of polymer and fibers, shaping, controlled heating and/ or reactions [20.21].

3.2.2 Metal Matrix Composites (MMCs)

Metal matrix composites can be obtained using either a primary liquid phase approach such as squeeze casting/infiltration or spray deposition, or a primary solid state processing such as powder techniques and foil diffusion. Common MMCs are aluminum based MMCs, fiber reinforced titanium alloys, and magnesium alloy-SiC particulate MMC. The aluminum-based materials are the most popular for reasons of cost and ease of fabrication

3.2.3 Ceramic Matrix Composites (CMCs)

Ceramic Matrix Composites (CMCs) are used for very high temperature environments. The definition of the ceramic matrix can be rather broad. It includes inorganic silica-based glasses, crystalline ceramics, glass-ceramics, intermetallic and carbon. All of these have implicit unifying thread in that they are fairly high temperature structural materials.

3.2.4 Carbon - Carbon Composite (CCC s)

The development of carbon-carbon materials began in 1958 and was nurtured under the US Air Force space plan program DynaSoar, and NASA 3 Apollo projects Carbon-carbon materials are a generic class of composites much like graphite /epoxy family of polymer matrix composites[22.23].

3.2.5 Intermetallic Matrix Composites (IMC s).

Several major problems limit the development of inter-metallic-matrix composites (IMCs), including chemical incompatibility and CTE mismatch between potential reinforcing fibers and matrix materials, poor low- temperature ductility, and marginal high-temperature oxidation resistance of intermetallic materials. Composite fabrication and joining processes do not result in excessive fiber/matrix reaction or matrix contamination[21.23].

3.3 Applications of Composite Materials

This is a brief listing of current and proposed applications of composite materials in various branches of industry. It is not intended to be comprehensive or all embracing, but merely to give an indication of the range of possibilities for designers[24,25].

3. 3.1Aerospace

A wide range of load-bearing and non-load-bearing components are already in use in both fixed-wing and rotary wing aircraft. Many military and civil aircraft now contain substantial quantities of lightweight, high-strength carbon-, Kevlar- and glass-fibre composites, as laminated panels and mouldings, and as composite honeycomb structures with metallic or resin-impregnated paper honeycomb core materials[24,25].

3.3.2 Automotive Engineering

There is increasing interest in weight reduction in order to permit both energy conservation and increased motoring economy. Reduction in the weight of an automobile structure achieves primary weight-saving and if carried to sufficiently great lengths enables the designer to use smaller power plants, thus achieving substantial secondary improvements in fuel economy[24,25].

3.3.3 Bio Engineering

Carbon-fibre-reinforced plastic and carbon components are in use for prosthetic purposes, such as in orthopaedic fracture fixation plates, femoral stems for hip replacements, mandibular and maxillary prostheses (jaw remodelling, for example), and for external orthotic supports in cases of limb deformity etc[24,25].

3.3.4 Civil/Structural Engineering

Again the bulk of composites used in this field are glass-reinforced plastics. The low inherent elastic modulus of GRP is easily overcome in buildings by the use of double curvature and folded-plate structures: thin GRP panels also offer the advantage of translucency. Glass-reinforced cement (GRC) products made with Cem-FIL (alkali-resistant glass fibres) are gradually being introduced as structural cement-based composites, but these GRC are still regarded with some suspicion by architects who prefer to consider only non-load-bearing applications for glass-reinforced cement.

3.3.5 Electrical Engineering

Typical applications are radomes, structural components for switch gear, power generator coolant containment and large-diameter butterfly valves, high-strength insulators (eg. for overhead conductor systems), printed circuit boards, and casings for electronic equipment. incorporate GRP or hybrid blading**[24,25]**.

3.3.6 Marine Engineering

Marine applications include surface vessels, offshore structures and underwater applications. A vast range of pleasure craft has long been produced in GRP, but much serious use is also made of the same materials for hull and superstructure construction of passenger transport vessels, fishing boats and military (mine-countermeasures) vessels. Sea-water cooling circuits may also be made of GRP as well as hulls and other structure**[24,25]**.

3.3.7 Sport

Perhaps the most visible development in the use of composites has been in the sports goods industry. Manufacturers have been quick to seize on the potential advantages of new materials like carbon and boron fiber composites over conventional wood and metal for sports

Fig (3.3) Application of Composite Materials

3.4Advantages of Composites

Composites are engineered materials. We can engineer them specifically to meet our needs on a case-to -case basis In general properties like Lower density (20 to 40%) , Higher directional mechanical properties (specific tensile),strength (ratio of material strength to density) 4 timesgreater than that of steel and aluminum , Higher Fatigue endurance , Higher toughness than ceramics and glasses ,Versatility and tailoring by design , Easy to machine and Can combine other properties (damping, corrosion)**[26,27]**.

Chapter Three

Martials and Methods

4.1 Introduction

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 Sodium Chloride(NaCl) ,Quartz (SiO2).

4.2 Materials Samples

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

4.2.1 Sodium chloride

Sodium chloride it also known salt is readily soluble in water and insoluble or only slightly soluble in most other liquids it forms small ,transparent ,colorless to white ,cubic crystal.it is an ionic compound Sodium chloride is odorless but has an ionic characteristics tasted. Being made up of equal numbers of positively charges sodium and negatively charges chloride ions .when it is melted or dissolved in water the ions can move about freely ,so that dissolved or molten sodium chloride is conductor of electricity .it can be decomposed into sodium and chlorine by passing an electrical current through it sodium chloride has Density (2.165 g/cm3), Melting point (801 C^{o}), and refractive index($\boldsymbol{n_D}$=1.5442) [28] fig(4.1) shows sodium chloride sample .

4.2.2 Quartz

Quartz is a very common mineral a chemical compound of silicon and oxygen , silicon dioxide SiO2 ,commonly called silica . if pure Quartz is colorless

,transparent ,and vary hard crystalline material of glass like look .the well-known rock crystal six-sided prism with a six –sided pyramid at their ends are simply well formed crystals of Quartz . Quartz is important rock forming mineral ,being a constituent of many common rocks like granite .Quartz has Refractive index(n_ω=1.543-1.545, n_ε= 1.552-1.554),Melting point (1670 c (β tridynite), 1713 c (β critoblite)), Density(2.66 g/cm)and Hardness(7).fig[29] (4.2)shows Quartz sample .

Fig(4.1) sodium

Fig(4.2) Quartz

4.3 Experimental part

The main purposes of this part description of the experimental setup used for released of light on material as well as the materials used beside of the procedures requested .

4.4 Instruments :

the instruments are used in the experiment like

4.4.1 Photoelectrical cell

Photoelectrical cell is an electronic device that converts light into electrical energy by producing a voltage or that uses light to regulate the flow of current , used in automatic control system for doors , burglar alarm, lighting etc figure (4.3) shows representation of photoelectric cell .

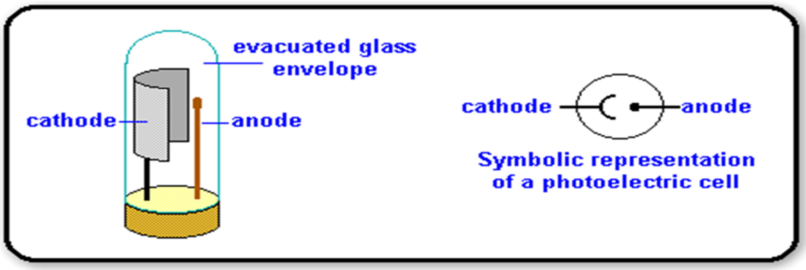


fig (4.3) symbolic representation of photoelectric cell .

4.4.2 Multi- Meter

AVO Meter is a device to measure current , voltage and electrical resistance . multi- Meter is short for Ampere Volt Ohm meter. Figure(4.4) of AVO Meter

Figure(4.4) Multi- Meter

4.4.3Laser Light Source

Laser is a device that emits electromagnetic radiation through a process of optical amplification based on the stimulated emission of photons . lasers are devices that produce intense beams of light which monochromatic , coherent and highly collimated . the wave length of laser light is extremely pure when compared to other sources of light all photons that make up the laser beam have a fixed phase relationship with respect to one another .light from a laser typically has very low divergence [1213]. fig(4.5) shows symbolic of laser source

fig(4.5) symbolic of laser source

4.4.4 piece of Glass

The main characteristics of glass are transparency , heat resistance , pressure and breaking resistance and chemical resistance . glass refractive index is 1.52 fig(4.6) shows symbolic piece of glass.

.

fig(4.6) piece of a glass

4.4.5 white Light source

Light is electromagnetic radiation within a certain portion of the electromagnetic spectrum .the word usually refers to visible light , which visible to the human eye and it is responsible for the sense of slight fig(4.7) shows symbolic of white light source[8,9].

fig(4.7) symbolic of white light source

4.5 Experimental Procedures

Sodium chloride and quartz materials in powder form are exposed first to Laser and Light at distances 10cm and 15cm respectively .The powder was put on glass substrate and the light sources above it illuminate the sample .the mlti- meter was mounted below the sample and glass , to take the reading of the voltage resulting from exposure of photo cell detector to light .By this way was taken different grams of gypsum and graphite separately and taken as mixture Sodium chloride and quartz at different ratios of increasing amount of both materials as single and as in composite case .

4.6 Experimental set up :

The setup is shown in figure (4.8-A), it was composed of laser source , AVO meter, photocell and slice of glass (with material).

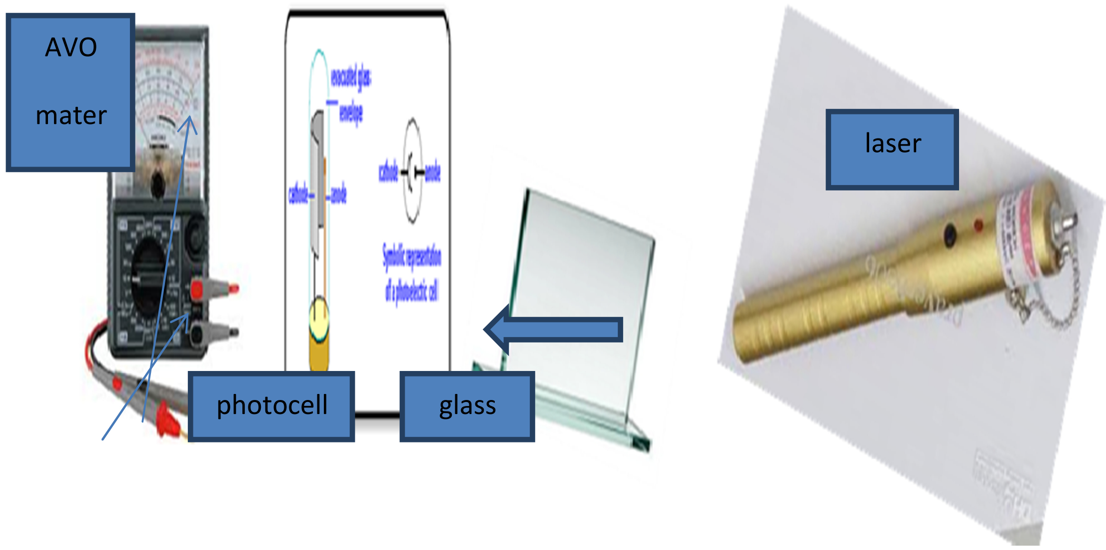


Fig (4.8-A) schematic diagram of experiment of using laser source

The setup is shown in figure (4.8-B), it was composed of white light source , AVO meter, photocell and piece of glass (with material).

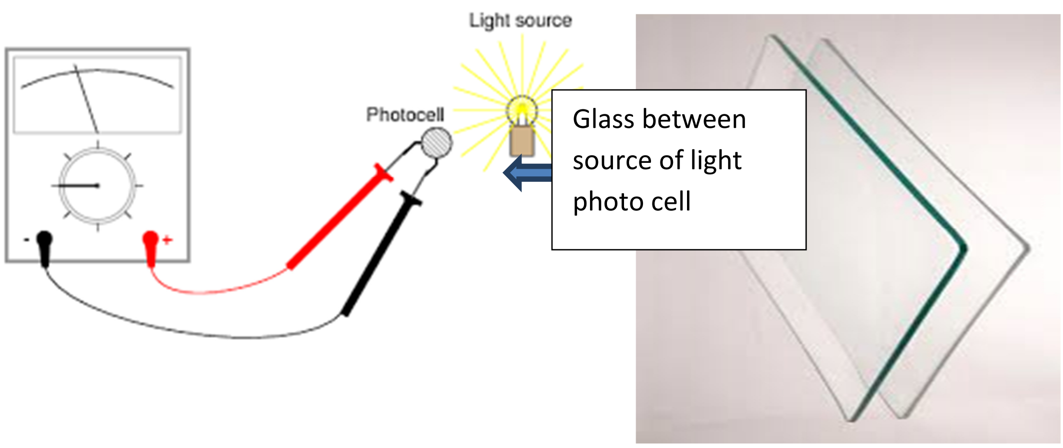


Fig (4.8-B) schematic diagram of experiment of using white light source

4.7 Results and Discussions

4.7.1 Separate Results of Sodium Chloride and Quartz

Table (4.1) Results of Sodium chloride exposed by laser at distance 10cm and 15cm

The results show that when the mass increased the value of voltage decreased in same in two distances the inverse proportional with voltage

	Sodium chloride		Quartz	
Mass (g) $\pm \mathbf{0.5g}$	V(Volts) $\pm \mathbf{1}$mv 10cm-laser source	V(Volts) $\pm \mathbf{1}$mv 15cm- laser source	V(Volts) $\pm \mathbf{1}$mv 10cm- laser source	V(Volts) $\pm \mathbf{1}$mv 15cm- laser source
0.5	2.5	2.2	1.2	1.1
1.0	1.8	1.5	0.6	1.0
1.5	1.5	1.2	0.5	0.8
2	1.0	0.8	0.4	0.4
2.5	0.8	0.6	0.3	0.3

Table (4.2) Results of Sodium chloride exposed by white light at distance 10cm and 15cm- The results show that when the mass increased the value of voltage decreased in same in two distances the inverse proportional with voltage .

	Sodium chloride		Quartz	
Mass (g) $\pm \mathbf{0.5g}$	V(Volts) $\pm \mathbf{1}$mv 10cm-light source	V(Volts) $\pm \mathbf{1}$mv 15cm-light source	V(Volts) $\pm \mathbf{1}$mv 10cm-light source	V(Volts) $\pm \mathbf{1}$mv 15cm-light source
0.5	10	6.6	1.2	2.8
1.0	5.3	5.2	0.6	2.2
1.5	3.5	5.0	0.5	0.8
2	2.6	4.2	0.4	0.7
2.5	1.6	1.2	0.3	0.6

4.7.2 composite Results of Sodium Chloride and Quartz

Table (4.3) Results of sodium chloride and Quartz composite in ratio (1:0.25) with laser and white light at distance 10cm and 15cm- the results gave best results with white light and show inverse proportional between mass and voltage addition change of distance had different effects in two lights also followed decreasing of voltage with increasing of distance the figures (4.9),(4.10),(4.11)and (4.12) show relations between mass and voltage in distances 0f 10 15cm of sodium chloride and Quartz composite in ratio (1:0.25) by using laser and white light

	Laser		White light	
Mass (g) $\pm 0.5g$	V(Volts) ± 1mv 10cm	V(Volts) ± 1mv 15cm	V(Volts) ± 1mv 10cm	V(Volts) ± 1mv 15cm
0.5	1.5	0.6	20	14.2
1	1.0	0.5	15.8	10.4
1.5	0.6	0.4	11.2	8.0
2	0.5	0.4	8.5	6.6
2.5	0.4	0.3	4.6	5.0

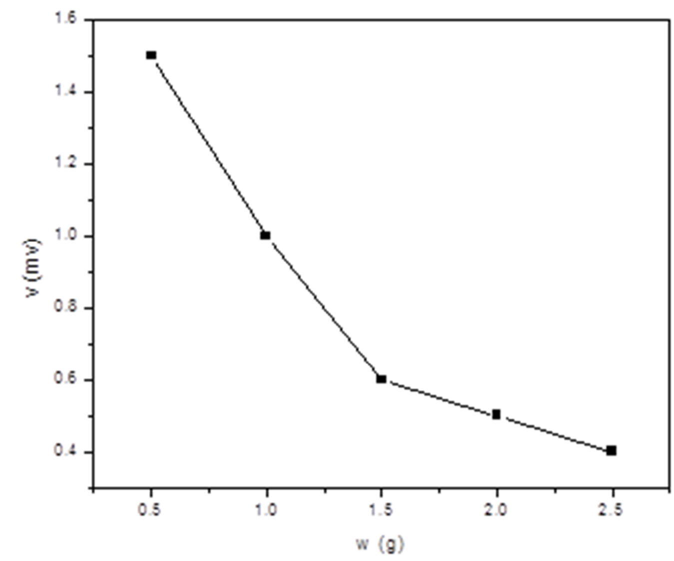


Fig (4.9) Results of sodium chloride and Quartz composite in ratio (1:0.25) with laser at distance 10cm

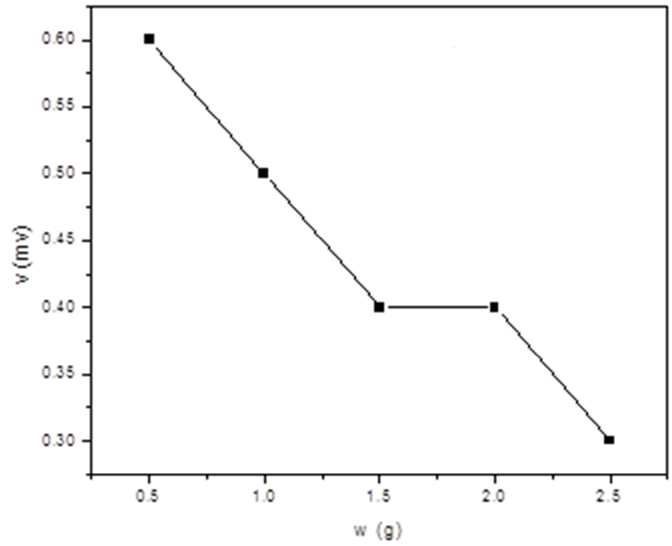
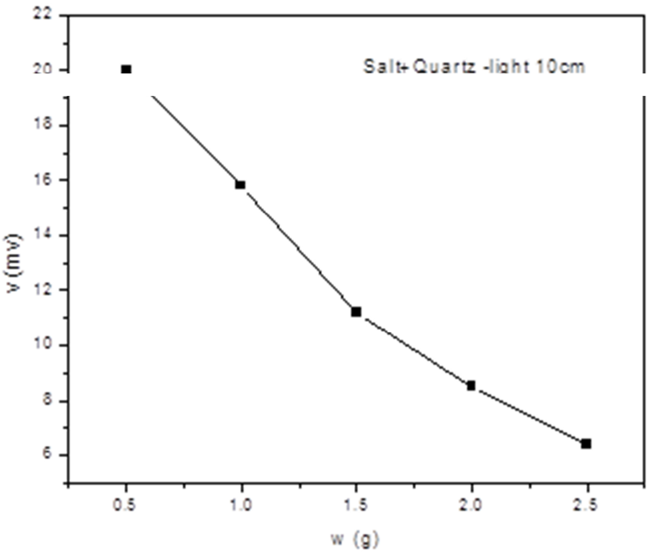
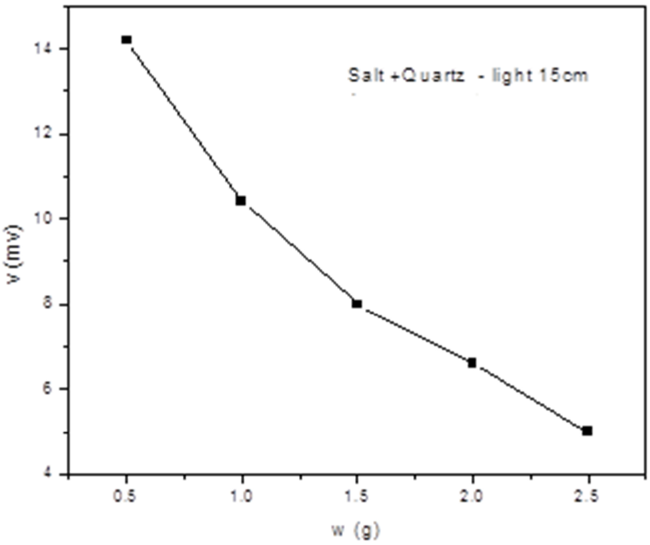


Fig (4.10) Results of sodium chloride and Quartz composite in ratio (1:0.25) with laser at distance 15cm



Fig(4.11) Results of sodium chloride and Quartz composite in ratio (1:0.25) with white light at distance 10cm



fig(4.12) Results of sodium chloride and Quartz composite in ratio (1:0.25) with white light at distance 10cm and 15cm

4.7.3 Velocity, wavelength, intensity, momentum and wave number:

By using equations (2.22)and(2.23)The incident velocity of laser:(V1 $=7.1\times10^{5}$m/s) for white light ($V2=20.5\times10^{5}$m/s)and wavelength(ƛ1= 3.7 $\times10^{11}$m),(ƛ2= 6.20×10^{11}m) respectively for laser and white light. Also using equations (2.25),(2.17)and (2.25) to find Wave number Intensity and Momentum

Table (4.4)Results Laser on Sodium Chloride-Quartz Composite in ratio(1:0.25) and some physical quantities- In the order get optimum properties from this mixture of sodium chloride –quartz by the obtained light effect on this compound the results of wavelength of the light showed different relations with some physical quantities the values of wavelength are decreased from ranges ($3.7\text{-}1.3\times10^{11}$m) at minimum value of laser and ($6.2\text{-}2.7\times10^{11}$m) at minimum value of Wight light .The relationships of wavelength with some physical relations of obtained results showed as following :

Velocity of light decreased with decreasing of wavelength it takes ranges from(7.1-1m/s)at minimum value of laser .Momentum and Wave Number both are increasing with decreasing of wavelength the momentum takes values ($4.125\text{-}5.070\times10^{20}$ gm/s)for laser and($1.833\text{-}2.444\times10^{20}$ gm/s)and wave number takes values ($3.925\text{-}4.831\times10^{20}$ gm/s) for laser

Voltage (U)volt	Velocity(v) $\times10^{5}$m/s	Wave length(ƛ) $\times10^{11}$m	Intensity(i) $\times1o^{(-22)}$	Momentum(p) $\times10^{-20}$gm/s	Wave number(k) $\times10^{-11}$ m^{-1}
0.6	1.4	1.6	0.96	4.125	3.925
0.5	1.3	1.5	0.80	4.400	4.186
0.4	1.1	1.4	0.64	4.714	4.485
0.4	1.1	1.4	0.64	4.714	4.485
0.3	1.0	1.3	0.48	5.076	4.831

Table (4.5)Results White Light on Sodium Chloride Quartz Composite- and some physical quantities Velocity of light decreased with decreasing of wavelength it takes ranges (20.5-4.1m/s)at minimum value of Wight light Momentum and Wave Number both are increasing with decreasing of wavelength the momentum takes values (1.833-2.444×10^{20} gm/s)and wave number takes values (1.705-2.325×10^{20} gm/s) for white light the tables(4.13)and(4.14)explain relation between wavelength, momentum and wave number.

Voltage (U)volt	Velocity(v) ×10^5m/s	Wave length(ʎ) ×10^{11}m	Intensity(i) × 1o$^{(-22)}$	Momentum(p)×1(^{20}gm/s	Wave number(k) ×10^{-11} m^{-1}
14.2	7.0	3.6	22.72	1.833	1.705
10.4	6.0	3.3	16.64	2.000	1.903
08.0	5.3	3.1	12.8o	2.129	2.025
06.6	4.8	3.0	10.56	2.200	2.093
05.0	4.1	2.7	08.00	2.444	2.325

4.7.4 Coefficients and Refractive Index :

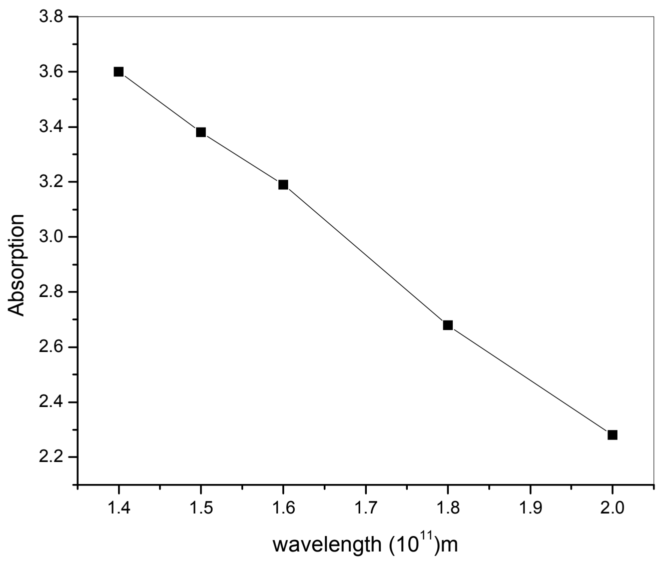
by using equations(2.19),(2.20),(2.21)and (2.26) to find these physical quantities .

Table(4.6)Results of three coefficients and Refractive index of sodium chloride-Quartz by using laser- Momentum and Wave Number both are increasing with decreasing of wavelength the momentum takes values (4.125-5.070×10^{20} gm/s)for laser and wave number takes values (3.925-4.831×10^{20} gm/s) for laser .Absorption , Reflection and Wave Number are increased with decreased of wavelength the Fig(4. 13) for Absorption and Fig (4. 17) for wave number. -Transmission the results showed that proportional with wavelength they are decreasing with increasing of amount of material increasing of amount of the material Table(4.17)and (4.18)explain relation between wavelength and Transmission .

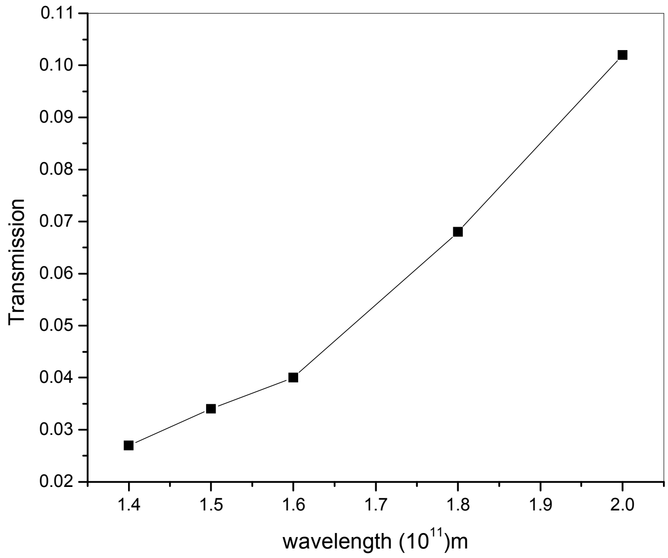
Wavelength(ʎ) ×(10^{11}m)	Absorption	Transmission	Reflection	Refractive index
2.0	2.28	0.102	1.38	1.85
1.8	2.68	0.068	1.74	2.05
1.6	3.19	0.040	2.23	2.31
1.5	3.38	0.034	2.41	2.46
1.4	3.60	0.027	2.62	2.64

Table (4.7) Three coefficients and Refractive index of Sodium chloride -Quartz by using white light- Momentum and Wave Number both are increasing with decreasing of wavelength the momentum takes values(1.833-2.444×10^{20} gm/s)and wave number takes values (1.705-2.325×10^{20} gm/s) for white light .Absorption , Reflection and Wave Number are increased with decreased of wavelength the Fig (4. 15) for Absorption and Fig (4. 18) for wave number. -Transmission the results showed that proportional with wavelength they are decreasing with increasing of amount of material increasing of amount of the material fig (4.16)explain relation between wavelength and Transmission .

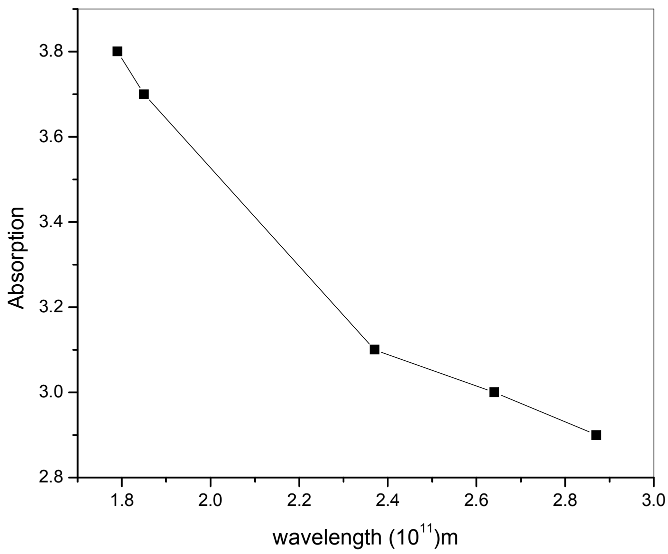
Wavelength(ʎ) ×1011m	Absorption	Transmission	Reflection	Reflective index
3.8	1.79	0.166	0.900	1.63
3.7	1.85	0.156	1.006	1.67
3.1	2.37	0.093	1.463	2.00
3.0	2.64	0.070	1.710	2.06
2.9	2.87	0.056	1.926	2.14



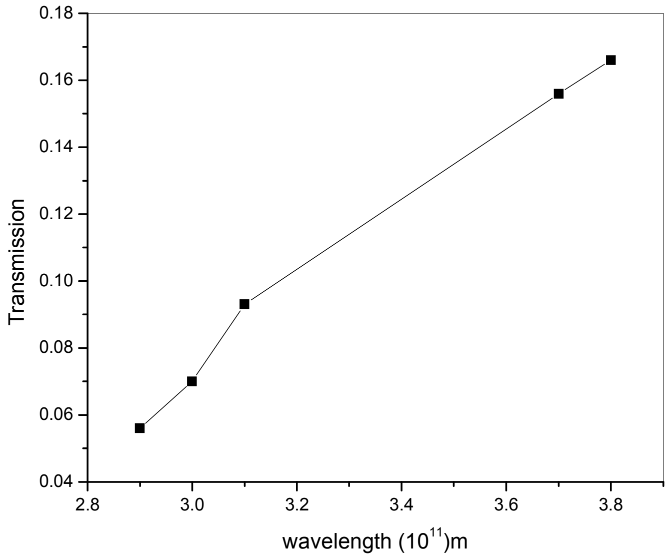
Fig(4. 13) Wavelength Versus Absorption of Laser on Sodium Chloride- Quartz Composite in ratio(1: 0.25)



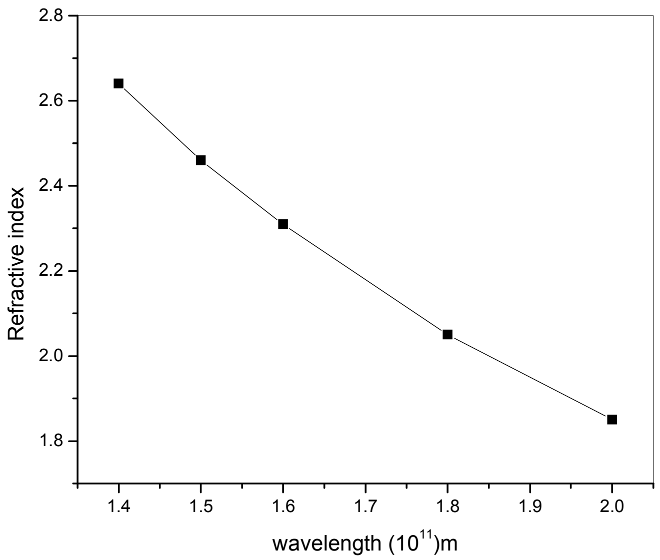
Fig(4.14) Wavelength Versus Transmission ofLaser Through Sodium Chloride - Quartz Composite in ratio(1: 0.25)



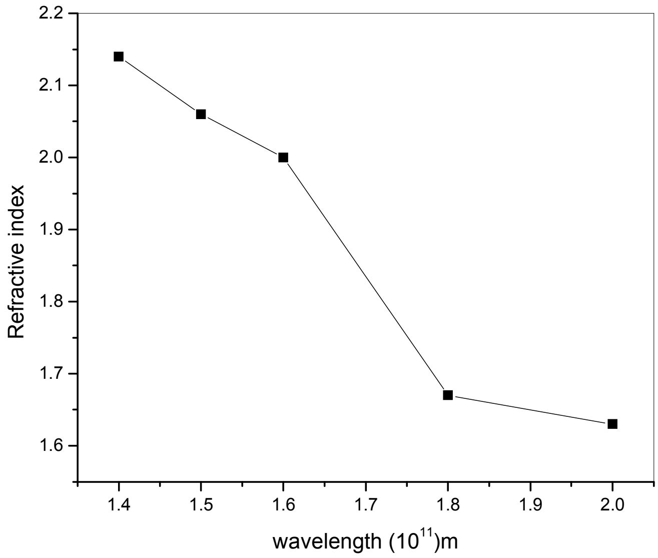
Fig(4.15) wavelength Versus Absorption of white light on Sodium Chloride Quartz Composite in ratio(1: 0.25)



Fig(4.16) wavelength Versus Transmission of White Light Through Sodium Chloride-Quartz Composite in ratio(1: 0.25)



(4.17)Wavelength versus refractive index of laser on sodium chloride Quartz in ratio(1: 0.25)



(4.18)Wavelength versus refractive index of Wight light on sodium chloride –quartz in ratio(1: 0.25)

4.8 Conclusion

In the light of the information to sum up, the following conclusions can be drawn:

The data shown that studied wavelength was realized the physical relation.

The results of white light was better than laser light results according to the strong of the light this composite of sodium chloride – quartz improved it's characteristics with Wight light .Sodium chloride as matrix material and Quartz as reinforcement material give good properties with light.

The experimental indicated that must be some criteria to make composite materials by the stander of specialized agency and with considering application of that composite .

When sodium chloride –quartz in same quantity occupy intermediate results.

4.9 Recommendations

The results can be improve to get better in future planning as these points :

1- Safety and Certification Initiatives of selected materials composites
2- Work with industry, other government agencies, and academia to ensure safe andefficient deployment of composite technologiesbeing pursued for use in suitable applications.
3- Update policies, advisory circulars, training, and detailed background used to supportstandardized composite engineering practices.
4- Primary goals to help ensure consistent and stable materials to study comprehensive control of ingredients and processes for producing the material.
5- In this composite must be study thermal ,mechanical and others physical propertiesfull assessment of these effects to make decisions about application and a new material created by mixture system.

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