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RESEARCH ARTICLE

DOPING OF SOME ORGANIC MATERIALS (TALHA & HASHAB)

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ABSTRACT

In this work we used powder of Aluminum hydroxide $AL(OH)_3$ and the solution of iodine as doping materials for two type of Arabic Gum(Talha and Hashab) with different in concentration and doping rate. The samples were heated first then pressed to act as p-type sheet. The energy gap at Talha was 3 eV as maximum when doping rate was 0.8% and concentration was 0.8mg/L while Hashab the maximum energy gap was 2.199700 eV when the doping rate was 0.2% and concentration was 0.2 mg/L. These new materials for doping semiconductor Arabic Gum shows many interesting properties. Talha Gum get regular increasing of energy gap related to increase in concentration and doping rate. While the Hashab get the random increasing of Energy gap related to decrease in concentration and doping rate ; It was observed that the different concentration of the samples confirmed the reason for the band gap shifts in addition to active Aluminum properties that increased energy gap.

INTRODUCTION

A semiconductor is a substance, usually a solid chemical element or compound that can conduct electricity under some conditions but not others, making it a good medium for the control of electrical current. Its conductance varies depending on the current or voltage applied to a control electrode, or on the intensity of irradiation by infrared (IR), visible light, ultraviolet (UV), or X rays. The specific properties of a semiconductor depend on the impurities, or dopants, added to it. An N-type semiconductor carries current mainly in the form of negatively-charged electrons, in a manner similar to the conduction of current in a wire. A P-type semiconductor carries current predominantly as electron deficiencies called holes. A hole has a positive electric charge, equal and opposite to the charge on an electron. In a semiconductor material, the flow of holes occurs in a direction opposite to the flow of electrons (Bell *et al*., 2008 and Bubnova *et al*., 2011). Doping is the process of adding impurities to intrinsic semiconductors to alter their properties. Normally Trivalent and Pentavalent elements are used to dope Silicon and Germanium. When an intrinsic semiconductor is doped with trivalent impurity it becomes a P-Type semiconductor (Gregg *et al*., 2004 and Kim *et al*., 2012). The P stands for Positive, which means the semiconductor is rich in holes or Positive charged ions. When we dope intrinsic material with Pentavalent impurities we get N-Type semiconductor, where N stands for Negative. N-type semiconductors have Negative charged ions or in other words have excess electrons.

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EXPERIMENTAL SETUP

MATERIALS AND METHODS

-Two types of Arabic Gum (Talha, Hashab) **-**Aluminum hydroxide AL $(OH)_3$, -Water -Solution of Iodine, -Furnace, Manual pressing device and -USB2000 Fiber Optic Spectrometer.

USB2000 Fiber Optic Spectrometer

The USB2000 Spectrometer connects to a notebook or desktop PC via USB port or serial port. When connected to the USB port of a PC, the USB2000 draws power from the host PC, eliminating the need for an external power supply (Kim, 2011 and Xia, 2012).

Fig. a. Ocean Optics USB2000 Fiber Optic Spectrometer

Method I

How Sampling Works

The following list explains the function of Ocean Optics sampling components in the sampling process:

- The user stores reference and dark measurements to correct for instrument response variables.
- The light from the light source transmits through an optical fiber to the sample.
- The light interacts with the sample.
- Another optical fiber collects and transmits the result of the interaction to the spectrometer.
- The spectrometer measures the amount of light and transforms the data collected by the spectrometer into digital information.
- The spectrometer passes the sample information to OOIBase32.
- OOIBase32 compares the sample to the reference measurement and displays processed spectral information.

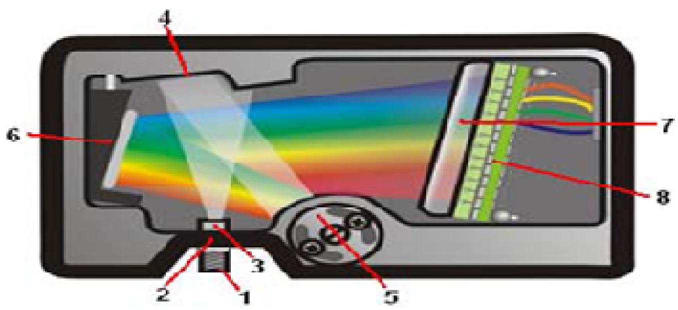

Fig. b. USB2000 Spectrometer with Components

Method II

Samples of Arabic Gum was dissolved, lending in water each of them separately and added to a solution of iodine and AL (OH) $_3$ powder in different concentrations and then placed in Petri dishes and exposing the samples by furnace to a temperature up to 300^{O}C degrees and then formed in the form of tablets by using manual pressing device and got 4 samples of each type and put discs in the USB2000device, and read the results of energy gap for all samples.

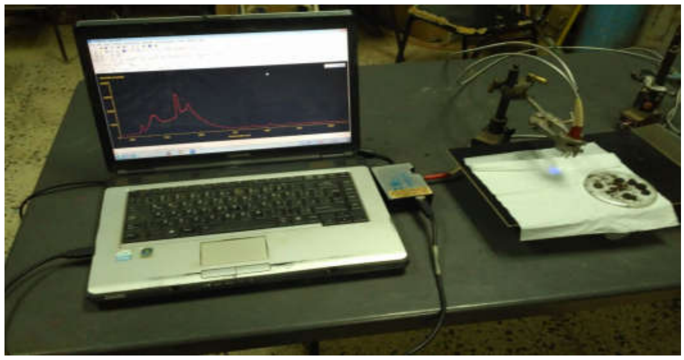

Fig (C) shown the tablet of Arabic Gum doped by active Aluminum AL^{+3} using USB2000 device to take the energy gab Readings

RESULTS

Was calculated the energy gap of all sample of doping Arabic Gum with iodine according to the samples that came from Hashab and Talha and the results were as shown in the fig (1 to 8)

Table 1. Relationships between energy gap and doping concentration of Talha Gum

No of samples	Doping %	Concentration of Talha (mg/L)	Energy gap(eV)
Sample 1	0.2	0.2	1.6365
Sample 2	2.4	2.4	1.75733
Sample 3	0.6	0.6	2.06900
Sample 4	0.8	0.8	3.00000

Table 2. Relationship between energy gap and doping concentration of Hashab Gum

No of samples	Doping %	Concentration of Talha (mg/L)	Energy gap(eV)
Sample 1	0.2	0.2	2.199700
Sample 2	2.4	2.4	2.102236
Sample 3	0.6	0.6	1.672900
Sample 4	0.8	0.8	2.146466

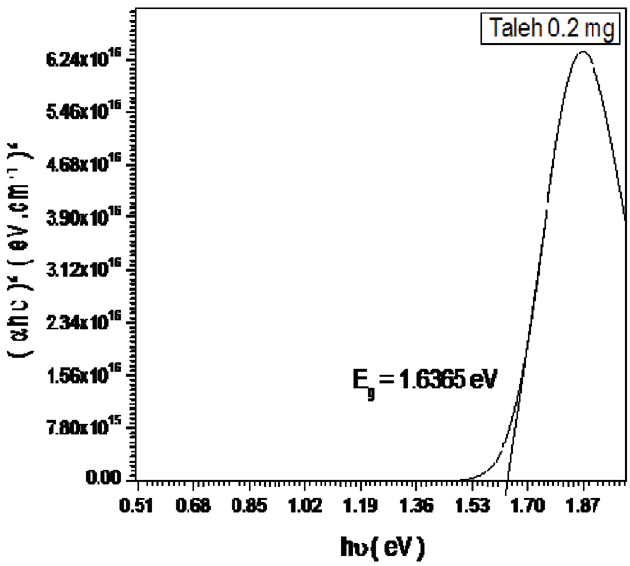

Figure 1. Shows the energy gap of Talha gum with doping rate 0.2%

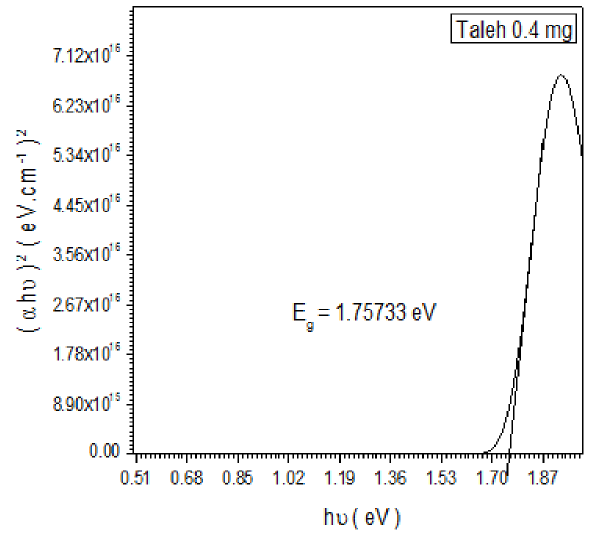

Figure 2. Shows the energy gap of Talha gum with doping rate 0.4 %

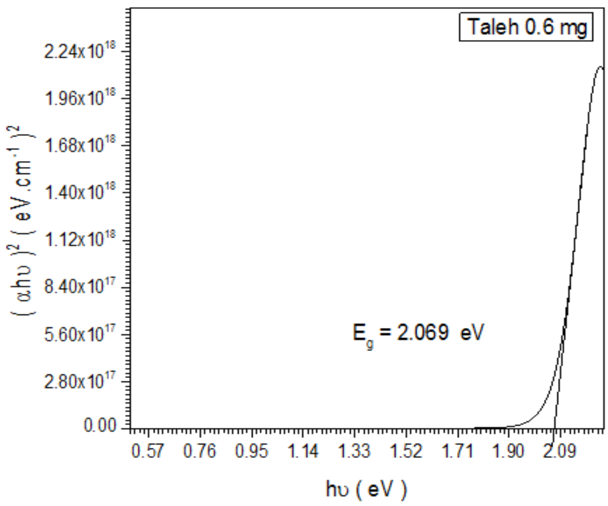

Figure 3. Shows the energy gap of Talha gum with doping rate 0.6 %

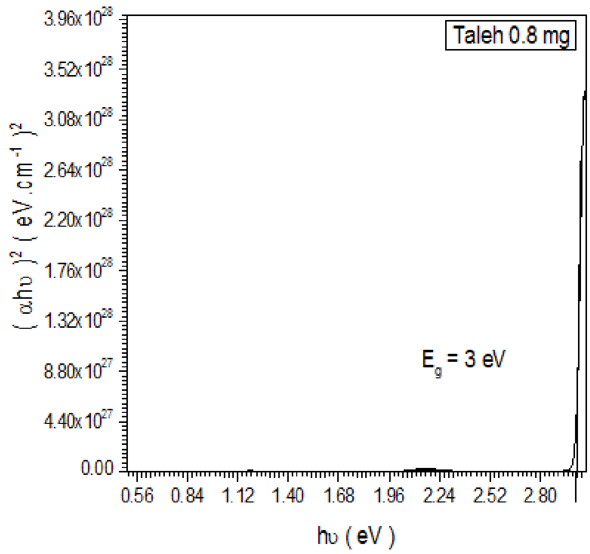

Figure 4. Shows the energy gap of Talha gum with doping rate 0.8 %

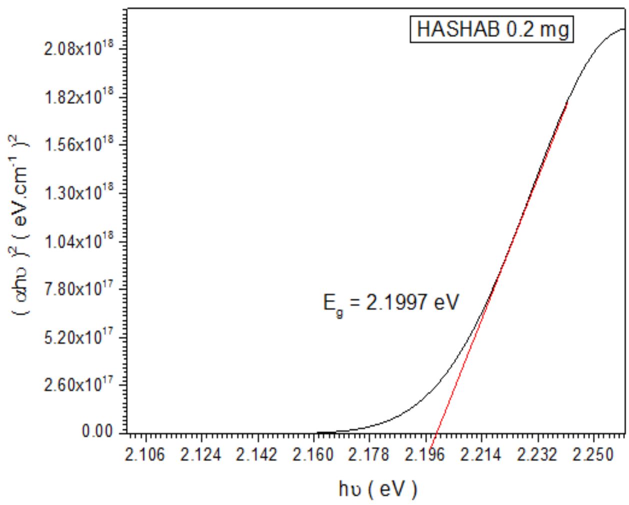

Figure 5. Show the energy gap of Hashab gum with doping rate 0.2 %

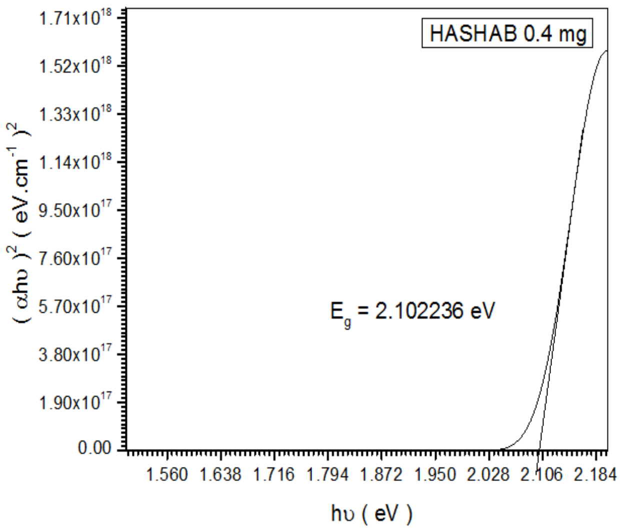

Figure 6. Shows the energy gap of Hashab gum with doping rate 0.4 %

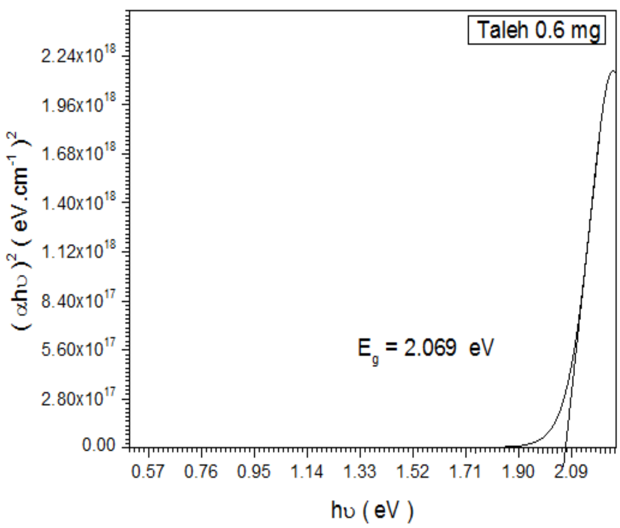

Figure 7. Shows the energy gap of Hashab gum with doping rate 0.6 %

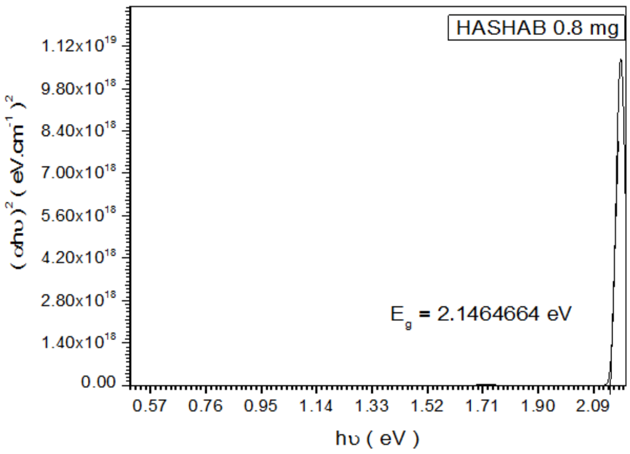

Figure (8) shows the energy gap of Hashab gum with doping rate 0.8 %

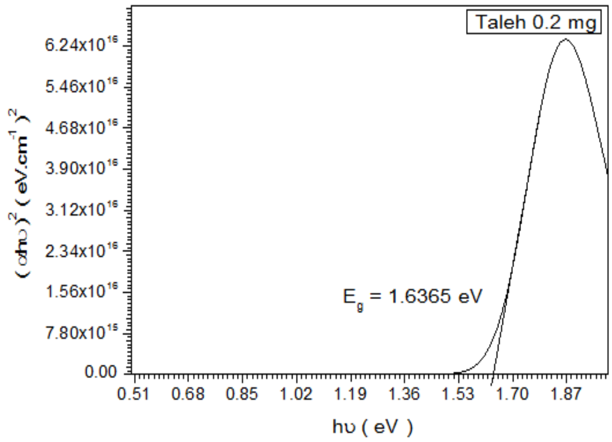

Figure 1a. from table 1 shows the energy gap of Talha gum with doping rate 0.2%

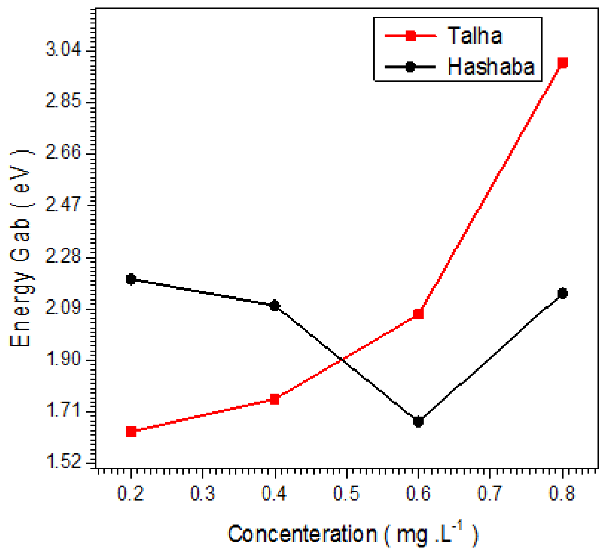

Figure 9. Shows the Variation of concentration and Energy Gab for Hashab and Talha GUM

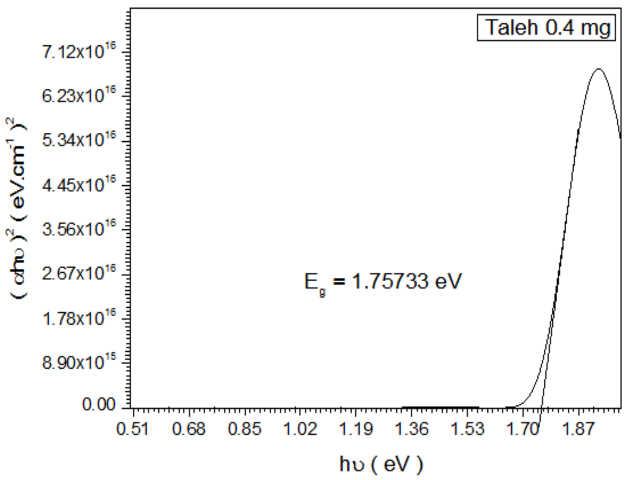

Figure 2a. From table 2 shows the energy gap of Talha gum with doping rate 0.4 %

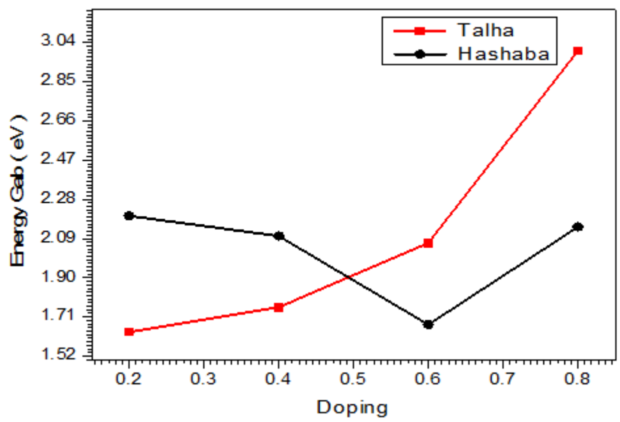

Figure 10. Shows the Variation of doping and Energy Gab for Hashab and Talha GUM

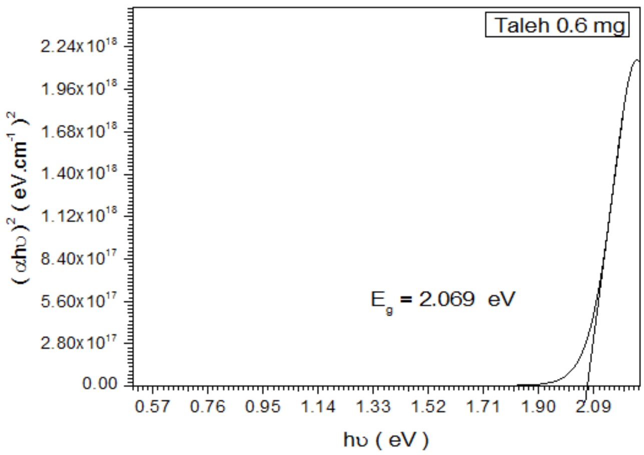

Figure 3a. From table 1 shows the energy gap of Talha gum with doping rate 0.6 %

RESULTS

Was calculated the energy gap of all sample of doping Arabic Gum with iodine according to the samples that came from Hashab and Talha and the results were as shown in the fig (1 to 8).

DISCUSSION

The optical energy gap (E_g) of grop one (Talha Gum)

The optical energy gap (E_g) has been calculated by the relation $(\alpha h\upsilon)^2 = B(h\upsilon - E_g)$ where (B) is constant. By plotting $(\alpha h\upsilon)^2$ vs photon energy ($h\upsilon$) as shown in fig.(1-a) to fig (4-a) for all sample treatment of Arabic Gum by Aluminum hydroxide $AL(OH)_3$. And by extrapolating the straight thin portion of the curve to intercept the energy axis.

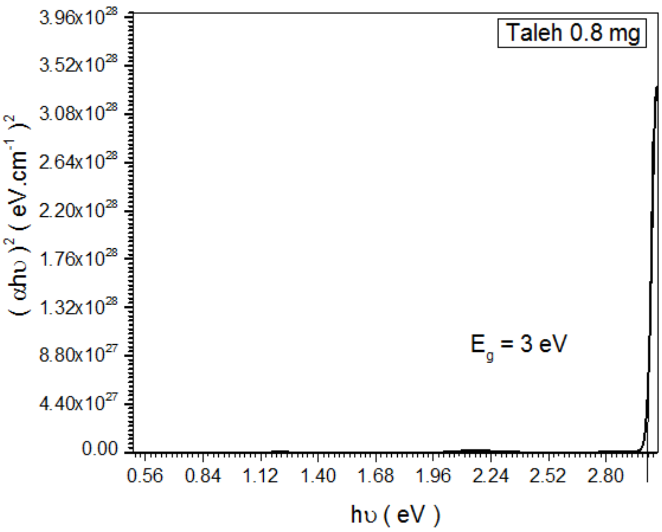

Figure 4a. From table 1 shows the energy gap of Talha gum with doping rate 0.8 %

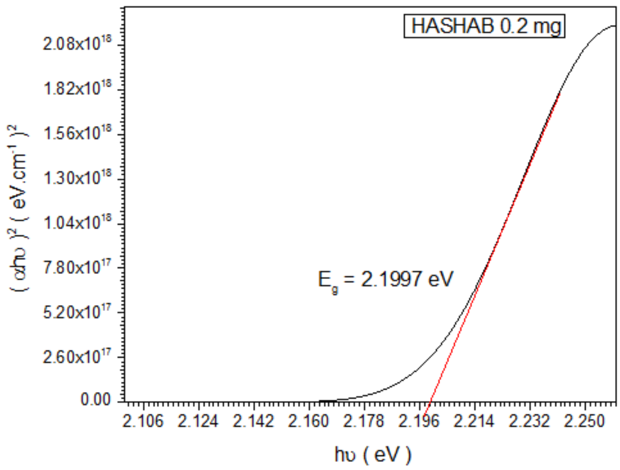

Figure (1-b) from table 2 shows the energy gap of Hashab gum with doping rate 0.2 %

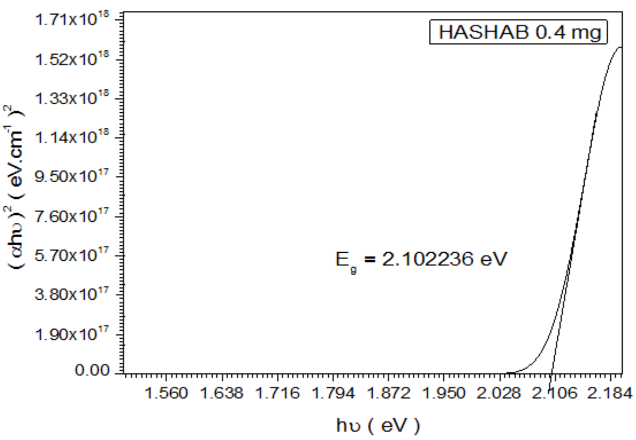

Figure 2b. From table 2 shows the energy gap of Hashab gum with doping rate 0.4 %

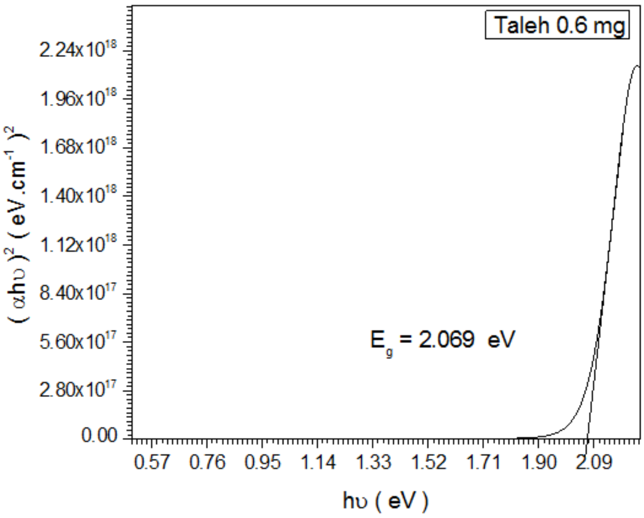

Figure 3b. From table 2shows the energy gap of Hashab gum with doping rate 0.6 %

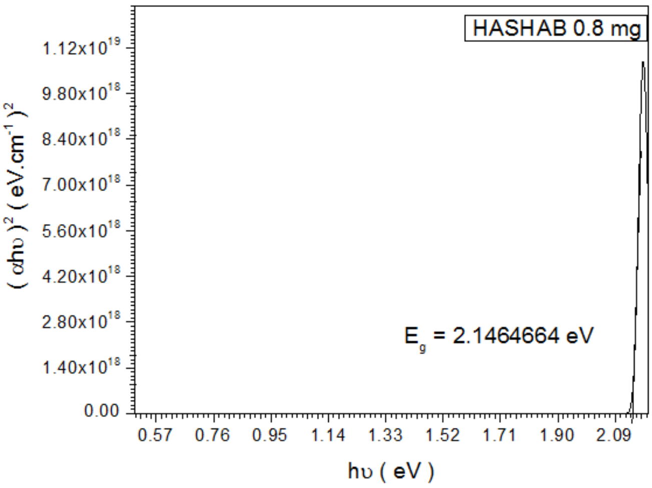

Figure 4b. From table 2 shows the energy gap of Hashab gum with doping rate 0.8 %

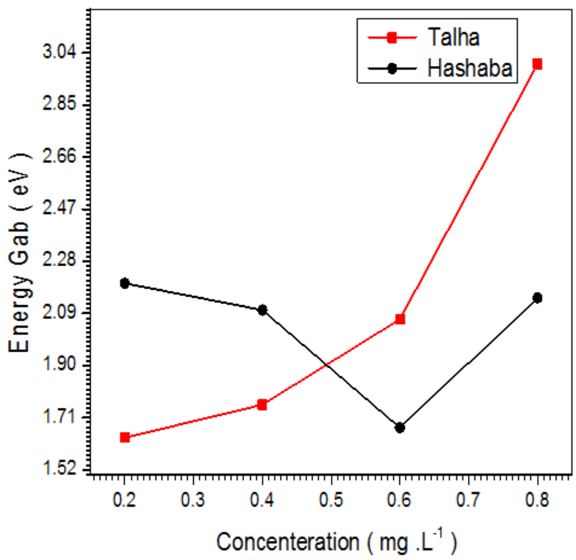

Figure 5. Show the Variation of concentration and Energy Gab for Hashab and Talha GUM

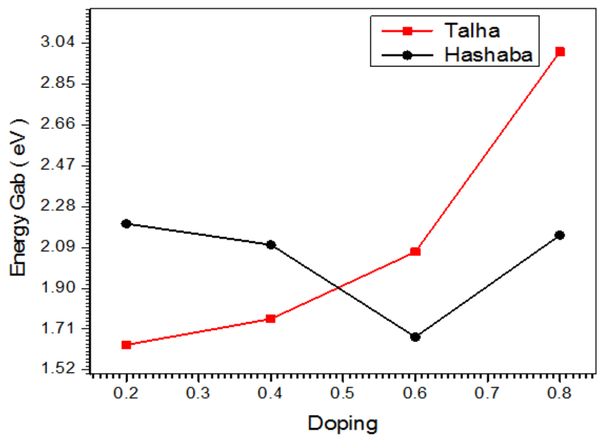

Figure 6. Shows the Variation of doping and Energy Gab for Hashab and Talha GUM

The value of the energy gap has been calculated In fig (1-b) was obtained by Talha 0.2% was 1.6365 eV. as Shown in fig(2-b) energy gap has been calculated for Hashab 0.4% was 1.75733 eV and The optical energy gap (E_g) has been calculated when using Hashab0.6 as shown in fig.(3-b) was 2.06900 eV and the energy gap for Talha 0.8% as shown in fig(4-a) was 3.00000 eV. In this Talha group the value of E_g was increased from 1.6365 eV to 3.00000 eV. The increasing of E_g related to increase in concetration and doping of samples. It was observed that the different concetration of the samples confirmed the reason for the band gap shifts also.

Conclusion

*Were prepared tablets of Arabic Gum and iodine doped by aluminum hydroxide AL(OH)3 were introduced in USB2000 device where it was knowing the energy gap in Talha Gum ;highest energy gap was 3.0000 eV when the doping rate was 0.8 % and the concentration of Talha was 0.8 mg / L. In Hashab Gum the highest energy gap was 2.199700 eV when the doping rate was 0.2 % and the concentration of Hashab was 0.2 mg / L.

*The work done shows that increasing of doping rate lead to regular increasing of E_g.

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