Study The Spectrum of un annealed and annealed V_2O_5 thin films by Raman Spectroscopy

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Abstract:-

In this work ,the wavelengths of light emitted and the amount of intensity from un annealed (V_2O_5) thin film and it annealed at (100,200)℃ were studied by Raman spectroscopy .

In order to study the influence of the annealing on the amount of light intensity emitted from films, the results showed that the amo- unt of light intensity emitted from annealed thin films higher than un annealed thin films and it increased as the temperature annealing increase, studied Atomic Force Microscopy (AFM) of un annealed (V_2O_5) thin film and annealed (V_2O_5) thin films at (100,200)℃ where viewed that the surface characteristics changed for it where the crystal structure became butter at thin films annealing where annealed(V_2O_5) thin films at (200)℃ became brightest and homogenous.

Introduction:

Nowadays ,many analytical laboratories are equipped (IR)and a Raman spectrometer, be it a dispersive device or a Fourier transform (FT) instrument Raman and IR spectra provide images of molecular vibrations that complement each other and thus both spectroscopic techniques together are also called vibrational spectroscopy.

The concerted evaluation of both spectra gives more information about the molecular structure than when they are evaluated separately

Raman spectroscopy is based on inelastic scattering of light by matter.The simplest way of explaining the classical or spontaneous Raman effect.

The intensity of Raman scattering is proportional to the square of the change in the molecular polarizability a resulting from a normal mode

$$I_{RA} \; \alpha \; \left(\frac{\partial a}{\partial q} \right)^2 \quad \text{.........(1)}$$

Where

a resulting from a normal mode.

Otherwise stated, a vibrational mode that satisfies the requirement 0 ∂a/∂q≠

$$\frac{\partial a}{\partial q} \neq 0$$

Is said to Raman active [1].

Vanadium has various states and results in a number of oxide forms of Vanadium oxide ,V_2O_5,VO_2 and V_2O_5 films have been widely studied for optical, electrical , electrochemical , thermo chromic and thermal switching materials [2].

The interest in these materials has increased in the last few years due to their potential application in a wide variety of optical modulation devices , V_2O_5 crystallize in a layered structure and has been widely used in a variety of scientific and technological applications for example as a catalyst, a window, for solar cells, electro chromic devices, electronic information displays and colour memory devices [3-9].

The spectral analysis is one of the techniques that enable us to measure physical properties such as measuring the amount of absorption, emission and scattering for Electromagnetic radiation and the technical know the knowledge spectrum.

Spectroscopy based on the use of laser (Laser-baser spectroscopy) is now an essential tool in the science analysis that most of the laser when it crashed on the sample that bounces off the sample and dispersed at the same wavelength of laser light, but some rays of light at different wavelengths and this because of the interaction of laser movement seismic particles constituting the sample of these vibrations make the photons of the laser gain or lose energy.

Displacement in energy gives information on moods of vibrations in the sample.

Raman spectrometer that helps to study the wavelengths o f light emitted and the amount of intensity from which to identify the items in the sample and the amount of focus.

By knowing where the amount of the intensity of the wavelength appears to focus wavelength.

This technique does not occur any damage to the sample under examination because when the laser snatch from the surface material is not visible [10].

Experimental Work

The deposition of the film V_2O_5 glass on the rules of Chinese made kind(Pyrex) by the technique of thermal evaporation in a vacuum under the pressure (10^{-5} mbar) and the thickness (3200 Aº) and deposition rate (13 Aº/S) and temperature of the foundation (25℃) and using a paint-type (BALEERS BAE 370).

Evaporation system that contains the poles associated with the electric source as it is installed trough evaporation (Boat) between these two poles and also contain a carrier of the samples mounted on the rotor pivot is controlled by its system of external electric .

Separated by evaporation trough for a distance (25cm)of sample holder to ensure that the largest area of deposition and contains the system to measure the thickness of the (Quartz-Crystal thickness Monitor) to measure the thickness of the film through the process of deposition ,The films are annealing two degrees of heat (100,200) ℃ for a period of one hour in a vacuum using a vacuum oven of the type(Precision) of production (Precision Scientific Group).

The wavelengths of light emitted and the amount of intensity from un-annealed V_2O_5 thin film and annealed at (100,200)℃ respectively by using Raman spectroscopy, Fig(1) the laser Raman spectrometer (LRS) is optimized for the nondestructive analysis of major molecular species in fluid [11], Where laser of Helium-Neon (632.81 nm) induced on the un-annealed V_2O_5 thin film and annealed V_2O_5 thin films.

Results and Discussion

Fig.(2) shows the variation of the intensity vs. Raman shift, for the un annealed V_2O_5 thin films observed that, the bigger peak intensity (23 cnt) from un annealed V_2O_5 thin film at(5499)cm^{-1}.

Fig.(3) shows the variation of the intensity vs. Raman shift, for the annealed V_2O_5 thin films at (100)℃ observed that, the bigger peak intensity (27)cnt from it at(5517)cm^{-1}.

Fig.(4) shows the variation of the intensity vs. Raman shift, for the annealed V_2O_5 thin films at (200)℃ . observed that, the bigger peak intensity (29)cnt from it at (5501)cm^{-1}, this is attributed to the decreasing in the absorbance and increasing in the energy gap. Fig.(2) shows the noisiness is a big in un annealed V_2O_5 thin film .

Fig.(3) shows the noisiness is a decreases with annealed V_2O_5 thin film at (100)℃ .

Fig.(4) shows the noisiness is amore decreases with annealed V_2O_5 thin film at (200)℃ .

Fig.(5) to characterize the topography of un annealed V_2O_5 thin film in Atomic Force Microscopy (AFM).

Fig.(6) the image of annealed V_2O_5 thin film at (100)℃ revealed gradual changes in surface morphology.

Fig.(7) the image of annealed V_2O_5 thin film at (200)℃ directly revealed gradual changes surface morphology.

(AFM) views of height images in annealed V_2O_5 thin films.

Fig.(5) views (RMS) the surface roughness a big at un annealed V_2O_5 thin film.

Fig.(6) (RMS) the surface roughness is decrease of annealed V_2O_5 thin film at (100)℃

Fig.(7) (RMS) the surface roughness is a more decrease of annealed V_2O_5 at (200)℃ and brightest.

V_2O_5 thin films it is a bigger in annealed V_2O_5 thin film at (200)℃ and it to be homogenous.

Conclusion:

In this work, the effect of the annealed on the amount of light intensity emitted from non-annealed and annealed at (100,200)℃ V_2O_5 thin films were studied. The results show that the amount of light intensity emitted from annealed thin films higher than non-annealed thin films and it increased as the temperature annealed degree and

The noisiness is decrease with annealed V_2O_5 thin films at (100,200)℃ respectively.

In this work (AFM) views of height images in annealed V_2O_5 thin films then the annealing increase with (RSM) the surface roughness decrease.

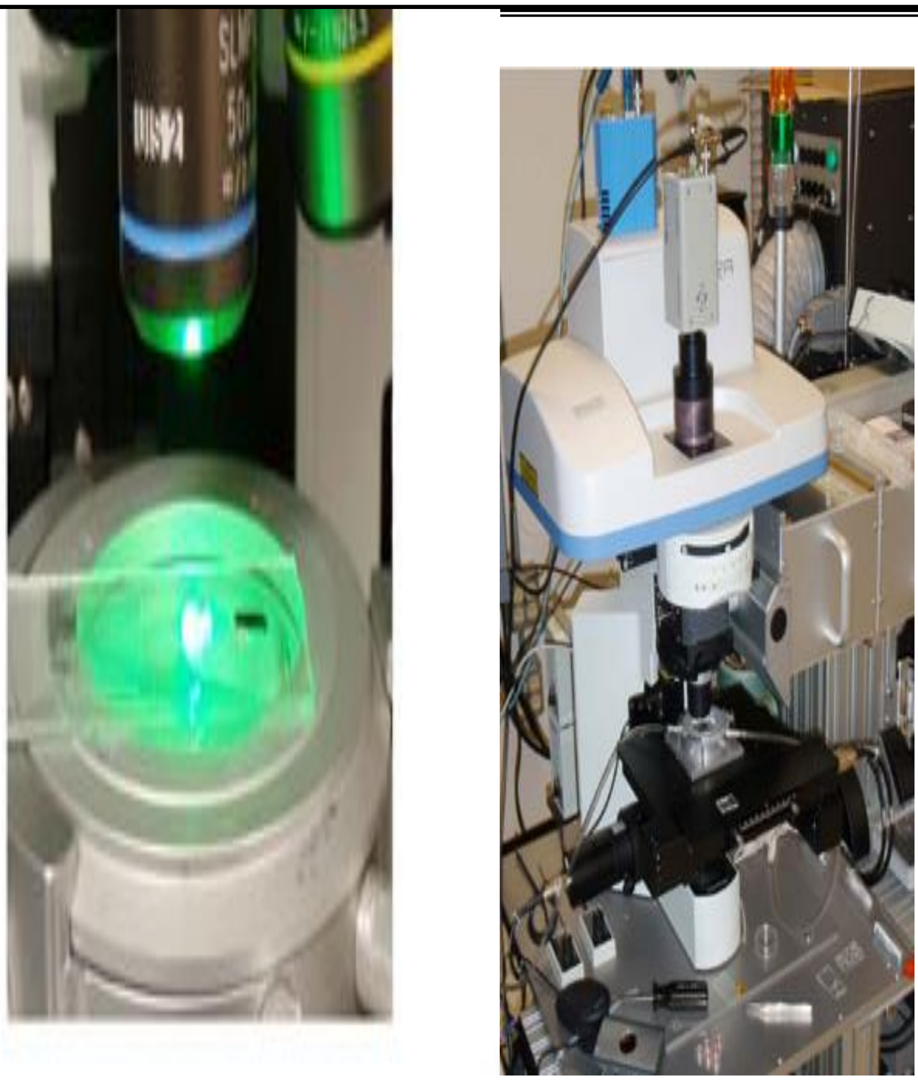


Figure (1) photo of laser Raman spectrometer

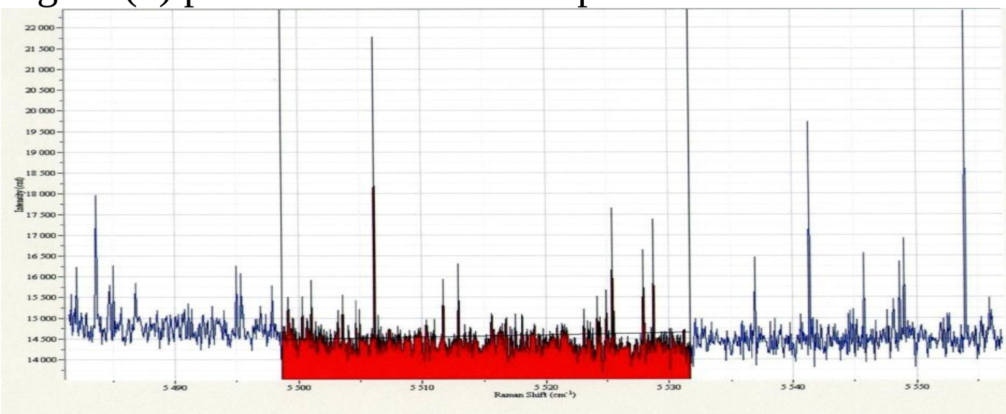
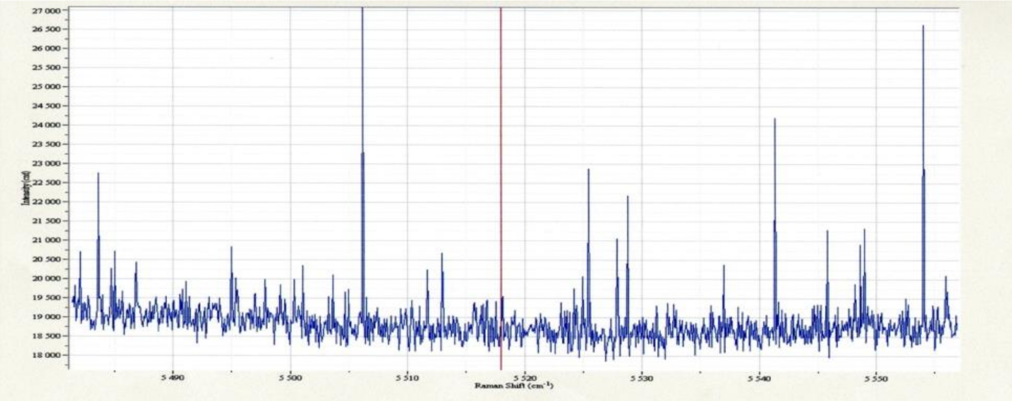
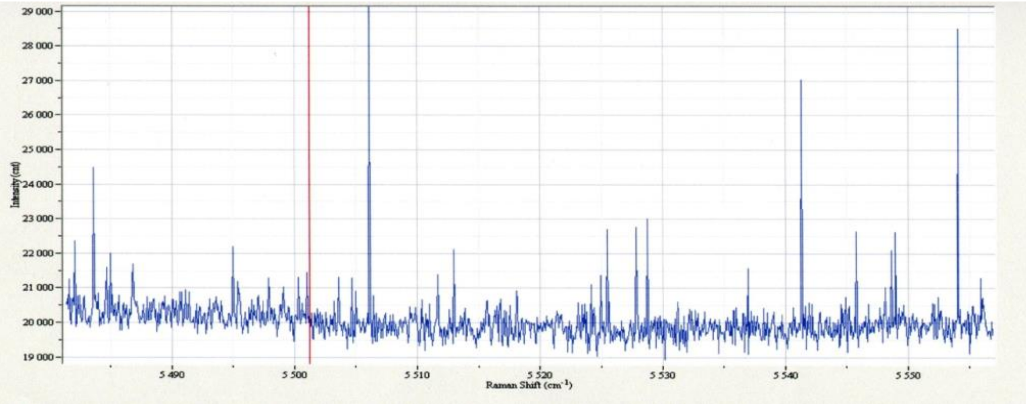


Fig (2) Shows the variation of the intensity vs. Raman shift for the as deposited V_2O_5 thin film



Fig(3) Shows the variation of the intensity vs. Raman shift for the as deposited V_2O_5 thin film at 100℃



Fig(4) Shows the variation of the intensity vs. Raman shift for the as deposited V_2O_5 thin film at 200℃

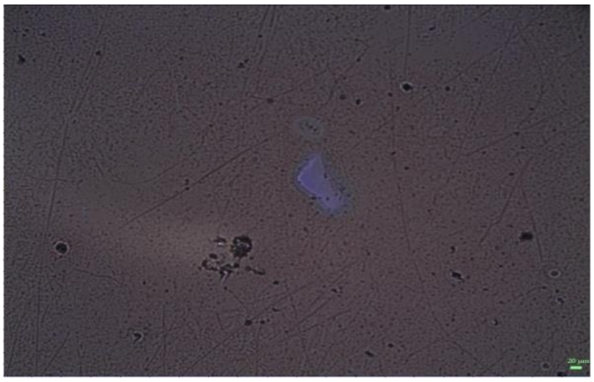


Fig.(5) Shows the surface roughness for the non-annealed V_2O_5 thin film

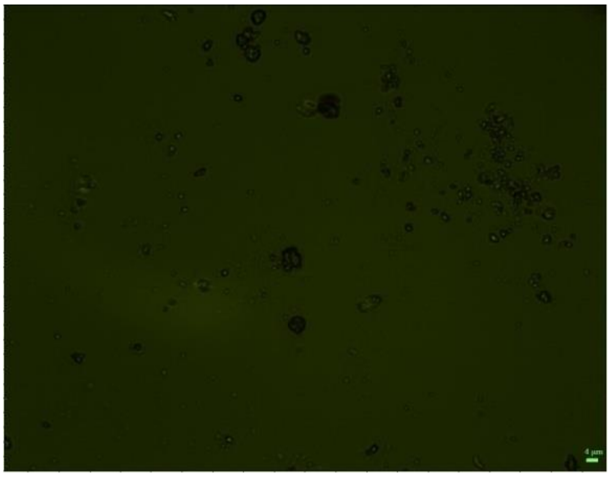


Fig.(6) Shows the surface roughness for the annealed V_2O_5 thin film at 100℃

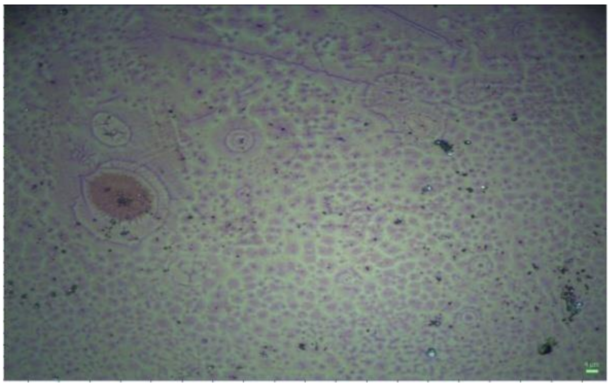


Fig.(7) Shows the surface roughness for the annealed V_2O_5 thin film at 200℃

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دراسة طيف الأغشية الرقيقة V_2O_5 الغير الملدنة والملدنة باستخدام مطياف رامان

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الخلاصة:-

تم في هذا البحث دراسة الأطوال الموجية والشدة للضوء المنبعث من غشاء (V_2O_5)غير الملدنة والملدن عند درجة حرارة(100,200)درجة مئوية بأستخدام استطارة رامان وتم التوصل الى ان شدة الضوء المنبعث من الأغشية الملدنة أعلى من شدة الضوء المنبعث من الاغشية الغير ملدنة وكلما زادت درجة حرارة التلدين زادت الشدة وقد تم دراسة (AFM) للاغشية (V_2O_5)الغير ملدنة والملدنة لوحظ ان خواص السطح للأغشية تتغير حيث يصبح التركيب البلوري أفضل عند تلدين الأغشية حيث اصبحت غشاء (V_2O_5) الملدن عند درجة الحرارة (200) درجة مئوية اكثر سطوعا وتجانسا.