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Study of Some optical properties of silver oxide (Ag_2o) using UV-Visible spectrophotometer

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***Abstract**: This paper examinesOptical property of silver oxide.The aim of this work is to calculate the results obtained via experimentsconducted on samples of silver oxide (Ag_2o).UV-Visible spectrophotometer was used at normal incident of light inthe wavelength range of 200–1100nm.The Results in all samples showed high absorption in visible region with absorption edges in the blue region of the electromagnetic spectrum. Photo activation of silver oxides Ag_2o in this region causes transition from the groundto excited state.Results also showed that samples have high transmittance in the near infrared region and hence could be of use in devices that provide heat and visible light into the house.*
Keywords: Ag_2O, UV-Visible spectrophotometer, *optical properties.*

I. Introduction

This paper attempts to study optical properties for silver oxide. In this concern, silver oxide refers to the chemical compound with the formula Ag_2O. Uses of silver oxide include some silver-oxide batteries (I, IIIoxideAg4O4). In organic chemistry, silver oxide is used as a mild oxidizing agent oxidizing aldehydes to carboxylic acids. Such reactions often work best when the silver oxide is prepared in sit form silver nitrate and alkali hydroxide. The compound Ag_2O possesses a simple cubic structure at room temperature; Thermal decomposition of silver oxide into oxygen and silver is the unique characteristics, which led to the promising technological applications [1]. There are different phases of silver oxide including Ag2O,AgO, Ag3O4, Ag4O3, and Ag2O3 [11]in interaction with oxygen and with different crystalline structures. Thermos observable and stable phases are Ag2O andAgO . $AgxO$In addition, we can found widely studies of thin films owing to their wide range of applications [10]. The use of a silver oxide ($AgxO$) film as an optical film that suggests a promising uses because of its distinctive optical properties. In addition, suggested that a$AgxO$ film deposited by magnetron reactive sputtering can be used as a surface-Plasmon and surface-enhanced Raman spectroscopy source. Particularly, $AgxO$ film has been found to have a promising application in optical and magneto–optical storage since 1992 [9]. Metal oxides in the Ag-O system, includingAg_2O, AgO,Ag_3O_4 Ag3O4andAg_2O_3, constitute a fascinating group of inorganic materials .also the Silver oxides crystallize in vari- ous types of crystal constructions, foremost to a diversity of interesting physico chemical properties such as exciting, electrochemical, electronic and optical properties [2]. All this uses and applicationof silver oxideAg_2Ogive the significance of this study

Experimental Details

0.25 g of silver nitrate ($AgNO_3$) solid was dissolved in 5mL of distilled water in a 100mL beaker. Then, triethanolamine TEA solution was added drop wise with constant stirring until the initially formed precipitate was dissolved (brownish solution becomes colorless). More distilled water was added to make a total volume of 80 mL. The pH of the bath was 8.0. Glass slides that have been preleased by degreasing in concentrated H_2SO_4, washed with water and detergent, and rinsed with distilled water were vertically placed into the beaker and the bath was brought to and kept at 50∘C on a hot plate. After various periods of time (50, 60, 70, 80, and 90mins), the coated slides were removed from the bath, thoroughly rinsed with distilled water, and air-dried using electrical hand drier. The films were annealed at 200∘C for better adhesion and homogeneity on the substrates.Characterizations the optical properties of the films were examined by using a UV-Visible spectrophotometer at normal incident of light in the wavelength range of 200–1100nm. Thus to calculatedthe band gaps and the refractive index of the samples:

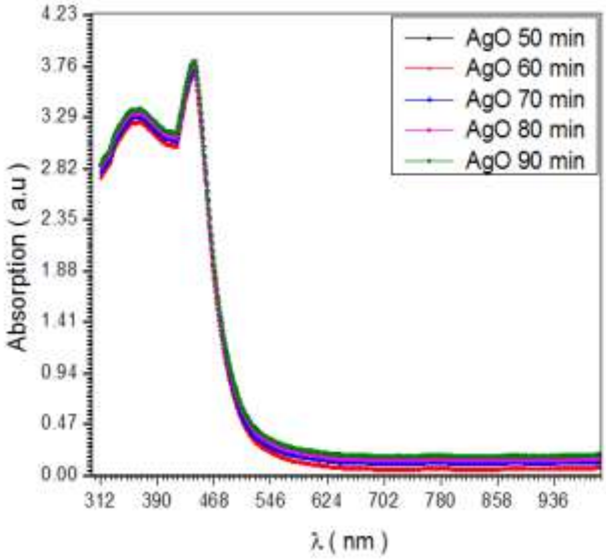

Fig (1)

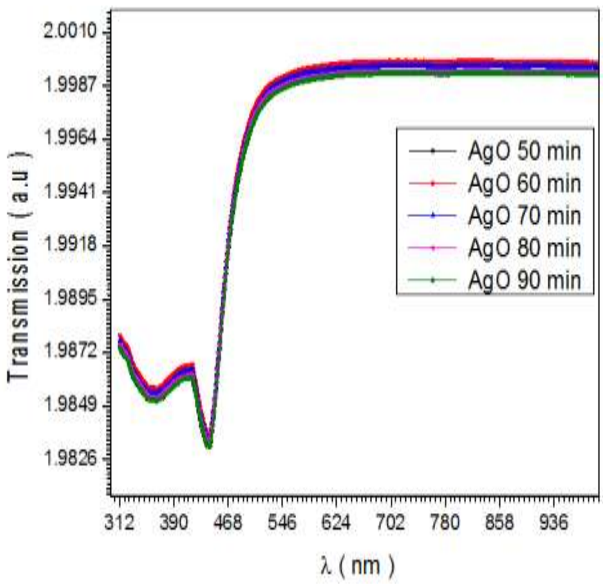

Fig (2)

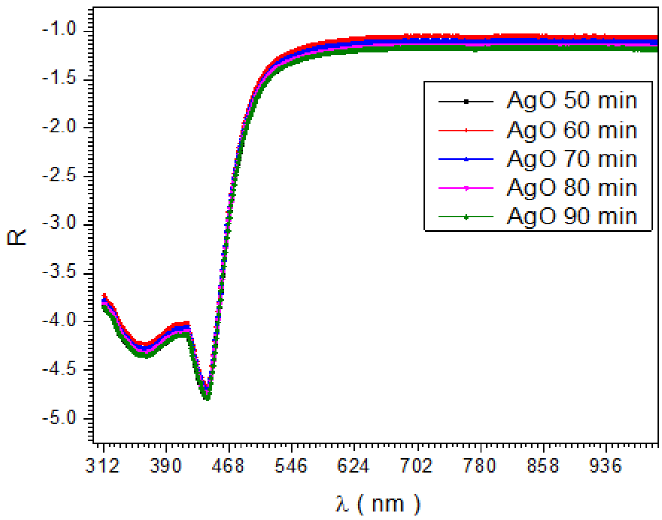

Fig (3)

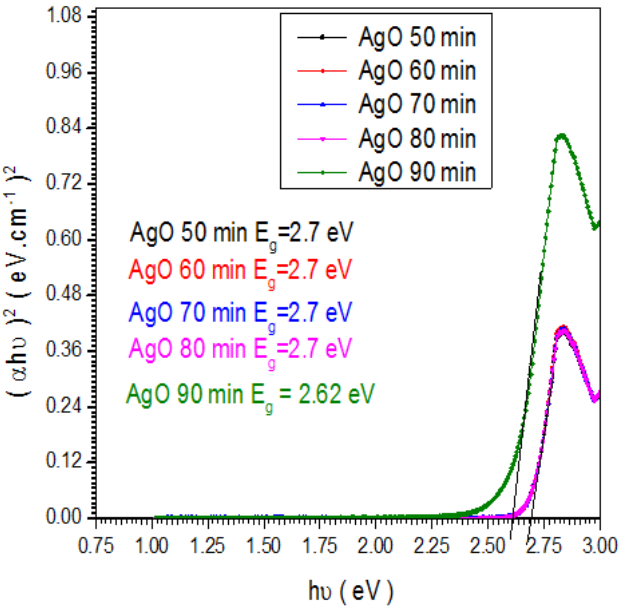

Fig (4)

II. Optical Studies

Figure (1) shows the absorbance plot as a function of wavelengths as obtained from the UV-VIS spectrophotometer. We calculated the transmittance and reflectance using Beer Lamberts and assuming negligible scattering .all the samples showed high absorption in the visible region with absorption edges in the blue region of the electromagnetic spectrum. Photo activation of silver oxides AgxO in this region causes transition fromthe groundto excited state. The electrons transit to the impurities energy level induced by photo catalytic centers (Ag3O, Ag2O+O, and Ag3 +O)when being photo activated by blue light. ThisExplains why illumination of silver oxide samples with blue and UV mercury lamp produces fluorescent AgxNano clusterswhich agrees with [3]. This phenomenon of Ag2O is whatmakes it suitable for Surface Enhanced Raman Scattering detection (SERS) for chemical and biological molecules as Some research also assume [8, 5] and optical data storage . There was a decrease in the absorption as the dip time increased from 70 to 90mins. This is likely due to an increase in the transmittance and reflection of the samples as the dip time increases.This implies that at a higher dip time, transparent films are obtained which could be used as a transparent conducting oxide (TCO).The samples also show high transmittance in the near infrared region and hence could be of use in devices that provide heat and visible light into the house (Figure 2). The observation of peaks in absorption and transmission data is confirmed to be that of the samples. The samples removed after 50mins showed slight lack of trend with other samples. This is not easily discernible and could have resulted from unforeseen deposition conditions. The refractive index is related to the reflectance and extinction coefficient according to Equation in reference [7]:

R=$(n-1)^2+k^2(n+1)^2+k^2$

Where$R$is the reflectance, $k$is the extinction coefficient, and $n$is the refractive index of the medium. For semiconductors and insulators in which absorption is high and interference is neglected, $k^2 \ll n^2$, the relationship approximates to

R=$(n-1)^2/(n+1)^2$

Figure 3 shows the plotof refraction against wavelength. The range ofrefractive was seen to be between -4.5 to -1 withincreasing trend between the 70 to 90mins dip time. The50 mines dip time showed an anomaly.

These absorption spectra, which are the most direct and perhaps the simplest method for probing the band structure of semiconductors, are employed in the determination of the energy gap, Eg. The Eg was calculated using the well-known Talc's relation:

$$\alpha = (hv - Eg)nh\bar{\upsilon}$$

Where$A$ is a constant, hv is the photon energy, and $\alpha$is the absorption coefficient, while n depends on the nature of the transition. For direct transitions n = 2 or 2/3, while for indirect ones n = 1/2 or 3, depending on whether they are allowed or forbidden, respectively. The best fit of the experimental curve to a band gap semiconductor absorption function was obtained for n = 2 to obtain direct band gap energy values. The obtained values between 2.7 eV for all sample except 90 min is 2.62eV, respectively (Figure 4).as shown in [8-9]

III. Conclusions

We found in this study that thesamples show high transmittance in the near infrared region and hence could be of use in devices that provide heat and visible light into the houses.

References

[1]. A. C. Nwanya,1 P. E. Ugwuoke, and etc, Structural and Optical Properties of Chemical Bath Deposited Silver Oxide Thin Films: Role of Deposition Time,Hindawi Publishing Corporation Advances in Materials Science and Engineering Volume 2013, Article ID 450820, 8pages http://dx.doi.org/10.1155/2013/450820.
[2].GandhimathinathanSaroja and etc , Optical Studies of Ag2O Thin Film Prepared by Electron Beam Evaporation Method, Open Journal of Metal, 2013, 3, 57-63 Published Online December2013(http://www.scirp.org/journal/ojmetal)http://dx.doi.org/10.4236/ojmetal. 2013.34009 Open
[3]. K. L.Chopra and L. K. Malhota, Eds., Optical Properties ofThinFilms, Tata McGraw-Hill, New Delhi, India, 1985.
[4].L. A. Peyser, A. E. Vinson, A. P. Bartko, and R. M. Dickson,"Photoactivated fluorescence from individual silver nanoclusters,"Science, vol. 291, no. 5501, pp. 103–106, 2001.
[5]. L. Zhang, Y. Fang, and P. Wang, "Experimental and DFTtheoretical studies of surface enhanced Raman scattering effecton the silver nano arrays modified electrode," SpectrochimicaActa A, vol. 93, pp. 363–366, 2012.
[6]. M. Bielmann, P. Schwaller, P. Ruffieux, O. Gröning, L. Schlapbach, and P. Gröning, "AgO investigated by photoelectron spectroscopy: evidence for mixed valence," Physical Review B, vol. 65, no. 23, Article ID 235431, 5 pages, 2002. View at Google Scholar · View at Scopus.
[7].N.R.C.Raju, K. J. Kumar, andA. Subrahmanyam, "Silver oxide(AgO) thin films for surface enhanced Raman scattering (SERS)studies," AIP Conference Proceedings, vol. 1267, pp. 1005–1006,2010.
[8]. N. R. C. Raju, K. J. Kumar, and A. Subrahmanyam, "Physicalproperties of silver oxide thin films by pulsed laser deposition:effect of oxygen pressure during growth," Journal of Physics D, vol. 42, no. 13, Article ID 135411, 2009.
[9]. S. M. Hou, M. Ouyang, H. F. Chen et al., "Fractal structure inthe silver oxide thin film," Thin Solid Films, vol. 315, no. 1-2, pp.322–326, 1998.
[10]Ezenwa I.A* et al. (IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH Volume No.3, Issue No.4, June - July 2015, 2220 – 2223.
[11]. *Zhao Meng-Ke and etc , Evolution of the structural and optical properties of silver oxide films with different stoichiometries deposited by direct-current magnetron reactive sputtering,Chin. Phys. B Vol. 21, No. 6 (2012) 066101.*