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ZNO Thin Film Prepared By Dip Coating Technique for Gas Sensing Application

Sounder.J[1], P.Gowthaman[2], M. Venkatachalam[3], M.Saroja[4], G.Parthasarathy[5]
[1,5]*Research Scholar, Thin Film Research Centre, Erode Arts and Science College (Autonomous), Erode.*
[2, 3, 4] *Assistant Professor, Department of Electronics, Erode Arts and Science College (Autonomous), Erode.*

Abstract: ***The quantum size effects are commonly expected and simply predict mostly the size will be reduced also causes more atoms are closer to the surface by using*** $ZnO(CH_3COO)_2$ ***As precursor solution and zinc oxide thin film were prepared by chemical dip coating method. When the transparent and conducting oxides thin films are the component of main devices for solar cells, thin film transistors and Sensors. SEM image and XRD analysis of the films match that all the films are polycrystalline Zinc Oxide in nature were hold hexagonal structure***
Keywords: Zinc Oxide, Thin Film, Gas sensor

I. INTRODUCTION

In the last few years the researcher notice that the more carried out on energy conservation and sensor technologies this research involves the eco-friendly semiconductor metal oxide such as TiO_2ZnO, SnO_2 etc..,(1,2)* Mostly the ZnO can be used to form of powder, thin film substrate. When they hear by challenging application of ZnO thin film having better self -cleaning properties of glass windows.Where theZnO can be coated onto glass and retain their gas sensor and photo catalytic properties.

II. MATERIAL AND METHODS

The Researcher make a sol of 0.5m concentration were prepared by dissolving the required essential amount of Zinc acetate dehydrate (Zn $(CH_3COO_2).2H_2O$) in to 20ml of iso-propanol it contain mono-ethanolamine(MEA) it perform as stabilizer by the researcher take the molar ratio of Zn^{2+} to MEA is kept 1:1 through synthesis. Then the researcher prepared Identical solution were stirred at 70^0C for 1 hours to accelerate hydrolysis reaction and it obtained a transparent sol-gel, which were used for coating after the room temperature nd also aged 24hrs. The prepared the ZnO thin films for depositing sol on the glass substrate by using dip-coating method at the time of 30sec dip and 1min dry at the same time of 75^oC and also repeated this process for 10 times and the researcher coated film were annealing at 400^0C for 1 hrsto achieve the pure ZnO thin films. Finally allowed to cool at room temperature and additionally it taken for various studies.

III. RESULT AND DISCUSSION

The Researcher synthesized ZnO films were characterized by X-ray diffraction (XRD) and also characterized the scanning electron microscope (SEM) and sensor properties .At first the researcher shown the XRD spectra.
ZnOfilm was shown hexagonal structure and the morphology that shows in nano rod wasconfirmed by SEM analysis that found that the films deposited on the glass at the substrate temperature. XRD pattern of the films deposited below T_s=400^0C shown 2θ value (100),(002),(101) reflected, so these parallel kind of observed in XRD pattern of the ZnO films deposited by dip coating below 400^0c.

A. X-Ray spectrum for prepared ZnO

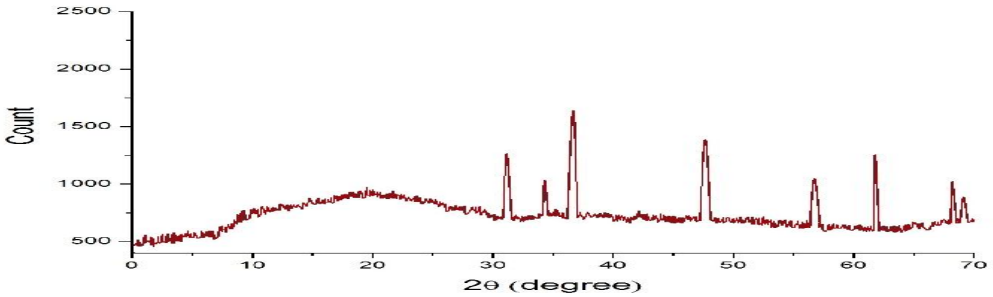


Figure 1: XRD Pattern of ZnO thin film

The XRD pattern shows the most prominent peak observed corresponding to (101) plane other planes corresponding to (100),(002),(102),(110),(103),(112),(201) are also observed with low relative intensities.Respectively according to JCPDF No. 036 1415 shown in Figure 2.

The particle sizes have range of 13.86, 9.25 and 18.25 nm. The nano-particle sized were calculated using Debye Scherrer's formula. $D=k\lambda /\beta \cos\theta$

B. XRD values

S.No	2θ Value	hkl value
1	32.04	100
2	34.97	002
3	36.52	101
4	47.81	102
5	56.90	110
6	62.64	103
7	68.39	112
8	69.27	201

C. SEM Analysis

The Researcher is also shown that the SEM image of prepared thin film as shown below figure. Researcher says that the SEM studies were clearly shown in prepared ZnO film exhibits good morphology and the researcher prepared the ZnO film by a simple dip coating method is more effective and also useful for researcher research.

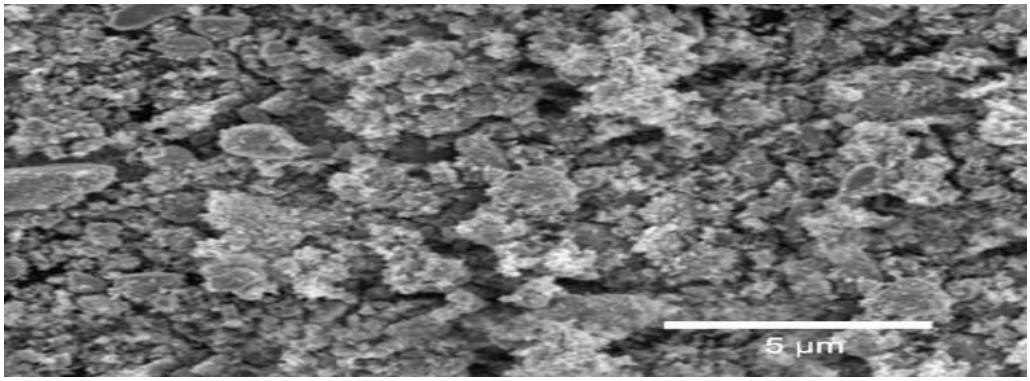


Figure 2:SEM image of ZnO thin film

D. GAS SENSOR PROPERTIES

Prec	CVD Method	Tdep ^{0}C	Form	Features nm	Sensor type	Top^{0}C	ppm	gas	R	tres
ZnO AC-400^{0}c	CVD	600	Film	220L	Ω + 0 SNO	600	240	ZnO + Ni + UV light	10.6	-

Prec - precursors, Tdep - temperature of deposition, Top: operating temperature,
tres: response time, ppm: partsper millon, R = Ra/Rg (oxidative gas),

R = Rg/Ra (reductive gas).

The researcher couldshown that the above tabulation that he could taken an constant higher value for sensor method than the tabulation shows that the required time will be constant at higher value . From the ratio value the researcher could identified than the ratio beteenchanges in resistance from the base resistance is response to high sensing material.

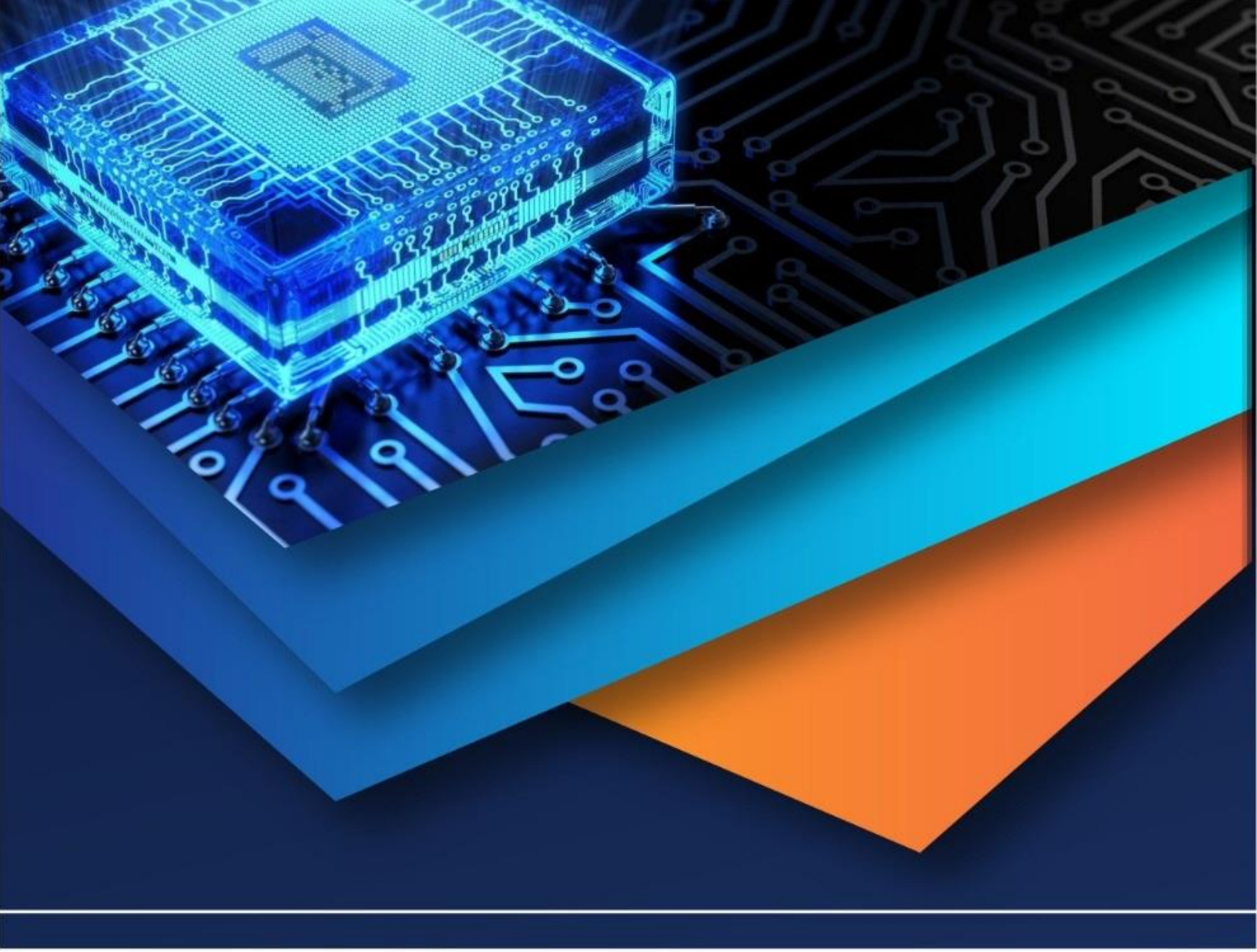
The response of film towards at 1×240 ppm of acetone, ethanol etc for this sensing the computer dynamic gas sensing setup was in the same one of paper (GK. Mani and others 2013)[21].The researcher observed that having an lower detection limited of annealed ZnO thin film was 240 ppm and the response was found s=10.6 low response 1ppm was according to acetone module, The researcher are also notice that the very high response of 1×240ppm.

II. CONCLUSION

The simple dip coating ZnO Nano rods with gas sensor method and its gas sensing characteristics were studied. The most stable nano particles are in amorphous form structure was confirmed by XRD. Researcher is also done the gas sensor test by the closed chamber at room temperature. The gas sensor tests shown that the ZnO Thin film can act as an acetone sensor from constant values. Hence the Researcher has finally concluded that it has identified diabetes.

REFERENCES

[1] Fujishima, T.N. Rao, D.A. Tryk, Titanium dioxide photocatalysis, J.Photochem. Photobiol. C: Photochem. Rev. 1 (2000) 1–21.
[2] K. Rajeshwar, M.E. Osugi, W. Chanmanee, C.R. Chenthamarakshan, M.V.B.Zanoni, P.Kajitvichyanukul, R. Krishnan-Ayer, Heterogeneous photocatalytic treatment of organic dyes in air and aqueous media, J. Photochem. Photobiol.C: Photochem. Rev. 9 (2008) 171–192.
[3] K.R. Murali, Preparation of sol–gel dip-coated zinc oxide thin films, J. Phys.Chem. Solids 98 (2007) 2293–2296.
[4] K.A. Whitehead, N L. Caballero.S. Allen, J. Verran, Inactivation of Escherichia coli on immobilized TiO2 using fluorescent light, J. Photochem. Photobiol. A: Chem.202 (2009) 92–98.
[5] J. Zhao, X. Yang, Photocatalytic oxidation for indoor air purification: a literature review, Build. Environ. 38 (2003) 645–654.
[6] G. Srinivasan, N. Gopalakrishnan, Y.S. Yu, R. Kesavamoorthy, J. Kumar, Influence of post-deposition annealing on the structural and optical properties of ZnO thin films prepared by sol–gel and spin-coating method, Superlattices Microstrut. 43 (2008) 112–119.
[7] D. Wang, G.P. Bierwagen, Sol–gel coating on metals for corrosion protection,Prog. Org. Coat. 64 (2009) 327–338.
[8] P. Jongnavakit, P. Amornpitoksuk, S. Suwanboon, T. Ratana, Surface andphotocatalytic properties of ZnO thin film prepared by sol–gel method, Thin Solid Films 520 (2012) 5561–5567.
[9] J. Lv, W. Gong, K. Huang, J. Zhu, F. Meng, X. Song, Z. Sun, Effect of annealing temperature on photocatalytic activity of ZnO thin films prepared by sol–gel method, Superlattices Microstruc. 50 (2011) 98–106.
[10] M. Dutta, S. Mridha, D. Basak, Effect of sol concentration on the properties ofZnO thin films prepared by sol–gel technique, Appl. Surf. Sci. 254 (2008) 2743–2747.
[11] M.T. Weller, Inorganic Materials, Oxford Chemistry Primer, 1996. p. 15.
[12] R.D. Gonzalez, T. Lopez, R. Gomez, Sol–gel preparation of supported metalcatalysts, Catal. Today 35 (1997) 293–317.
[13] C.J. Brinker, A.J. Hurd, P.R. Schunk, G.C. Frye, C.S. Ashley, Review of sol–gel thin film formation, J. Non-Crystal. Solids 147–148 (1992) 424–436.
[14] T. Koehler, S. Gledhill, A. Grimm, N. Allsop, C. Camus, A. Hänsel, W. Bohne, J.Rohrich, M. Lux-Steiner, C.H. Fischer, An investigation of the dip-Ion layer gas reaction process to produce ZnO films with increased deposition rates, Thin Solid Films 517 (2009) 3332–3339.
[15] J. Lv, K. Huang, X. Chen, J. Zhu, C. Cao, X. Song, Z. Sun, Optical constants of Na doped ZnO thin films by sol–gel method, Opt. Commun. 284 (2011) 2905–2908.
[16] L. Zhang, Y. Ding, M. Povey, D. York, ZnO nanofluids–a potential antibacterial agent, Prog. Natl. Sci. 18 (2008) 939–944.
[17] L. Jing, X. Sun, J. Shang, W. Cai, Z. Xu, Y. Du, H. Fu, Review of surface photovoltage spectra of nano-sized semiconductor and its applications in heterogeneous photocatalysis, Solar Energy Mater. Solar Cells 79 (2003) 133–151.
[18] H. Wang, C. Xie, W. Zhang, S. Cai, Z. Yang, Y. Gui, Comparison of dye degradation efficiency using ZnO powders with various size scales, J. Hazard.Mater. 141 (2007) 645–652.
[19] K. Haga, M. Kamidaira, Y. Kashiwaba, T. Sekiguchi, H. Watanabe, ZnO thin films prepared by remote plasma-enhanced CVD method, J. Cry. Growth 214–215(2000) 77–78.
[20] V. Tvarozek, I. Novotny, P. Sutta, S. Flickyngerova, K. Schtereva, E. Vavrinsky, Influence of sputtering parameters on crystalline structure of ZnO thin films, Thin Solid Films 515 (2007) 8756–8760.
[21] G.K. Mani, J.B.B. Rayappan, A highly selective room temperature ammonia sensor using spray deposited zinc oxide thin film,Sensors Actuators B Chem. 183 (2013) 459–466. doi:10.1016/j.snb.2013.03.132.



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