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GOLDEN RESEARCH THOUGHTS

COMPOSITE THIN FILM OF ZnO/TiO_2 BY SPRAY PYROLYSIS TECHNIQUE

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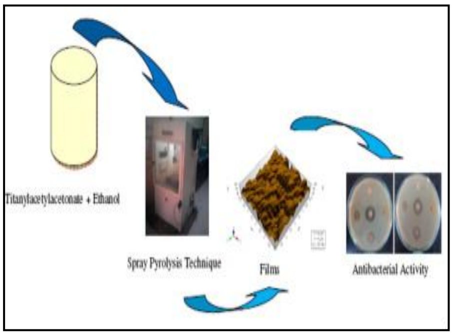
ABSTRACT

In present investigation ZnO/TiO_2 composite thin film were deposited on glass substrate by using spray pyrolysis. Optical characterization of prepared nanocrystalline films was performed by UV Visible spectroscopy. Various process parameters have been studied in order to optimize efficient photocatalytic reduction .



A Solar energy has the potential of becoming a renewable energy alternative to fossils fuels. The thin film technologies reduce the amount of material required in forming the active material of solar cell. Because of the photocatalytic activity prepeared composite thin films are used for water purification or for the gas leackage detector. This composite thin film were prepared by spray pyrolysis technique. Chemicals which are used like zinc acetate($(CH_3COO)Zn.2H_2o$),(0.2m) for ZnO & for Tio_2 TAA($C_{10}H_{14}O_5$),(0.01m).The structural properties of ZnO?Tio_2 composite thin film have been investigated by X-Ray Diffraction (XRD) & the optical properties were observed by UV – Vis Spectrometer (UV-Vis).

KEYWORDS : *spray pyrolysis technique , Optical characterization , photocatalytic activity.*

INTRODUCTION

Nowadays, the production of thin layers of materials like zinc oxide and titanium dioxide is very important because of their attractive applications such as transparent conducting oxide (TCO) arise from the combination of optical transparency, the electrical conductivity in doped zinc oxide , high photocatalytic activation , information technology devices including displays, solar cells and sensors , photoconducting properties ,high dielectric constant and is transparent to visible light In recent years, ZnO and TiO_2 nanostructures have attracted great attention in both fundamental studies and application. Zinc oxide, ZnO, is an inexpensive n-type semiconductor with a wide band gap of 3.3 eV, which crystallizes in the hexagonal wurtzite structure. This property makes it good candidate as host materials for the visible and infrared emission of various rare-earth ions .

Also, among the photocatalysts, nanocrystalline TiO_2 is widely used in water and air purification, in self-cleaning process and as bactericide under light irradiation. Photocatalysis with TiO_2 anatase is more efficient than rutile or brookite. Nanocrystalline anatase is commonly prepared with high surface area having a high degree of crystallinity .

During the last years, ZnO thin films have been studied extensively due to their potential applications, as piezoelectric transducers, optical waveguides, acousto-optic media, surface acoustic wave devices, conductive gas sensors, transparent conductive electrodes, solar cell windows, and varistors . On the other hand, TiO2 self-cleaning property can be bestowed on many different types of surface, and some TiO2-based self-cleaning products such as tiles, glass, and plastics have been commercially available.TiO2 self-cleaning coatings are finding increasing applications in buildings, public furniture and auto industry. The self-cleaning mechanism is mainly based on TiO2 photocatalysis, where photo-induced electron-holes catalyze reaction on the surface .

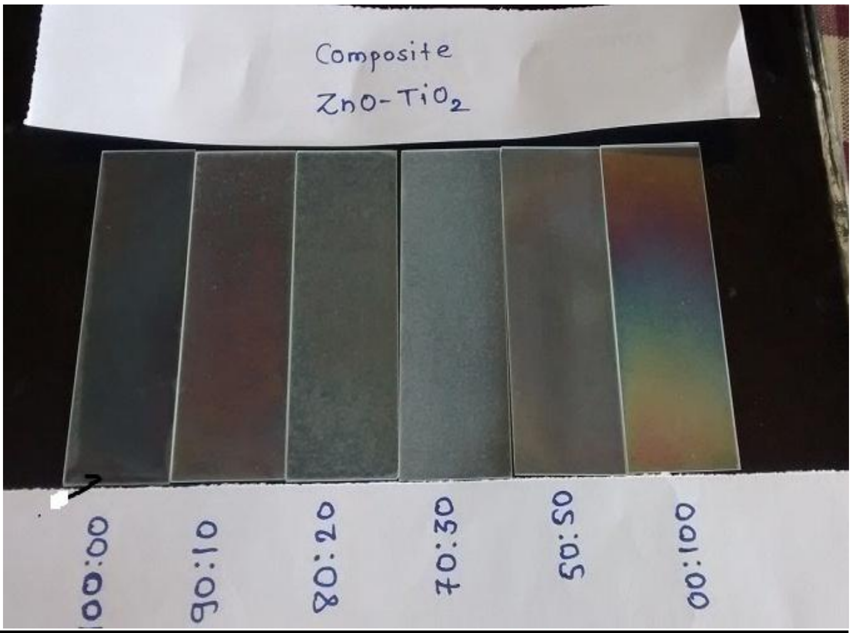
A rich variety of techniques about the preparation of thin films including sputtering , chemical vapor deposition (CVD) , spray paralysis , and sol-gel process are known. Among these methods, the spray paralysis method not only enables easy fabrication of a large area thin film at a low cost, but also easily controls over the film composition and uniformity of thickness . spray pyrolsis technique presents an inexpensive alternative for fabricatison of thin film.

A thin film is a layer of material ranging from fraction of nanometer to ceveral.micrometers in thickness. Electronic semiconductor devices and optical coatings are the main applications benefiting from thin film construction A thin film is a layer of material ranging from fraction of nanometer to several.

A familiar application of thin film is the household mirror, which typically has a thin metal coating on the back of a sheet of glass to form a reflective interface. The process of silvering was once commonly used to produce mirrors. A very-thin film coating (less than a nanometer thick) is used to produce two way mirrors.
Research is being done on a new class of thin film inorganic oxide, material, called amorphous heavy metal action multi-component oxides, which could be used to make transparent transistors that are inexpensive, stable and environmentally benign. work is being done with ferromagnetic and ferroelectric thin films for use as computer memory. it is being applied to pharmaceuticals via thin film drug delivery.

Composite of ZnO-TiO_2

Various composition of ZnO-TiO2 thin film obtained by using same procedure which is used for preparation ZnO&TiO_2 thin films.



Optical properties

Optical transmission spectra of ZnO Microrods are shown. The films are uniform and transparent. This is also confirmed by the transmittance spectra of the films. The developed interference pattern in the transmittance shows that the films are specular to a great extent. The average transmittance of the films in the visible region is about 95 % those are deposited at 400^0C and 0.2 M concentration, which is agree with pervious work reported . Also we observed that for higher concentration transmittance goes on decreasing.

For the direct transition, the optical band gap energy of ZnO thin film was determined by using the equation,

$$\alpha = Const.\frac{(h\nu - E_g)^{\frac{1}{2}}}{h\nu} \qquad \text{-----------------}$$

Where hν is the photon energy and Eg is the optical band gap which could be calculated from $(\alpha h\nu)^2$ verses hν plot, which are shown in fig. By extrapolating the linear part of the plot to α = 0, optical band gap was estimated. From fig., it is observed that as deposition temperature increases band gap increases, it becomes maximum (3.224 eV) at temperature 400^0C and for higher temperature it is slightly decreases. Also it is indicated that from fig., as concentration increases optical band gap decreases considerably due to increases in grain size compared to variation in temperature.

UV-Visible Absorption

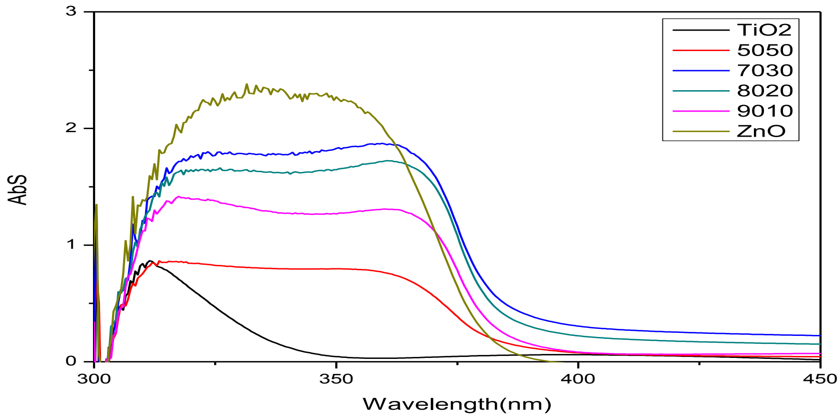
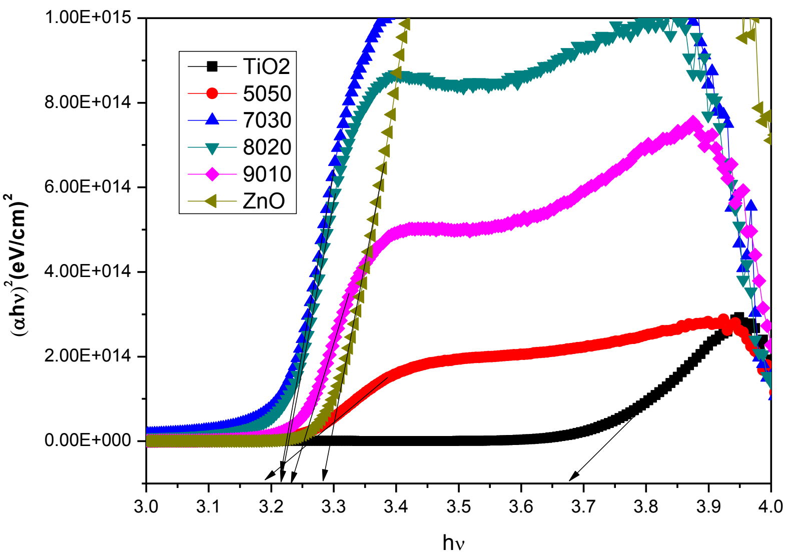


Fig- Absorption spectera

Band-gap



Composition	Band-gap(ev)
Pure ZnO	3.263
90-10	3.207
80-20	3.218
50-50	3.17
70-30	3.20
Pure Tio_2	3.66

CONCLUSION:-

Composite of ZnO-TiO_2 thin film were deposited by a spray pyrolysis technique. The films were deposited onto. Glass substrate at the selected temperature 450^0 C, 480^0 C respectively. Substrate temperature during deposition was found to have influenced the phase. The films has good optical quality properties and are well-suited for Solar Cell applications. The optical energy gap, E_g = 3.26 eV, and 3.66 eV are deduced for ZnO, TiO_2 films respectively.

The significant red-shift with lower band energy of ZnO-TiO_2 film comparing with the ZnO film and TiO_2 film may be owing to the differences in the surface state. The ZnO-TiO_2 film need lower energy to be excited than the ZnO film and TiO_2 film.

Future Plan-

Composite of ZnO-TiO_2 thin film were deposited by a spray pyrolysis technique. The films were deposited onto. If this composite thin film obtained on FTO substrate it is used in purification of water filter, because of it's photocatalytic activit

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