Fişa suspiciunii de plagiat / Sheet of plagiarism's suspicion	Indexat la: 0116/05

Opera suspicionată (OS) Suspicious work	Opera autentică (OA) Authentic work

OS	STAMATE, Marius, VASCAN, Ioan, LĂZAR,Iuliana, LAZĂR, Gabriel, CARAMAN, Iuliana and CARAMAN, Mihail. Optical and surface properties TiO2 thin films deposited by DC magnetron sputtering method. *Journal of Optoelectronics and Advanced Materials*. 7(2). April 2005. 771 – 774. Disponibil la / Available at: http :// joam . infim . ro / JOAM / pdf7 _ 2 / Stamate . pdf.
OA	STAMATE, M. and VASCAN, I. Variable optical band gap for TiO2 thin films deposited in a D.C. magnetron sputtering system. *Analele ştiinţifice ale Universităţii „Al.I.Cuza" Iaşi, Fizica Stării Condensate*. Tome XLV-XLVI. 1999-2000. 173-175. Disponibil la / Available at: http: // stoner . phys . uaic . ro / old / ANALE / Anale _ 1999 _ 2000 / An _ Univ _ Iasi _ 1999 _ 2000 _ 27 . pdf.

Incidenţa minimă a suspiciunii / Minimum incidence of suspicion	
p.771:05 - p.771:10	p.173:05 – p.173:10
p.771:14 - p.771:18	p.173:12 – p.173:17
p.771:22 - p.772:05	p.173:24 – p.174:17
p.772:Table 1	p.174: Table 1
p.772: Fig.1	p.175:Fig.1

Fişa întocmită pentru includerea suspiciunii în Indexul Operelor Plagiate în România de la www.plagiate.ro

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VARIABLE OPTICAL BAND GAP FOR TiO_2 THIN FILMS DEPOSITED IN A D.C. MAGNETRON SPUTTERING SYSTEM

M. STAMATE, I. VASCAN*

KEYWORDS: d.c. magnetron sputtering method, thin films, optical properties

TiO_2 thin films were deposited through a d. c. magnetron sputtering method. In this paper we present an analysis of optical properties of TiO_2 thin films deposited on glass. We conclude that there is a strong dependence between the values of TiO_2 optical band gap and argon/oxygen ratios. We found that the optical band gap may be varied from values cloused to 3 eV to values larger than 3.4 eV in respect to the varying of oxygen/argon ratios between 10% to 50%.

INTRODUCTION

Titanium dioxide (TiO_2) films are extensively used in optical thin film devices, because of their good transmittance in the visible region, high refractive index and chemical stability[1]. Many deposition methods can be used to prepare titanium oxides film: thermal [2] or anodic [3] oxidation of titanium, electron beam evaporation [4], chemical vapor deposition [5], plasma-enhanced chemical vapor deposition [6], sol-gel method [7] and reactive sputtering methods. The infrared transmission properties were studied in several papers: for angular selectivity of sputter-deposited Ti-oxide-based films, and for amorphous P.E.C.V.D. TiO_2 films[8]. Among the I.R. transmission properties of TiO_2 thin films the I.R. reflection properties may reveal more information about the film structure. In the present study, the present authors focus on the analysis of I.R. reflection spectra of TiO_2 thin films.

EXPERIMENTAL

The films were deposited in a home built magnetron sputtering system [9].

The vacuum chamber is an 80 l volume stainless steel chamber, a circular magnetron with a 60 mm diameter erosion zone was used as the cathode. The discharge

* Bacau University, Calea Marasesti nr.157, Bacau,5500, Romania

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characteristics have been controlled using a variable dc power supply (3kV and 500 mA). Pure titanium (99.5) of 130 mm diameter and 3 mm thickness has been used as a sputtering target. Pure argon (4N) and oxygen were used as the sputtering and reactive gases respectively. The gases were mixtured prior the admission in the sputtering chamber at several proportions, in respect to the varying of oxygen/argon ratios between 10% to 50%. The target substrate distance was 35 mm. The sputtering pressure was kept at 5.10^{-2} torr. Prior the deposition the target was well cleaned in order to remove the surface oxides layers. The substrate temperature was held at 250 °C by using a quartz halogen lamp whose power was controlled by varying the input voltage. Titanium oxides films were deposited on well cleaned microscope glass slides (75x25x1 mm^3) and on KBr crystals substrates. The deposition time was 1 hour and the sputtering power was about 110W (200mA x 550V). The thickness of the films has been determinated by using a multiple beam interferometry method to an accuracy of ± 10nm.

Transmission spectra were recorded with an Specord UV Vis , Karl Zeiss Jena. The structure of the films was examined by using X-ray diffraction with Cu K_{α} radiation in a standard X-ray diffractometer (DRON). The conductivity of the films were recorded by a four probe methods that is sensitive for resistivity up to 10^{11} Ω.cm

RESULTS AND DISCUSSION

X-ray diffraction's analysis revealed that all the TiO_2 films were amorphous. The conductivity of the films at room temperature (300 K), was found to be of the order of 10^{-8} $\Omega^{-1}cm^{-1}$, that assure a composition for the film close to a stoichiometryc one .

Table.1 Sputtering conditions.

Sample	Sputtering pressure [Torr]	Gas flow Ar/O_2 [sccm]	Deposition rate [nm/min]	Support temperature [°C]	Ratio Ar/O_2
TiO_2-D1	2.10^{-3}	19.20	6.67	150	50/50
TiO_2-D5	1.10^{-3}	50.60	5.45	300	75/25
TiO_2-F1	2.10^{-3}	46.11	5.71	300	90/10

There were been recorded the transmission spectra for the TiO_2 films and the glass substrate. In Fig. 1 is shown the absorption spectra for tree films whose deposition parameters are presented in table 1.

From figure is revealed that for lower oxygen proportions the band gap width decrease up to 3.13 eV, while for higher proportions the TiO_2 band gap width increase up to 3.38 eV.

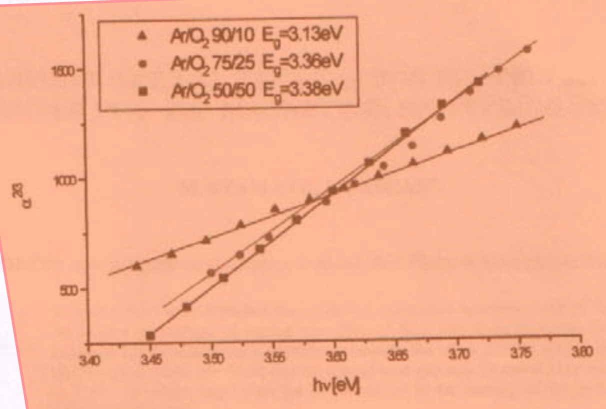

Fig .1. The absorption $\alpha^{2/3}$ versus hν for TiO_2 thin films

CONCLUSIONS

In the paper we have analyzed the properties of TiO_2 thin films, and we found that controllable tehnological parameters makes possible to grow films with different band gap width. This method is suitable to the preparation of separate films with different band gap width or to TiO_2 sandwich based structures with different band gap width films for optical or electrical purposes [10].

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