

(ECD) (ITO) (EC) (APTA)

APTA () (OAD)

OAD APTA

WO_3 :

Effect of organic additives on the morphological and electrochromic properties of WO_3 films

M. Sharbatdaran, H. Nourkojouri, S. M. Mohati and A. J. Novinrooz

*Agricultural, Medical and Industrial Research center.
Nuclear Science and Technology Research Institute, AEOI*

Abstract- The WO_3 film is the most important material for electrochromic (EC) layer especially in electrochromic display (ECD). In this project WO_3 films were deposited on indium thin oxide (ITO) glass substrates. For this propose peroxotungstic acid derivative (APTA) was synthesized by sol-gel method and was used as a precursor solution for depositing by dip coating technique. Whereas many properties of the films, including some of the EC properties, they were dependent on microstructure of the films, were found to be modified by the addition of small amount of oxalic acid dihydrate which is an organic compound, ranging from 0% to 10% by weight in PTA solution. In this report, The morphology of the film structure, and EC response were investigated. Heat treatment of APTA and transparency of layer were carried out in different temperatures and concentrations. The findings showed that the addition of oxalic acid to the precursor solution on the films resulted in excellent EC properties without micro cracks.

Keywords: WO_3 , Electrochromic, Sol-gel, Peroxotungstic acid, ECD's

[]

(APTA)

)
(% /
(%)

[]
(WO)

()
()

(PTA)

%)

WO

[]

(

(PTA)

PTA

WO

(APTA)

[]

APTA

PTA

)

APTA

(

APTA

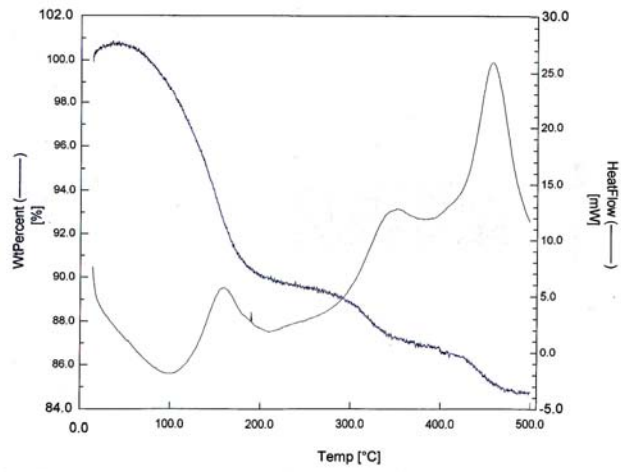
APTA

/ /

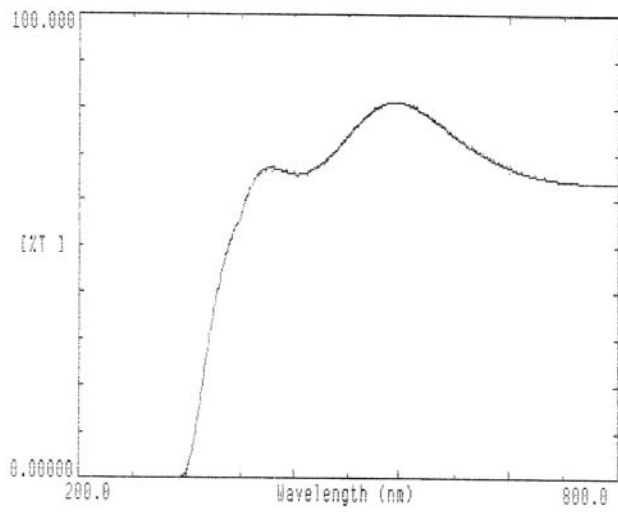
()

APTA

Cm^{-1}
 $W(\text{O}_2)$
 () $W=O$
 [] Cm^{-1} ITO
 APTA / \times (Ω/\square)
 $2\theta=10-90$ X
 (DSC-TGA) -
 APTA /
 TGA
 DSC %
 OAD OAD
 TGA
 DSC FT-IR
 X Shimadzu-4600
 Philips PW 1840
 PTA (TGA-DSC)
 Rheometric STA-1500
 (APTA + OAD) APTA Trace (CV)
 Analyzer 746 VA
 () %
 (SEM) CARY-17D
 nm
 b a
 + OAD) APTA Philips XL-30
 (APTA
 a OAD
 OAD (APTA) FT-IR



APTA (DSC-TGA)



APTA + OAD

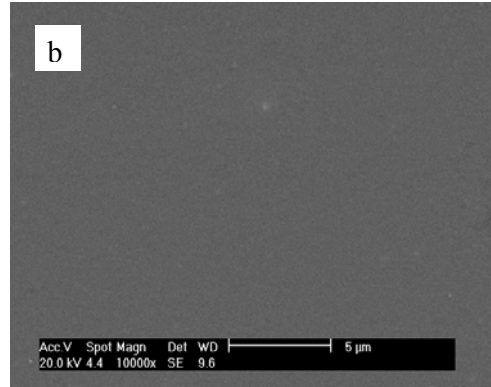
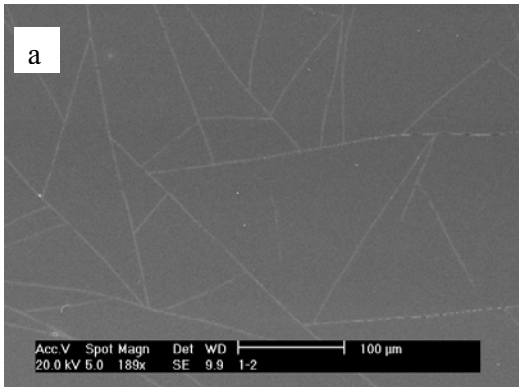
Ag/AgCl

+ / /

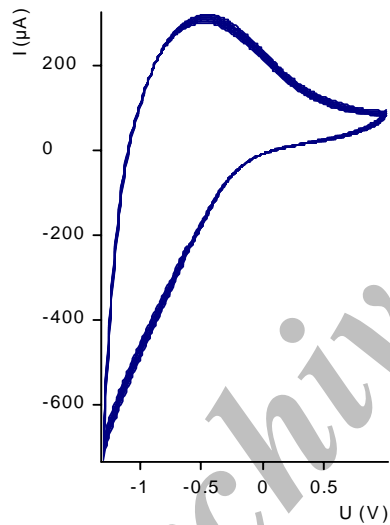
(b)
OAD

OAD / /
[] APTA OAD

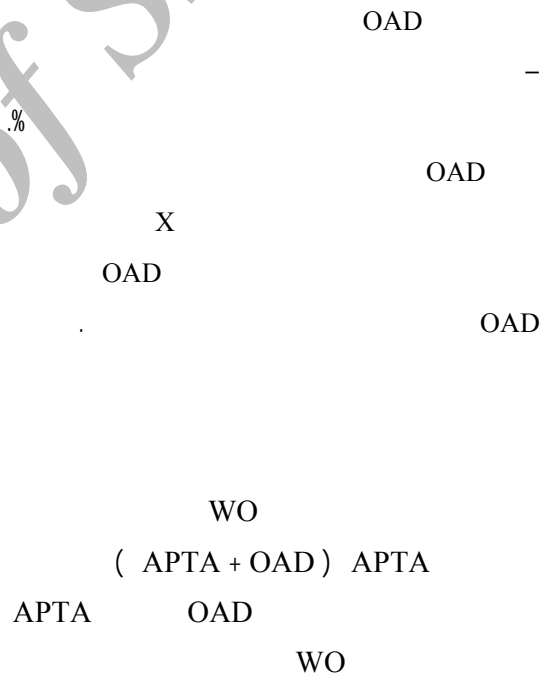
[]



APTA + OAD (b) APTA (a)



APTA و 5% OAD



1. M. Sharbatdaran, A. Novinrooz and H. Noorkojouri, *Preparation of WO_3 electrochromic films obtained by the sol-gel Process*, Iran. J. Chem. Eng, 25(2)(2006)25-29.
2. A. J. Novinrooz, M. Sharbatdaran and H. Noorkojouri, *Structural and optical properties of WO_3 electrochromic layers prepared by the sol-gel method*, Central Eur. J. Phys, 3(3)(2005)456-466.
3. B. Krause, *Thin Film on Glass*, Springer, Berlin, (1997).

8. G. Lrftheriotis, S. Papaefthimiou, P. Yianoulis and A. Siokou, *Effect of tungsten oxidation states in the thermal coloration and bleaching of amorphous O_3 films*, Thin Solid Films, 384(2001)298-306.
9. N. Sharma, M. Deepa, P. Varshney and S. A. Agnihotry, *Influence of organic additives on the electrochromic properties of sol-gel derived WO_3 coatings*, J. Sol-Gel Sci. and Technol., 18(2000)167-173.
10. H. L. Hartnagel, A. L. Dawar, A. K. Jain and C. Jagadish, *Semi conducting Transparent Thin Films*, IOP, London, (1995).
11. K. D. Lee, *Preparation and electrochromic properties of WO_3 coatings deposited by the sol-gel method*, Sol. Energy Mater, 57(1999)21-30.
4. M. Seman and C. A. Wolden, *Characterization of ion diffusion and transient electrochromic performance in PECVD grown tungsten oxide thin films*, Sol. Energy Mater. and Sol. Cells, 82(2004)517-530.
5. M. A. Aegerter, R. C. Mehrotra, I. Oehme, R. Reisfeld, S. Sakka, O. Wolfbeis and C. K. Jorgense, *Structure and Bonding, Optical and Electronic Phenomena in Sol-Gel Glasses and Modern Application*, Springer, Berlin, (1996).
6. A. C. Pierre, *Introduction to Sol-Gel Processing*, Kluwer Academic Publisher, Boston, MA, (1998).
7. J. P. Cronin, A. Agraval, D. J. Tarico and J. C. Tonazi, *Precursor solutions forming coatings*, US Patent 5,525,246, 11, (1996).

Archive of SID