

Effect of thermal evaporation parameters on tungsten oxide structure

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Tungsten oxide presents different crystalline phases, according to the synthesis parameters.^[1] These phases, monoclinic, orthorhombic, among others, are able to lead to different optical^[2] and electrochemical properties^[3], providing wide range of applications in new technologies. We obtained thin films of WO₃ by thermal evaporation and the deposition parameters were studied according to a 2³ factorial design, with variables: substrate type, substrate temperature and deposition time (Table 1). The deposition occurs through heating of WO₃ powder at 1100 °C under O₂ atmosphere at 10⁻³ torr. The stability of the films to the lixiviation (pH 6.0) was evaluated by Rutherford Backscattering Spectrometry (RBS) being (+) level for non-lixiviated and (-) for lixiviated films. Structural characterization was performed by Scanning Electron Microscopy (SEM). It is observed homogeneous spherical nanostructured films, with diameter varying from 650 to 350 nm, for synthesis over Au/Si substrates at higher temperature and deposition time. The condition of high temperature and Au/Si substrate produce films resistant to lixiviation. These films will be characterized with respect to their crystalline structure and electric properties.

Table 1 – Factorial design 2³ for optimization of experimental conditions to produce WO₃ films. Levels: (-) Au deposited on silicon substrates (Au/Si), 200 °C and 60 min; (+) ITO/glass, 600 °C and 90 min.

Experiment	Variable			Response
	Substrate	T _s /°C	t /min.	Lixiviation test
1	-	-	-	
2	+	-	-	
3	-	+	-	+
4	+	+	-	-
5	-	-	+	
6	+	-	+	
7	-	+	+	+
8	+	+	+	

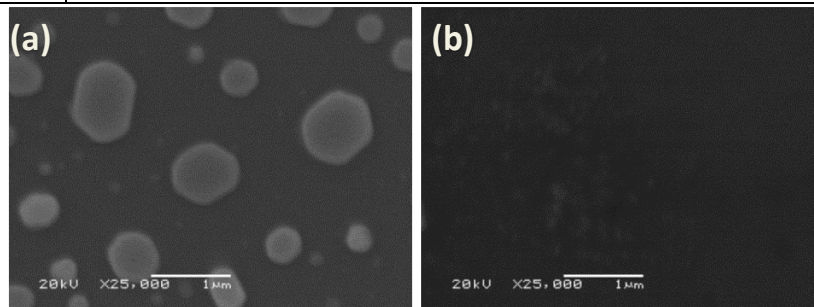


Figure 1: Micrographs of WO₃: (a) sample number seven (b) sample number eight (see Table 1).

Keywords: Factorial design, thermal evaporation, tungsten oxide films.

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