Accepted Manuscript

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PII: S0040-6090(17)30054-8
DOI: doi: 10.1016/j.tsf.2017.01.044
Reference: TSF 35756

To appear in: *Thin Solid Films*

Received date: 17 August 2016
Revised date: 10 January 2017
Accepted date: 21 January 2017

Please cite this article as: Kentaro Nishiyama, Junji Sasano, Seiji Yokoyama, Masanobu Izaki , Electrochemical preparation of tungsten oxide hydrate films with controlled bandgap energy. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Tsf(2017), doi: 10.1016/j.tsf.2017.01.044

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Electrochemical Preparation of Tungsten Oxide Hydrate Films with Controlled Bandgap Energy

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Abstract

Tungsten oxide hydrate films of $WO_3 \cdot H_2O$ and $WO_3 \cdot (H_2O)_{0.33}$ were prepared on conductive glass substrates by anodic deposition in aqueous 0.01–0.5 mol/L WO_4^{2-} solutions. Structural and optical characterizations were carried out by X-ray photoelectron spectroscopy, X-ray diffraction, SEM observation, optical absorption measurements, and photoelectrochemical measurements. The films composed of large $WO_3 \cdot H_2O$ grains with square shapes, which was obtained in the 0.01–0.09 mol/L WO_4^{2-} solutions, possessed a bandgap energy of approximately 2.5 eV, and the

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