Microstruture and surface characteristics evolution of mesoporous multiple spin-coated titania films

Toktam Geramipour, Hamid Oveisi

PII: S0040-6090(16)30621-6
DOI: doi:10.1016/j.tsf.2016.10.030
Reference: TSF 35554

To appear in: *Thin Solid Films*

Received date: 5 June 2016
Revised date: 7 October 2016
Accepted date: 15 October 2016

Please cite this article as: Toktam Geramipour, Hamid Oveisi, Microstruture and surface characteristics evolution of mesoporous multiple spin-coated titania films, *Thin Solid Films* (2016), doi:10.1016/j.tsf.2016.10.030

Microstruture and surface characteristics evolution of mesoporous multiple spin-coated titania films

Toktam Geramipour[a], Hamid Oveisi[a,* 1]
[a] Department of Materials and Polymers Engineering, Hakim Sabzevari University, Sabzevar 9617976487, Iran

Abstract

Multilayer nanocrystalline mesoporous titania films were synthesized using the layer-by-layer deposition and surfactant-assisted sol-gel methods on glass substrates. The thickness, morphology and surface roughness of the films were systematically investigated using field emission scanning electron microscopy (FE-SEM) and atomic force microscopy (AFM). Multilayer films were manufactured by repeated spin coating followed by heat treatment at 250^{o}C for 1h after each deposition, and a final calcination at 400^{o}C for 4h. Multilayer films with completely uniform thicknesses between 470nm-1.85μm and without clear interfaces were obtained by 1-6 coating cycles. The X-ray diffraction (XRD) analysis demonstrated 9.60 nm anatase crystallites. Interestingly, AFM analysis indicated that the root mean square (rms) surface roughness of the films was significantly reduced from 3.11 to 1.03 nm by increasing the deposited layers from 1 to 6. Moreover, power spectral density (PSD) analysis revealed that the roughness exponent and fractal dimension values of all films fall within the range of 0.48-0.53 and 2.47-2.52, respectively. This suggests that while the first titania layer exhibits a coarse microstructure, it acts as an intermediate layer in the formation of improved microstructures by eliminating the lattice mismatch between the glass substrate and subsequent titania depositions.

* Corresponding author.
E-mail address: hamid.oveisi@hsu.ac.ir