Supported tungsten based films obtained from polyperoxotungstic acid

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Tungsten oxides present interesting electrochromic, photochromic and gasochromic properties and can be used in smart windows and gas sensor dispositives [1]. These oxides can be obtained as supported films from the commercial tungsten oxide, by thermal evaporation [2,3] or tungsten sheets, by anodizing in aqueous solution [3,4]. In this work, we obtained supported films from the precursor polyperoxotungstic acid (PTA). We analyzed the effect of anionic surfactant as structuring agent in the final morphology and crystal structure of the films. Aqueous systems composed of the precursor and the structuring agent sodium dodecyl sulfate (SDS), in concentrations lower and upper the critical micelle concentration (9 $g.L^{-1}$), using ethanol as co-solvent, were characterized by pH, conductivity, surface tension and contact angle, as well as fluorescence spectroscopy. The values of the surfactant critical micelle concentration decreased with the addition of PTA. The PTA was responsible for reducing the Gibbs energy change of micellization from -28.53 $kJ.mol^{-1}$ to -45.38 $kJ.mol^{-1}$, favoring the micellization process. Supported oxide films were obtained by spin coating the precursor systems on silicon substrates, covered with a 20 nm silicon oxide layer. The films were dry at 100 °C and calcined at 500 ° C in air for 3 h. The calcination process was used to remove the organic material and dehydrate the PTA. The films were characterized by scanning electron microscopy, Raman spectroscopy and X-ray diffraction. The films developed micrometric fractal structures composed of nanospheres with diameters between 68 and 135 nm. The obtained films were composed of orthorhombic tungsten oxide as well as, triclinic and orthorhombic sodium tetratungstate. The surfactant concentration does affect the morphology of the films and particle sizes of the films but does not affect the crystalline structure of the formed materials.

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References

[1] Avellaneda, C.O., Bulhoes, L.O.S. J. Solid State Electrochem. **2003**, 7, 183-186.
[2] Corrêa, D. S., Pazinato, J. C. O. Freitas, M. A., Dorneles, L. S., Radtke, C., Garcia, I. T. S., *J. Braz. Chem. Soc.* **2014**, 25, 822-830.
[3] Garcia, I. T. S., Corrêa, D. S., Moura, D. S., Pazinato, J. C. O., Pereira, M. B., Costa, N. B. D., *Surface & Coatings Technology* **2015**, 283, 177-183.
[4] Costa, N. B. D., Pazinato, J. C. O., Sombrio, G., Pereira, M. B., Boudinov, H., Gündel, A., Moreira, E. C., Garcia, I. T. S., *Thin Solid Films* **2015**, 578, 124-132.