Nanostructured WO_3 Thin Films Prepared by Aerosol Flame Deposition Process

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1-D tungsten oxide thin films have been considered as a promising photoanode material for photoelectrochemcial water-splitting techonologies. However, the nearly cubic WO_3 crystal tends to grow as an isotropic 3-D structure instead of an anisotriopic 1-D structure. In our work, 1-D WO_3 nanostructures were grown by a two-step approach that takes advantage of intrinsically anisotropic growth of W18O49: the 1-D $W_{18}O_{49}$ nanostructures were synthesized in the fuel-rich premixed flame by using W wire as precursor, followed by air annealing to oxidize the sub-stoichiometric WO_3. WO_3 thin films with 1-D morphology were deposited on both silicon substrate and ITO glass substrate. We investigated the effects of the various process parameters, such as metal wire position in between substrate and flame burner, deposition height, substrate temperature and deposition time on resultant morphology and thickness of metal oxides thin films respectively. The structure properties were characterized by Scanning electron microscopy and X-ray diffraction and the photoelectrochemical properties were tested by IPCE measurement system.