PHOTOELECTROCHEMICAL PROPERTIES OF ANODIC NANOSTRUCTURED Cu-WO_3 MATERIALS

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Nanostructured semiconducting materials have been studied for many years thank to their interesting optical and photoelectrochemical properties. Among them, tungsten oxide deserves special attention due to its optical and catalytic properties. WO_3 is an n-type semiconductor with 2.5 – 3.2 eV indirect band gap. Tungsten oxide, especially in the nanostructured form can find promising applications as sensors, in photocatalytic degradation of organic dye or in photoelectrochemical cells. It is widely recognized that doping with transition metal ions can enhance the photoelectrochemical properties of nanostructured semiconductor metal oxides [1 – 4].

Anodic WO_3 photoanodes were prepared by electrochemical anodization of tungsten foil in 1 M $(NH_4)_2SO_4$ + 0.075 M NH_4F at 50 V. Furthermore, a wet impregnation of anodic oxide with Cu ions were performed. Anodic WO_3 samples were soaked in 25 mM $Cu(CH_3COO)_2$ for 1, 5, 10 or 24 hours. In order to obtain a doped photoactive phase as-prepared samples were annealed at 500 ^oC for 2 hours. Complex characterization of received samples was performed using SEM, EDS, and XRD measurements. The photoelectrochemical tests were performed using a Teflon cell with a quartz window in a three-electrode system, where nanoporous WO_3 was used as a working electrode, a platinum foil as a counter electrode and an Ag/AgCl electrode as the reference electrode. The measurements were performed in a 0.1 M KNO_3 aqueous solution.

To sum up, it has been shown that the wet-impregnation is an easy and effective method to modify of nanoporous tungsten oxide with Cu. Cu modified WO_3 oxide layers exhibit enhanced photoresponse in the visible light up to 500 nm. The optical band gap is slightly narrower for Cu-WO_3 than pristine WO_3.

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References

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