SYNTHESIS OF HIGHLY POROUS PHOTOACTIVE WO_3 FOR GENERATION OF ClO^-

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Photoelectrochemical (PEC) generation of reactive chlorine species has attracted considerable attention because synthesis of H_2 on cathode can be coupled with production of high added-value chemicals such as HClO, H_2O_2, etc. on suitable photoanode [1]. Chloride anion oxidation (or hypochlorite production) is an attractive alternative to the oxygen evolution reaction due to a large amount of seawater as natural electrolyte on Earth and the massive application of hypochlorites in industrial water disinfection and sanitization [2-3]. In this study, porous WO_3 films were formed on fluorine-doped tin oxide (FTO) substrates by low temperature chemical bath deposition (CBD) and tested for PEC chloride oxidation.

To prepare WO_3 photoanode, $Na_2WO_4.2H_2O$ was dissolved in deionized water under constant stirring, which was followed by the addition of citric acid and 3M HCl consecutively. Cleaned FTO substrates were immersed in the above solution and the deposition was allowed to proceed for two hours. The films were annealed at 400ºC in air. The same procedure was repeated four times to obtain layers with increasing thickness. After first coating procedure comparably "thin" WO_3 nanostructured films with a layer thickness of several hundred nanometers and nanosheet morphology are typically obtained (Fig. 1a). After four chemical bath deposition cycles, several micrometers thick porous WO_3 layers were formed.

Fig.1b shows cyclic voltammograms (CV) of one-layer WO_3 photoanode measured in 0.5 M NaCl under dark and light to evaluate the PEC performance of the film. The photocurrents of CBD-deposited WO_3 films were found to be increasing with the layer thickness. Faradaic efficiency of PEC formation of ClO^- was evaluated.

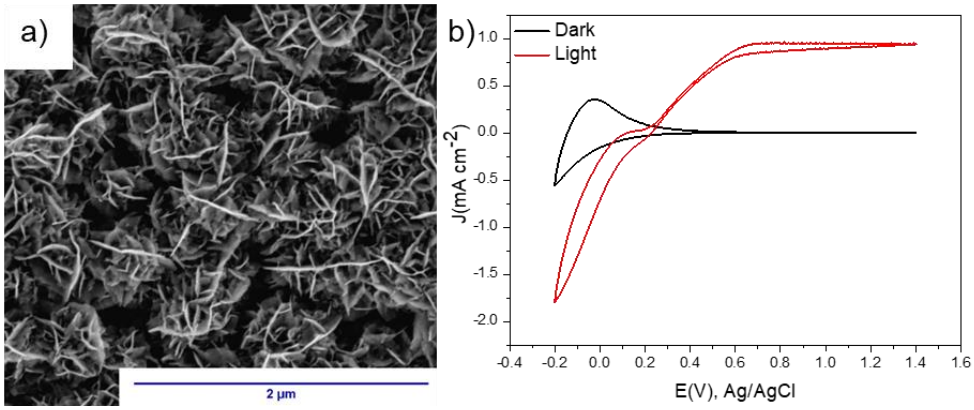

Fig. 1. a) SEM image of one-layer WO_3 coating prepared in CBD synthesis, b) CV of the same electrode in 0.5 M NaCl; illumination intensity 100 mW cm^{-2}; potential scan rate 50 mV s^{-1}.

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References

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