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# Photoelectrochemical generation of active chlorine species at sol-gel derived nanostructured $WO_3$ electrode

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Due to strong oxidative power of hypochlorous acid (HClO), it is worldwide used for the disinfection of water [1, 2]. Solar-driven generation of HClO in chloride solutions (e.g. seawater) can offer a sustainable way to produce this chemical, which is currently produced by highly energy-intensive chlor-alkali process.

In this study the suitability of tungsten (VI) oxide anode for the photoelectrochemical formation of active chlorine species ($Cl_2$, HClO, $ClO^-$) was investigated.

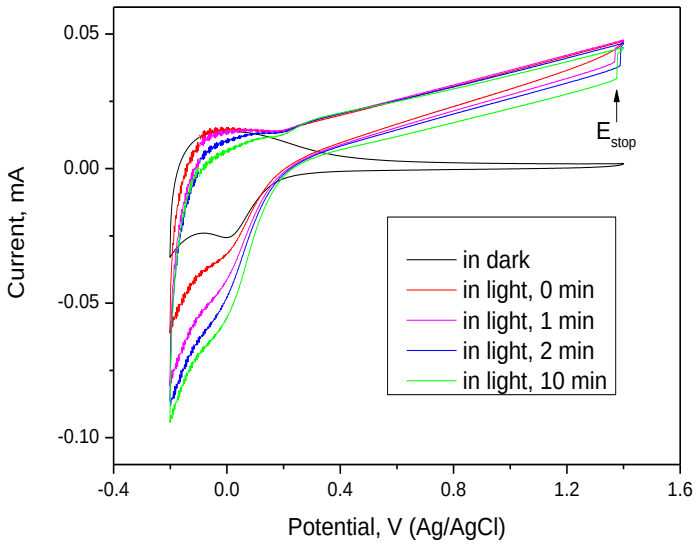


Fig. 1 Cyclic voltammograms of sol-gel prepared $WO_3$ photoelectrode in 0.5 M NaCl solution: potential scan was stopped at 1.4 V for periods of time specified in the inset; potential scan rate 50 mV $s^{-1}$

Nanostructured layers of $WO_3$ on fluorine-doped tin oxide (FTO) substrate were formed by sol-gel method. Peroxytungsten acid (PTA) was synthesized using sodium tungstate ($Na_2WO_4$ x $2H_2O$), HCl (37%) and $H_2O_2$ as precursors and $(NH_4)_2C_2O_4$ as capping agent. Subsequently, propanol was added as a reductant, which slowly and controllably reduced peroxotungstates to form uniform and ordered $WO_3 \cdot H_2O$ films on FTO-covered glass substrates under soft water bath conditions at 85ºC. After coating procedure samples were annealed at 500°C for 2 h with heating rate of 1°C/min to obtain a crystalline nanostructured $WO_3$ films and to remove residual carbon [3]. The coatings were characterized using X-ray diffraction (XRD) analysis and scanning electron microscopy (SEM).

Photoelectrochemical experiments in chloride containing solutions revealed the activity of $WO_3$ films in active chlorine species formation. Increasing photocurrent was observed in the potential, E, range above 0.2 V (vs. Ag/AgCl) (Fig. 1). When photoanode was polarized at E = 1.4 V for different periods of time, increasing cathodic current was recorded during subsequent negative going scan at E < 0.3 V. This current should be attributed to reduction of $ClO^-$. The stability of the photoelectrodes along with applicability of nanostructured $WO_3$ films for water disinfection was studied.

REFERENCES

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