11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Chloride Adsorption over Gold Surface: An Amperometric Sensor of Cl^-

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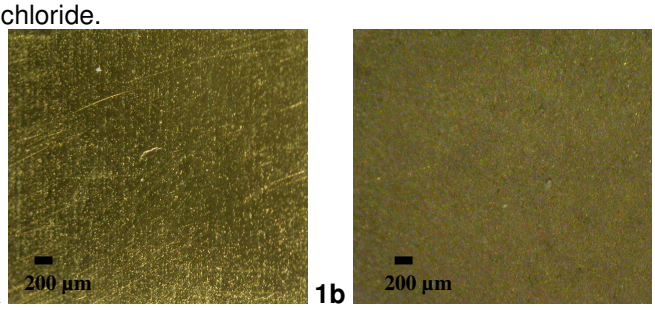
Abstract – Chloride sensor, with gold working electrode modified for chloride adsorption, have been developed using the amperometric electrochemical method. DPV technique was used to apply potentials ranging from -1.1 to +1.1 V. It was observed $AuCl^-_4$ film formation (positive potentials) and chloride response at 0.22 V. As a result, a linear curve current vs. chloride concentration was achieved: **I** (μA) **= 1.42 10^{-6} [Chloride] + 231.66** (μA) for chloride concentrations increments of 10 mmol L^{-1} starting from 0.

Chloride adsorption processes over gold electrode surface have been largely studied for chemical, environment and biochemical applications [1, 2]. The halides, which are present in the support electrolyte, can be interference-elements or a measuring specimen. In this case, they are electrochemically investigated using conventional techniques that allow one to observe and analyze adsorption on the electrode surface of metallic films [3].

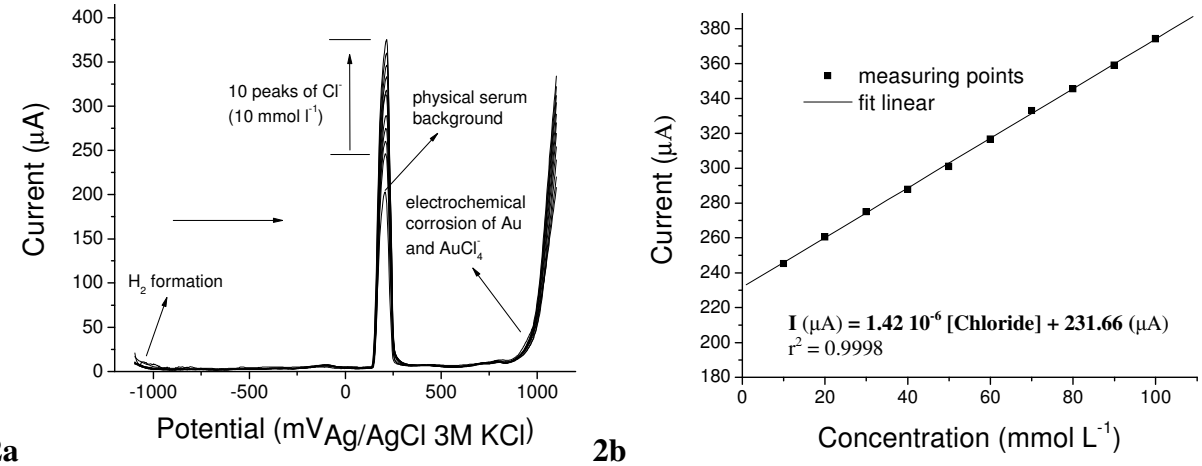
In this work, we have developed an electrochemical planar sensor with three electrodes (not showed) composed of a gold working electrode modified by adsorption of chloride, a gold auxiliary electrode and an Ag/AgCl 3M KCl reference electrode. The experiments were performed in physical serum (NaCl 0.9%, pH = 7.3) as support electrolyte. DPV (Differential Pulse Voltammetry) technique was utilized to analyze the chloride electrochemical behavior for potentials ranging from –1.1 to +1.1 V. Figure 2a shows chloride response next to 0.22 V due fast chloride adsorption over gold ($AuCl^-_4$) at positive potentials (see Figure 1b), hydrogen gas evolution at negative potentials lower than -1.0 V and an electrochemical corrosion of $AuCl^-_4$ or Au at potentials higher than 0.80 V.

A linear calibration curve current vs. chloride concentration was achieved with an excellent linearity coefficient (Figure 2b) for chloride concentrations ranging from 0 to 0.1 mol L^{-1} with increments of 10 mmol L^{-1}, meaning high sensitivity and repeatability. Finally, this work contributes with the development of electrochemical sensors for chloride.



1a 1b

Figure 1: Optic microcopy image of working electrode, **a)** bare Au and **b)** with $AuCl^-_4$ film.



2a 2b

Figure 2: Chloride Measuring, **a)** Cl^- peaks by DPV technique and **b)** calibration curve of the chloride.

References

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[3] A. Zolfaghari et al. Electrochimica Acta 47 (2002) 1173-1187.