

Electrocatalytic Oxidation Of Glucose On Ag Upd Au Film Electrode

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1. Introduction For practical application to the glucose–oxygen fuel cell, oxidation of glucose at a large area Ag upd Au film electrode was investigated in this paper, and the relations of peak potential and current with the size of electrode, concentration of glucose and supporting electrolyte were reported.

2. Experimental Gold film electrodes were prepared by vapor-deposition, and gold surface was modified by silver with underpotential deposition in aqueous sulphuric acid.

1/3 ML Ag upd Au film electrode was used for the electrochemical oxidation of glucose in alkaline solution.

3. Results and discussion **Fig. 1** shows CV of 1 mM Ag_2SO_4 at evaporated gold film electrode of large area. The obtained CV was very similar to that at Au(111) single crystal, which suggests that the prepared gold film electrode was rich in Au(111) structure. 1/3 ML Ag upd Au electrode showed high catalytic activity for the oxidation of glucose in alkaline aqueous solution with negative shift of peak potential 0.10 - 0.15 V and a little increase in peak current as shown in **Fig. 2**. Peak potential and current of CV of glucose oxidation were stable during a long time reaction under stirring and continuous scanning. As shown in **Table 1**, catalytic activity of 1/3 ML Ag upd Au electrode was nearly independent on the electrode area though there were slight differences in peak potential and current density with the increase in electrode area, and peak current was proportional to the size of electrode and the concentration of glucose. Therefore, the increase in the size of electrode and/or the concentration of glucose allowed a large current. Peak potential and current were also dependent on the concentration of supporting electrolyte. A higher concentration of alkaline solution was favorable to catalytic activity of the electrode as shown in **Table 2**, and peak potential and current got to constant when the concentration of alkaline solution increased to a certain extent. 1/3 ML Ag upd Au electrode could also be used repeatedly with keeping catalytic activity and without damaging film surface in the different experiments.

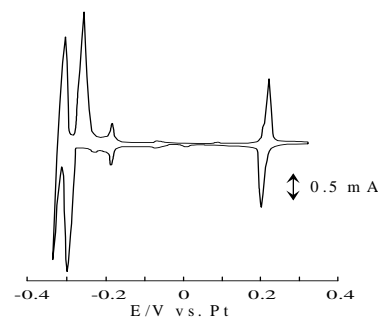


Fig. 1 CV of 1 mM $\text{Ag}_2\text{SO}_4/0.05 \text{ M H}_2\text{SO}_4$ for bare Au(111) at 5 mV s^{-1} . Size of electrode: $8 \times 5.5 \text{ cm}$

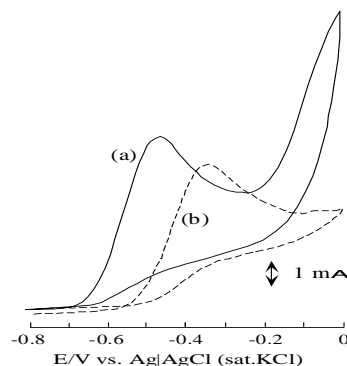


Fig. 2 CVs of 10 mM $\text{C}_6\text{H}_{12}\text{O}_6 / 0.3 \text{ M NaOH}$ at a scan rate of 50 mV s^{-1} . WE: (a) 1/3 ML Ag upd Au(111). (b) Bare Au(111). Size of electrode: $2 \times 2 \text{ cm}$

Table 1 Effect of the size of electrode and the concentration of glucose on peak potential and current^(a)

Size of electrode	Solution	E/V vs. Ag AgCl	I/mA
2 x 2 cm	10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.3 M NaOH	-0.46	7.1
3 x 3 cm	10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.3 M NaOH	-0.42	14.4
4 x 4 cm	10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.3 M NaOH	-0.39	27.5
4 x 4 cm	25 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 1.0 M NaOH	-0.39	64.0
8 x 5.5 cm	10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.3 M NaOH	-0.36	66.0
8 x 5.5 cm	25 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 1.0 M NaOH	-0.36	154.0

(a) WE:1/3ML Ag upd Au. CE:Pt. Scan rate:50 mV/s

Table 2 Effect of the concentration of supporting electrolyte on peak potential and current^(a)

Solution	E/V vs. Ag AgCl	I/mA	I(mA/ $\text{cm}^2 \cdot \text{mM}$)
10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.1 M NaOH	-0.20	17.5	0.11
10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.2 M NaOH	-0.28	25.0	0.16
10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.3 M NaOH	-0.39	27.5	0.17
10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.4 M NaOH	-0.40	27.5	0.17
10 mM $\text{C}_6\text{H}_{12}\text{O}_6/$ 0.5 M NaOH	-0.40	27.5	0.17

(a) WE:1/3ML Ag upd Au. 4x4cm CE:Pt. Scan rate:50 mV/s