

## Performance of Pt-TiO<sub>2</sub> Electrocatalyst for CO Oxidation in the Electrochemical Gas Sensor

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**Abstract:** It is reported for the first time that the Pt/TiO<sub>2</sub> electrocatalyst was successfully used for the electrocatalytic oxidation of CO in the electrochemical gas sensor with a controlled potential mode. The stability of electrocatalytic activity of the Pt-TiO<sub>2</sub> electrocatalyst for the CO oxidation is better than that of Pt.

**Keywords:** CO, electrochemical gas sensor, electrocatalyst.

In the recent years, the considerable attention has been paid to the research and development of the electrochemical CO sensor with the controlled potential mode. Usually, in this kind of the CO gas sensor, Pt is used for the electrocatalyst. However, the Pt electrocatalyst for the electrooxidation of CO would be poisoned for the measurement of high concentration of CO gas<sup>1</sup>. In this paper, we reported for the first time the Pt-TiO<sub>2</sub> catalyst, which showed better electrocatalytic activity and stability for the electrochemical oxidation of CO gas.

The electrochemical measurements were carried out with CHI potentiostat (CHI Co. U.S.A.) and traditional three-electrode cell. A Pt wire and saturated calomel electrode were used as the auxiliary and reference electrodes, respectively. The Pt or Pt-TiO<sub>2</sub> electrode was used as the working electrode. The Pt-TiO<sub>2</sub> catalyst was prepared with electrochemical reduction-oxidation method<sup>2</sup>. The electrolyte is the 0.5mol/L H<sub>2</sub>SO<sub>4</sub> solution. Before the electrochemical measurements of CO, the solution was bubbled with CO gas until the solution was saturated with CO.

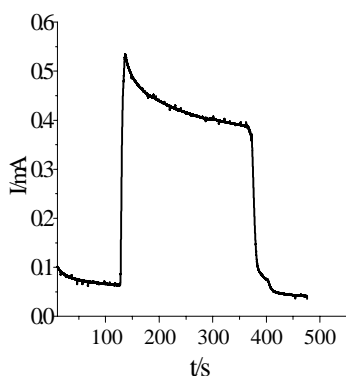
The CO gas sensor was consisted of the porous working electrode with Pt or Pt-TiO<sub>2</sub> catalyst and the porous O<sub>2</sub> electrodes with the Pt catalyst as that auxiliary and reference electrodes. The concentration of CO measured is about  $4.0 \times 10^{-3}$  mol/L. All the electrochemical measurements were carried out at  $21 \pm 2^\circ\text{C}$ .

In the cyclic voltammogram of CO saturated in the 0.5mol/L H<sub>2</sub>SO<sub>4</sub> solution at the Pt-TiO<sub>2</sub> electrode, one anodic peak was observed and located at 0.58 V. The peak current does not decay after 50 cycles. In the cyclic voltammogram of CO at the Pt electrode, the anodic peak is located at 0.6 V. In addition, the peak disappeared after

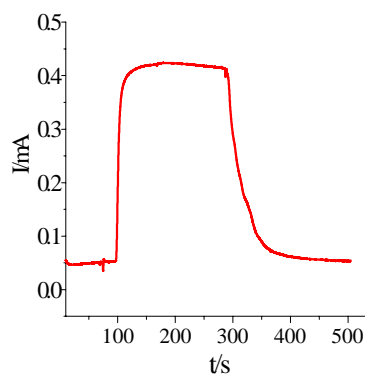
one or two cycles.

**Figure 1** and **2** show the relationship between time and response signal for the CO gas sensor with the Pt and Pt-TiO<sub>2</sub> catalysts, respectively. It can be seen that the response signal does not decay with time for the Pt-TiO<sub>2</sub> catalyst. However, it decreases 25% during 230s for the Pt catalyst.

**Figure 1.** The relationship between time and the response signal for the CO gas sensor with the Pt catalysts



**Figure 2.** The relationship between time and the response signal for the CO gas sensor with the Pt-TiO<sub>2</sub> catalysts



All of the results mentioned above clearly demonstrated that the electrocatalytic activity and stability of Pt-TiO<sub>2</sub> catalyst for the electrocatalytic oxidation of CO is much better than that for Pt catalyst and the electrochemical CO gas sensor with the Pt-TiO<sub>2</sub> catalyst showed good performance for measurements of CO gas with high concentration. It is attributed to weak adsorption of CO on the Pt-TiO<sub>2</sub> surface due to the interaction between Pt and TiO<sub>2</sub><sup>2</sup>.

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