

A Kind of Electrode Enhanced the Electrochemiluminescence

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Abstract: Three kinds of platinum electrodes with different geometry were designed. The relation of the electrochemiluminescence (ECL) intensity with the geometry of these electrodes has been investigated. The optical character of these electrodes was directly studied by observation of ECL image and measurement of the ECL intensity. The results showed that the ECL not only concentrated on the edge of the electrode but also concentrated on the edge of holes, which contain in the electrode. The ECL intensity from $\text{Ru}(\text{bpy})_3\text{Cl}_2 \cdot 6\text{H}_2\text{O}$ on round electrode was about half of that on four-hole round disk electrode for a same concentration of $\text{Ru}(\text{bpy})_3\text{Cl}_2 \cdot 6\text{H}_2\text{O}$, so the detection limit was improved to 10^{-18} mol/L $\text{Ru}(\text{bpy})_3\text{Cl}_2 \cdot 6\text{H}_2\text{O}$ on four-hole round disk electrode, three times higher than that on round disk electrode.

Keywords: Electrochemiluminescence, electrode, geometry.

Electrochemiluminescence (ECL), like other chemiluminescence technique, offers high signal-to-noise ratio. Furthermore, it has the advantage over other chemiluminescence techniques of being initiated by a voltage potential. Thus, it provides a better-controlled luminescence. This technique has been used in measuring many kinds of organic and inorganic matters, and analyzing many kinds of antigen, antibody and hapten, such as carcinoembryonic antigen and alpha-fetoprotein, *etc*¹⁻⁶. The electrode geometry and the detector capability remain problems of ECL assay. Based on the ECL mechanism¹, the electron providing efficiency of the working electrode directly influences the ECL efficiency. So, it is a significant work to study the relation of ECL efficiency to electrodes geometry. In recent technology, working electrodes are usually made of round disk with smooth surface. Yet, according to the "Hem effect" in physics, the distribution of electric charges are not even on the smooth surface of a working electrode. ECL, thus, concentrates on the edge of electrode. Central portion of electrode has nearly no ECL effect. This phenomenon results in a lower ECL efficiency, and limits the concentration detection ability at pmol/L or nmol/L. The research about the electrical and chemical properties of the working electrodes, including round disk, ring, spherical, hemispherical and band electrodes has been reported these years⁷⁻¹¹. But investigation on the relation of ECL efficiency to the geometry of a working electrode from the ECL image and ECL intensity was not reported yet. This work is to discuss the properties of the working electrodes with various geometries from the ECL image

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