金属ポルフィリンを電極触媒とする酸素還元反応に対する磁場効果

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1991 Fiscal Year Final Research Report Summary

Magnetic field effect on the cathodic reduction of oxygen utilizing metalloporphyrins as the electrocatalyst

Research Project

Project/Area Number

63550600

Research Category

Grant-in-Aid for General Scientific Research (C)

Allocation Type

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Research Field

工業物理化学

Research Institution

Kanazawa University

Principal Investigator

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Keywords

Magnetic field effect / Cathodic reduction of oxygen / MHD flow / Metalloporphyrin / Water-soluble / Electrocatalyst

Research Abstract

Magnetic field effect in the electrochemical reactions has been reported to lead to the increase in asymmetric yield, and the MHD (magnetohydrodynamic) flow of electrolyte which affects the reaction pathway and the diffusion limiting current. However, much attention has not been given to the magnetic property of reactant and catalyst taking part in the electrode reaction directly. It was studied how the magnetic property of metalloporphyrin as the electrocatalyst affected the cathodic reduction of oxygen in the magnetic field. As the metalloporphyrin, Co(III), Mn(III), and Fe(III) complexes of (1) water-insoluble meso-tetraphenylporphyrin (TPP-M), and (2) water-soluble meso-tetrakis (4-sulfonatophenyl) porphyrin (TPPS-M) and meso-tetrakis (l-methylpyridinium-4-yl) porphyrin (TMpyP-M) were chosen in the present research. The different states in the electrolytic system were compared.
(1) Magnetic field effect at water-insoluble metalloporphyrins
The magnetic field effect was examined by th e cyclic voltammetry, using a metalloporphyrin-coated glassy carbon electrode. The cyclic voltammograms in oxygen-saturated 0.1M NaOH with and without magnetic field were almost the same. The magnetic field (0.8 tesla) seems to have scarce effect on the activation of oxygen molecule at the immobilized metalloporphyrin.
(2) Magnetic field effect at water-soluble metalloporphyrins
The magnetic field effect was examined by the cyclic voltammetry in 0.1M NaOH dissolved metalloporphyrin, using a bare glassy carbon electrode. The cyclic

voltammograms with and without magnetic field showed a difference, especially at the diffusion limiting current. The diffusion limiting current for oxygen reduction increased with increasing the magnetic susceptibility of dissolved metalloporphyrin, which take part in the electrode reaction as the catalyst. The results suggest that the diffusion of oxygen is effectively promoted by the MHD flow of metalloporphyrin, and the oxygen reduction occurs on the molecular surface of metalloporphyrin, probably on the metal site.▲ Less

Research Products (2 results)

All Other

All Publications (2 results)

[Publications] Osamu IKEDA: "MAGNETIC FIELD EFFECT ON THE CATHODIC REDUCATION OF OXYGEN IN THE PRESENCE OF WATER-SOLUBLE METALLOPORPHYRINS" Chemistry Express. 6. 455-458 (1991)

[Publications] Osamu Ikeda and Chiaki Iwakura: "Magnetic field effect on the cathodic reduction of oxygen in the presence of water-soluble metalloporphyrins" Chemistry Express. 6-No. 7. 455-458 (1991)

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