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Oxygen Reduction on Carbon Electrode Investigated by Channel Flow Double Elctrode

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The analysis of the oxygen reduction mechanism is quite significant because the oxygen reduction is main cathode reaction of industrial electrolysis, fuel cell and metal corrosion *etc*, and it is expected to contribute to the development of new materials.

Products of oxygen reduction are H_2O and H_2O_2 by four and two electrons charge transfer, respectively, in aqueous solution. In addition, the four-electron reaction involves two different reactions that direct four-electron reaction and indirect four-electron reaction involving the intermediate. In the cases of the industrial electrolysis and the fuel cell, four-electron reaction is desired because the large discharge current can be obtained from one oxygen molecule.

Many researchers have investigated the oxygen reduction on various electrodes[1)-2)]. In these reports, the rotating ring-disk electrode (RRDE) and channel flow double electrode (CFDE) were used for the characterization of oxygen reduction on catalytic electrodes because the diffusion rate of oxygen can be controlled precisely. As an advantage of CFDE, the last product and the reaction intermediate can be determined *in-situly* because the detection time is sufficient short. In addition, it is easy to fabricate CFDE cell because of the simple structure. Therefore, CFDE was employ to analyze oxygen reduction in this paper.

As the first purpose, the number of electron for oxygen reduction is investigated from *I-E* curve measured by CFDE. Itagaki *et al.*[3)] applied electrochemical impedance spectroscopy (EIS) to the investigation of oxygen reduction electrode, and succeeded to discriminate direct and indirect four-electron reductions. Secondly in this paper, EIS study is extend to the analysis by multi-transfer functions. By using 4 channel frequency response analyzer, general electrode impedance and frequency dependent detection efficiency are determined. From these transfer functions, the adsorption the intermediate H_2O_2 for indirect four-electron reduction will be investigated.

References

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