Diffusion Impedance of Microband Electrode Array by FEM

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The diffusion impedance of the microelectrode was reported by Fleischmann *et al*. [1-5]. They derived the theoretical equations of diffusion impedance from two and three-dimensional Fick's second law using Neumann's integral theorem [5]. In case of the microband electrode array such as the comb-like structure, the large concentration gradient between the working electrode and the counter electrode is occurred because the each diffusion layer of the electrode lap over. However, the distribution of the diffusion layer of the microband electrode array is not clarified yet. In this study, the electrode reaction and the distribution of the diffusion layer of the microband electrode array was investigated by FEM.

The diffusion impedance of the microband electrode was simulated by FEM (COMSOL Multiphysics). The simulations were performed in the two-dimention. Figure 1 shows the simulation model of the microband electrode. The working electrode is arranged only in the solution. In this model, the impedance spectrum of the microband electrode calculated by FEM is shown in Fig. 2. When the frequency of applied potential became low, the real value of the impedance spectrum was increased and the imaginary value of the impedance spectrum converged to constant value. It is in good agreement with Fleischmann's report [5]. It was found that the result of impedance spectrum in Fig. 2 simulated the diffusion impedance of the two-dimentional diffusion of the microband elecrtrode by FEM. The effect of the distance between the working electrode and the counter electrode on the diffusion impedance will be discussed in this study.

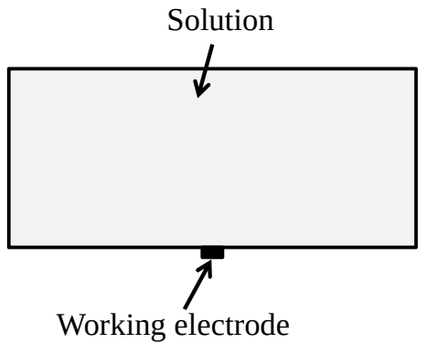

Fig. 1 The simulation model of the microband electrode.

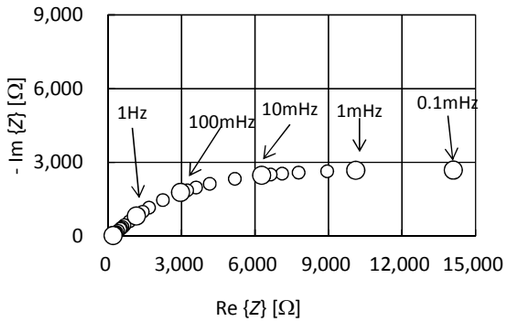

Fig. 2 The impedance spectrum of the microband electrode calculated by FEM.

Reference
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