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種別(和文)	要約
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Outline of thesis

The following list describes the outline of this thesis;

CHAPTER 1 – Introduction

In this chapter, the background of nano/microfluidic and their application are briefly introduced. Next, the technical point and specificity of the sensing device and system was described. In addition, the previous studied of electrical properties of nanofluidic and electrical measurement of biomolecules are reviewed. The research objectives and approaches are also included in this chapter.

CHAPTER 2 – Theory

In this research, I conducted the electrical impedance analysis of electrolyte and the biomolecule (e.g. DNA). In order to evaluate the mechanism behind these two measurements, the electrical physics study is necessary for both evaluations. Thus, in this chapter, I will comprehensively discussed about 1) Theory of electrical properties in the nanochannel and 2) Theory of DNA electrical properties. In addition, the basis of impedance analysis will be briefly discussed at the end.

CHAPTER 3 – Device fabrication and development

The principle and structure of the sensing device were concluded in this chapter. The device was composed of two crucial components 1) micro/nanofluidic channel for sample transportation and 2) nanoelectrode gap for sensing the samples. Thus, detection devices was developed having electrodes, which sandwiched the micro- nanochannel path. In order to create the nanogap, nanochannel was fabricated cut through the electrode lines and connected the two microchannel which linked to inlet and outlet. The device was then sealed with PDMS to complete the channel structure. In addition, the further development of device system to overcome biomolecules transportation and for parallel observation were also discussed in this chapter

CHAPTER 4 – Electrical Impedance Analysis of electrolytes

In this phase, the impedance measurement of electrolyte were conducted to identify the parameters (ion concentration, channel width and mobility of ions) to create high sensitive system. The results demonstrated the electrostatic of ion behavior and electrodynamic of electric double layer with the parameters variation. The electrical characteristic was separated to two distinct behaviors; before and after EDL overlapping. The ion conductivity was strongly depend on the ionic strength and the result was well supported by the Debye- Huckel and Onsanger theory. Whereas, the surface charge limits the resistance of the solution in the nanochannel under the EDL overlapping condition, which is consistent with the measurement results. These results provide better insight into the electrical characteristics of electrolytes in a nanochannel to improve electrical sensing and electrokinetic manipulation of molecules and other nanoparticles in nanochannels.

CHAPTER 5 – Electrical Impedance measurement of DNA

In this chapter, the evaluation of DNA impedance measurement was conducted. Firstly, the DNA samples were prepared utilizing the standard biotechnology method. Secondly, the mechanism of electric field effect on the DNA behavior was investigated in order to understand the DNA conformation and motion characteristic during the EIS measurement. Finally, the DNA was extensively analyzed using the impedance measurement to realize a label free, high sensitive electrical measurement of the biomolecules.

CHAPTER 6: Conclusions

This final chapter of this thesis describes the concluding summary of the research project.