論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Study on Measurement of Various Oxygen Potentials Using Solid Electrolyte Sensor for Liquid Lead-Bismuth Eutectic
著者(和文)	Adhi Pribadi Mumpuni
Author(English)	Pribadi Mumpuni Adhi
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第10813号, 授与年月日:2018年3月26日, 学位の種別:課程博士, 審査員:高橋 実,矢野 豊彦,加藤 之貴,小林 能直,塚原 剛彦
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第10813号, Conferred date:2018/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	要約
Type(English)	Outline

STUDY ON MEASUREMENT OF VARIOUS OXYGEN POTENTIALS USING SOLID ELECTROLYTE SENSOR FOR LIQUID LEAD-BISMUTH EUTECTIC

by

Pribadi Mumpuni Adhi

Supervised by

Professor Minoru Takahashi

Department of Nuclear Engineering

Graduate School of Science and Engineering

Tokyo Institute of Technology

March 2018

OUTLINE

Chapter 1 Introduction – This chapter presents the overview of the dissertation. The first part of this chapter mentioned the background about the utilization of liquid LBE in the nuclear energy field, the problems, and given the explanation of oxygen sensor for liquid LBE. The related studies are reviewed in details in this chapter. Finally, the purpose of present study is listed;

Chapter 2 Experimental apparatus and procedure – In this chapter, the detailed explanation of principle measurement of oxygen concentration using solid electrolyte oxygen sensor is given. The fabrication of oxygen sensor and experimental apparatus that used in this study is described. Methods to control oxygen potential in liquid LBE is also introduced. Finally, the electrochemical impedance spectroscopy (EIS) to measure the impedance of oxygen sensor is explained;

Chapter 3 Stabilization time of oxygen sensor in air environment – This chapter presents the experimental result of testing oxygen sensor with Fe/Fe_3O_4 and Bi/Bi_2O_3 reference electrode in an air environment. The stabilization time of each sensor was investigated by changing the volume of air inside the sensor compartment. The stabilization time can be made short by reducing the amount of residual air inside the sensor compartment. The result also shows that the oxygen sensor with Fe/Fe_3O_4 reference electrode has shorter stabilization time than the oxygen sensor with Bi/Bi_2O_3 reference electrode;

Chapter 4 Characterization of oxygen sensor for high, medium, and low oxygen potential in liquid LBE environment with oxide powders – This chapter presents the experimental result of testing oxygen sensor in various oxygen potential of LBE. The mass-exchanger method that has been explained in Chapter 2 is used to control the oxygen potential. The result showed that the oxygen sensor worked well in high and medium oxygen potential of liquid LBE. However, the result of cell potential measurement deviated in low oxygen potential;

Chapter 5 Characterization of oxygen sensor for low oxygen potential in liquid LBE environment using oxygen pump – This chapter is used to validate the experimental data in low oxygen potential since the result of Chapter 4 shows significance deviation from the theoretical calculation. Electrochemical oxygen pump (EOP) is introduced to reduce dissolved oxygen in liquid LBE. The result shows that the cell potential that obtained in this Chapter is nearly equal with the previous result in Chapter 4. The minimum oxygen partial pressure that can be measured in liquid LBE also obtained;

Chapter 6 Investigation on optimum material of reference electrode of oxygen sensor – This chapter presents the method to find optimum reference electrode material for the oxygen sensor in temperature 300 - 450°C. This low temperature has been proposed as working temperature for ADS. In this chapter, oxygen sensor with Bi/Bi_2O_3 and Ag/air reference electrode are compared. First, the accuracy of cell potential of each sensor is obtained. Then, by using electrochemical impedance spectroscopy (EIS), the impedance of each sensor is measured and analyzed. The result shows that Bi/Bi_2O_3 is better material than Ag/air for measurement in liquid LBE at temperature below 450°C;

Chapter 7 Conclusions – This chapter summarized overall conclusions obtained in this study.