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Quarterly Progress Report  
(May 01 – July 31, 2002)

Developing a Sensing System for the Measurement of Oxygen Concentration in Liquid Pb-Bi Eutectic

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Introduction

Accurate measurement of the oxygen concentration in liquid Lead-Bismuth Eutectic (LBE) cooling system is critical in the active control of the corrosion at the interface between LBE and the stainless steel of transport tubes. Currently, LANL (Los Alamos National Laboratory) scientists have employed an automobile-style YSZ (Yttria Stabilized Zirconia) oxygen sensor unit to measure oxygen levels in an engineering-scaled LBE test system. Although the theoretical model for calculating oxygen concentration based on voltage measurement of YSZ sensor in static conditions is well understood, there is an urgent and strong need to obtain a complete set of calibration curves for YSZ sensor systems under various temperature and flow conditions in LBE environment due to device and material imperfectness as well as the unwanted mobility of the electrons at high temperatures. This research project, therefore, is aimed at filling the gap of sensor calibration/validation and further developing new sensors for oxygen concentration measurement in a nuclear environment.

Personnel

Principal Investigators:
- Dr. Yingtao Jiang (Electrical and ComputerEngineering)
- Dr. Bingmei Fu and Dr. Woosoon Yim (Mechanical Engineering)

Students (Summer 2002):
- Mr. Xiaolong Wu, Graduate Student, (Mechanical Engineering)
- Mr. Jun Zheng, Graduate Student (Electrical and Computer Engineering)
- Mr. Ramkumar Bhavani Sivaraman (Electrical and Computer Engineering)
- Mr. Bin Chen, Graduate Student, (Mechanical Engineering)

Note:
One assistantship has been offered to a foreign student to join our team.

Management Progress

- Purchase of two complete computer systems (Gateway and Sony)
- Salary expenditures are on target.
- Expenditures incurred during this quarter are within the target amount allocated.

Management Problems

Mr. X. Wu and R. Sivaraman arrived in Las Alamos, New Mexico, on July 13, but it took much longer than we had anticipated for them to be cleared from the security check. This delayed their access to the LANL by about 10 days.
Technical Progress

- The faculty investigators and the students conducted literature survey related to the proposed work.
- The faculty investigators trained the graduate students with necessary skills useful in the lab work to be performed in Los Alamos.
- All team members, Drs. Yingtao Jiang, Bingmei Fu, Woonsoon Yim and the two graduate students, met with Dr. Ning Li from LANL on the May 8, 2002. All three faculty researchers visited LANL for research collaboration on July 15-16. In these meetings, the research work to be conducted in Las Alamos during the summer time was identified.
- The faculty investigators and Mr. Ramkumar studied the *Amperometric* method of oxygen measurement.
- The faculty investigators and Mr. Ramkumar did literature survey for the physical properties of LBE at required temperature ranges.
- Mr. Ramkumar was trained in LabView at the beginner’s level.

Plans for the Next Quarter

- We will train the newly hired graduate student to work for the project, when he arrives at UNLV.
- We will prepare to setup a testing system for the oxygen concentration measurement in UNLV. This system shall be accommodated in Dr. Y. Jiang’s lab located in TBE B311.
- We will continue to search new alternative sensing approach for the oxygen concentration measurement.
- We will search and evaluate candidate materials to be used in our sensor measurement system.