Abstract No: PO-15

Use of cuprous oxide thin film semiconductors for dissolved oxygen sensing: A preliminary study

H. E. Wijesooriya, J. A. Seneviratne, K. M. D. C. Jayathilaka and R. P. Wijesundera*

Department of Physics and Electronics, Faculty of Science, University of Kelaniya, Sri Lanka
palitha@kln.ac.lk*

Monitoring and maintaining the quality of water is extremely important as it can severely affect the health of humans as well as animals. Dissolved oxygen is one of the key indications of water quality. Cuprous Oxide (Cu_2O) semiconductor material is an ultra-low cost, environmentally friendly, earth abundant material which is considered as a green alternative to many sensing applications. Therefore, Cu_2O thin film semiconductors could potentially act as a dissolved oxygen sensor due to their unique electrical features. Generally, a significant change in the electrical conductivity is caused by the adsorption of molecules on the surface of Cu_2O semiconductor material. In this investigation, the possibility of sensing dissolved oxygen using Cu_2O thin film semiconductors was explored. Cu_2O thin films were grown using the electrodeposition technique on titanium (Ti) substrates at -200 mV vs Ag/AgCl for 60 minutes in an electrochemical cell containing an acetate bath of 0.1 M sodium acetate and 0.01 M cupric acetate. The temperature of the bath was maintained at 55 °C and stirred at a speed of 50 rev/min. The Ag/AgCl electrode was used as the reference electrode, while the platinum electrode was the counter electrode. Prepared Cu_2O thin films were characterized in two-electrode systems using resistance measurements at ambient conditions in two different Deionized (DI) water volumes of 100 ml and 200 ml while aerating oxygen at a constant rate at the room temperature. Significant linear change in resistance was observed with increasing dissolved oxygen concentration under ambient condition in both cases. In comparison with experiment carried out with 100 ml of DI water volume, it was observed that in 200 ml DI water volume it takes more than twice the time to saturate with oxygen. Furthermore, it was observed that the constant resistance value of the system at the saturation of 200 ml DI water volume was higher than the constant resistance obtained at the saturation of 100 ml DI water volume. This preliminary investigation revealed that Cu_2O thin films could use to monitor dissolved oxygen. However, further investigations need to be performed to optimize the dissolved oxygen sensing property of Cu_2O thin films.

Keywords: Cu_2O, Dissolved oxygen, Electrodeposition, Thin film semiconductor sensor, Water quality

Acknowledgment
This work was supported by the Accelerating Higher Education Expansion and Development (AHEAD) Operation of the Ministry of Higher Education of Sri Lanka funded by the World Bank under the research grant 6026-LK/8743-LK.