4.9 Dissolved oxygen microelectrode sensor — Robin Pascal

1. Introduction

A new dissolved oxygen sensor is being developed within OED. The sensor is based on a platinum microdisc (25 μm diameter) working electrode and a copper counter electrode. The advantage of this type of sensor compared to those commercially available is that it has the potential to have a very fast response time (fractions of a second) and should not suffer from hysteresis due to temperature and pressure effects.

To avoid signal fluctuations caused by water flow across the head, the electrode sits within a chamber through which water is pumped periodically. Oxygen measurements are made while there is no flow. Since the last trial of the sensor the electronics have been completely re designed and modifications made to the flow head arrangement. In addition a new pump was installed reducing the sensors current drain significantly, allowing the sensor to be powered directly from the CTD rather than using a battery pack. Earlier deployments had shown that the electrode potentials, which need to be setup precisely to measure oxygen, were being significantly shifted by the various metals on the CTD frame. It is hoped that the new electronics, designed so that it is completely isolated from the CTD and with digitally controlled timings and both analogue and RS232 connection, would demonstrate stable potentials when deployed.

2. CTD deployments

The sensor was installed on to the fin of the CTD frame at the start of the cruise. Initially results were not good and the sensor was unable to detect oxygen at all. The potentials were altered a number of times but without improvement. Eventually it was found that a low pass filter in the new electronics was causing problem. With the filter removed results were immediately better and the best results obtained when the potentials were returned to the design values, clearly demonstrating that the new sensor electronics isolation worked very well. In addition the sensor showed no shift in values when the CTD was stationary, as had been seen before, indicating that the new flow head arrangement was an improvement. One unexplained problem was that the sensor produced lower than expected oxygen values and that they increased with time during each cast, causing the up and down profiles to separate. The sensor was re configured from Cast 15528 to a 1.25 sec sampling rate with a cleaning cycle of 30 secs.

Appendix A. List of significant events.

Day 318: Oxygen sensor fixed to CTD Vane and connected directly to CTD including power for pump. Potentials set to Vmeas=-0.5v, Vclean=0.75v
Day 320: Oxygen sensor potentials set to Vmeas=-0.35v, Vclean=1.1v
Day 326: : Oxygen sensor potentials set to Vmeas=-0.434v, Vclean=1.004v
Day 330: : Oxygen sensor potentials set to Vmeas=-0.493v, Vclean=0.769v
Day 331: Flow chamber made bigger to ensure electrode not covered.
Day 334: Changed sampling rate to 1.25 seconds with a 30 sec cleaning pulse cycle.
Day 335: First CTD with new setting 15528
Day 336: Oxygen sensor deployed pointing downwards for casts 15538,15539
Day 337: Back in original position parallel to flow.
Day 339: Put 200micron gauze across input for cast 15546.
Day 340: Gauze off.