Geophysical Research Abstracts
Vol. 13, EGU2011-8919, 2011
EGU General Assembly 2011

Development of robust micro-colourimetric analysers for in situ detection and long term monitoring of trace metals in seawater.

Cedric F. A. Floquet (1), Ambra Milani (3), Vincent J. Sieben (1,2), Samer Abi Kaed Bey (1), Edward M. Waugh (1), Robin J. Brown (1), Lee R. Fowler (1), Peter J. Statham (3), Douglas P. Connelly (1), Hywel Morgan (2), Matthew C. Mowlem (1), and the MOMARSAT (Pourquoi pas?) science party Team

(1) National Oceanography Centre Southampton, Sensor Development, Southampton, United Kingdom (cfaf@noc.soton.ac.uk), (3) National Oceanography Centre, School of Ocean and Earth Science, University Of Southampton, Southampton, United Kingdom, (2) Nanoscale systems integration group, University Of Southampton, Southampton, United Kingdom

In-situ sensors are crucially important for understanding the physico-chemical processes that occur in the ocean environments. Trace elements are some of the key parameters that require long term observations. Trace metals such as Manganese and Iron are pumped into the deep ocean by hydrothermal vents. These species can be used as tracers to identify the location of these geochemically important sites. Availability of long term data sets of release of Mn and Fe2+ is limited and long term monitoring of these sites could provide valuable information on their stability.
The NOCS Iron and Manganese Sensors (IronManS) are a new low cost generation of in situ colorimetric chemical analysers developed in house, capable of measuring over a wide dynamic range (from 10 nM to 10 μM). They carry onboard standard to compensate for potential drift and validate in-situ measurements. IronManS relies on the colour development induced by the reaction between a reagent and the sample to analyse. The Ferrozine [1] and PAN [2] assays were chosen for measuring Fe2+ and dissolved Manganese respectively.
To enable long term measurements, the power and reagent consumption were minimised. A new microfluidic chip with built-in absorption cells was developed and validated [3-5]. The low internal volume of the microfluidic chip (<250μL) allows for very low reagent consumption (<25μL for each actuation). All fluids, including waste are stored in gas tight nutrition bags. The analyser is housed in an oil filled plastic container (pressure compensated design) and accommodates the fluidic and electronics aspects of the sensors. The device requires an average power of 3 W in measuring mode and 100 μW in sleeping mode to operate. The influence of pressure and temperature on the sensors was studied. The analyser was calibrated in a temperature controlled pressure chamber for conditions similar to those encountered during deployment. A limit of detection of 10-30 nM is reported for the iron assay.
A module composed of two analysers was integrated to the SEAMON EAST node deployed as part of the ESONET/MoMAR-D project near the Lucky Strike vents field. Recent results and fault findings are presented.

This study was supported by: the UK Natural Environment Research Council (NERC) through the Oceans 2025 core programme of the National Oceanography Centre, Southampton; by both NERC and the UK Engineering and Physical Sciences Research Council (EPSRC) through grant EP/E016774/1; by the European network of Excellence FP6-ESONET.

[1] L.L. Stookey, Analytical Chemistry, 42 (1970) 779-&.
[2] C.S. Chin, K.S. Johnson, K.H. Coale, Marine Chemistry, 37 (1992) 65-82.
[3] I.R.G. Ogilvie, V.J. Sieben, C.F.A. Floquet, R. Zmijan, M.C. Mowlem, H. Morgan, Journal of Micromechanics and Microengineering, 20 (2010) 065016.
[4] V.J. Sieben, C.F.A. Floquet, I.R.G. Ogilvie, M.C. Mowlem, H. Morgan, Analytical Methods, 2 (2010) 484-491.
[5] C.F.A. Floquet, V.J. Sieben, A. Milani, E.P. Joly, I.R.G. Ogilvie, H. Morgan, M.C. Mowlem, Talanta, In Press, Accepted Manuscript.