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Development of a colorimetric micro-sensor for seawater pH analysis: microfluidic design and oceanic deployment

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Ocean acidification is a serious cause of concern for the marine ecosystems as well as for the ocean's capacity to absorb atmospheric CO_2. Accurate and precise autonomous *in situ* pH sensors deployed on remote platforms are required to study the changes in the ocean's carbonate system and their consequences.

The aim of our project is to develop a low cost miniaturized pH system for *in situ* long-term deployment. The system is based on the spectrophotometric approach. A simple micro-fluidic design integrated in a shipboard instrument with low power and reagent consumption is presented as a key step toward the targeted micro-sensor. A robust optical set up is achieved with the use of a custom-made polymeric flow cell coupled to a three wavelength LED. The measurement is made close to *in situ* temperature (+0.2 ˚C) in the sampling chamber which has a continuous flow of the ship's underway seawater supply.

The system features a short term precision of 0.0008 pH unit (n=20) and an accuracy within the range of a certified Tris buffer (0.004 pH units). The pH sensor has been deployed on RRS *Discovery* cruises D366 as part of the UK Ocean Acidification Research Program and D368 as a contribution to GO-SHIP sustained hydrography program. The automated pH system was operated continuously for a period of two months on an underway seawater supply.

Technical details of the sensor with an emphasis on the microfluidic design are presented here as well as the pH data obtained during the cruises D366 and D368.