



## **Next generation in-situ optical Raman sensor for seawater investigations**

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We introduce the next generation of optical sensors based on a combination of surfaced enhanced Raman scattering (SERS) and shifted excitation Raman difference spectroscopy (SERDS) suited for investigations of tiny concentrations of pollutions in the seawater. First field measurements were carried out in the Arctic area which is of global interest since it is more affected by global warming caused climatic changes than any other areas of our planet and it is a recipient for many toxic organic pollutants. A significant long-range atmospheric transport of pollutants to Svalbard is mainly originated from industrialized countries in Europe and North America during the last decades. Therefore, the main interest is to investigate the Arctic water column and also the sediments. Standard chemical methods for water/sediment analysis are extremely accurate but complex and time-consuming. The primary objective of our study was to develop a fast response in-situ optical sensor for easy to use and quick analysis. The system comprises several components: a handheld measurement head containing a 671 nm microsystem diode laser and the Raman optical bench, a laser driver electronics board, a custom-designed miniature spectrometer with an optical resolution of 8 cm<sup>-1</sup> and a netbook to control the spectrometer as well as for data evaluation.

We introduced for the first time the portable Raman sensor system on an Arctic sea-trial during a three week cruise on board of the James Clark Ross research vessel in August 2011. Numerous Raman and SERS measurements followed by SERDS evaluations were taken around locations 78° N and 9° E. Different SERS substrates developed for SERS measurements in sea-water were tested for their capability to detect different substances (PAHs) in the water down to very small (nmol/l) concentrations. Stability tests of the substrates were carried out also for the applicability of our system e.g. on a mooring.

Details of the in-situ Raman sensor were presented together with the measurements results from the Arctic area.