Simultaneous Measurements of Dissolved Inorganic Carbon, pH, and CO₂ Fugacity in Seawater

Researchers at the University of South Florida have designed a new device with an operating software for measuring carbon dioxide in all forms. The device can also measure the pH and volatility of carbon dioxide within a solution.

Carbon dioxide is the most significant long-lived greenhouse gas in Earth's atmosphere. Furthermore, emissions have rapidly increased over the last two centuries, increasing its concentration in the atmosphere and causing ocean acidification. Consequently, there is a need for a system that can sense CO₂ changes in both freshwater and seawater. The capability to simultaneously and autonomously measure three CO₂ system parameters will greatly increase the efficiency and the temporal resolution of global CO₂ system measurements.

Our inventors have designed a spectrophotometer-based system which unifies measurements of different CO₂ parameters. The system can measure multiple parameters at relatively low costs. The device includes software and a Multi-parameter Spectrophotometric Elemental Analysis System (M-SEAS). The MSEAS has 3 main components consisting of a graphical user interface (GUI), an M-SEAS spectrophotometric unit, and the Device Control. The GUI enables the user to control the M-SEAS and monitor autonomous operation. It also transmits commands to the M-SEAS unit. The device control software system receives commands from M-SEAS and returns the battery voltage, salinity, seawater temperature, and depth data.

This technology allows for frequent autonomous measurement of CO₂ and multiple additional parameters, in seawater in real time.

ADVANTAGES:
- High sensitivity and stability
- Multiple CO₂ parameters measured
- Suitable for seawater and freshwater
- Efficient device and control software

A System To Measure Multiple CO₂ Parameters Simultaneously

Illustrating the Main Components of M-SEAS (top) and the equilibrium/optical cell (bottom)