Strategy for detection and monitoring of stored CO2 leakage from seafloor

Kiminori Shitashima[1]

[1] CRIEPI

CO2 storage into the ocean and/or the seabed geological formations has being studied as one of possible options to limit the accumulation of anthropogenic CO2 into the atmosphere. To investigate the validity of CO2 storage into the sub-seafloor, development of detection and monitoring techniques of leaked CO2 from seafloor is important.

In-situ pH/pCO2 sensor is high precision in-situ measurement technology of pH and pCO2 in seawater. The pH sensor used an ion sensitive field effect transistor (ISFET) for the pH electrode and a chlorine ion selective electrode (Cl-ISE) for the reference electrode. For the pCO2 sensor, the pH sensor was sealed with a gas permeable membrane filled with the inner solution. This sensor can detect the changes of pH and pCO2 derived from leaked CO2 precisely and rapidly. Towing multi-layer monitoring system is diffusion behavior observation technology in mid-depth of the ocean. This system can observe the diffusion behavior of leaked CO2 by towing several in-situ sensors and transponders in the CO2 leakage area. Automatic elevator is time-series observation technology of diffusion behavior. This equipment can observe diffusion behavior of leaked CO2 in Eulerian method by going up and down the buoy which installed the in-situ pH/pCO2 sensor and depth sensor. Bottom-installed acoustic tomography is detection technology for emission of liquid CO2 and/or CO2 gas bubble from seafloor. Several sensors installed AUV was applied for automatic detection and monitoring of CO2 leakage from seafloor. The performance of these technologies was confirmed by natural analogue in seafloor hydrothermal systems.

Detection and monitoring of leaked CO2 from seafloor are performed as follows. Step 1: monitoring of CO2 leakage by bottom-installed acoustic tomography. Step 2: mapping survey of leakage point by pH/pCO2 sensor installed AUV. Step 3: observation of impact area by ROV, automatic elevator or towing multi-layer monitoring system.