

CO₂ Capture and Fixation Technology Utilizing a Seabed Ground Improvement System

CO₂ Fixation Technology Using the Cement Deep Mixing Method

Deep mixing (CDM) is a method of improving soft ground by stirring and mixing cement slurry with soft ground on the seabed in situ by a large working vessel and chemically solidifying it.

We are developing technology to recover part of the CO₂ emitted from the power generation engine of the deep mixing processing vessel, feed it to cement slurry, and fix it in the ground as an improved body.

Development of Supply and Fixation of Carbon Dioxide

● Form of CO₂ Supply

The following methods are assumed for supplying CO₂.

- ① Gas (2) Liquefied carbon dioxide (3) Solid (dry ice)

● CO₂ supply locations

The following CO₂ injection points are being examined for the CDM method:

- ① Injection into cement slurry inside mixers or agitators
- ② Injection into cement slurry transfer pipelines
- ③ Injection directly into the improved ground

● Evaluation method of carbon dioxide fixation

A gas pressure quantification method was established as a simple and rapid on-site analytical technique for measuring CO₂ fixation.

● Experimental Study on CO₂ Injection and Fixation in Cement Slurry

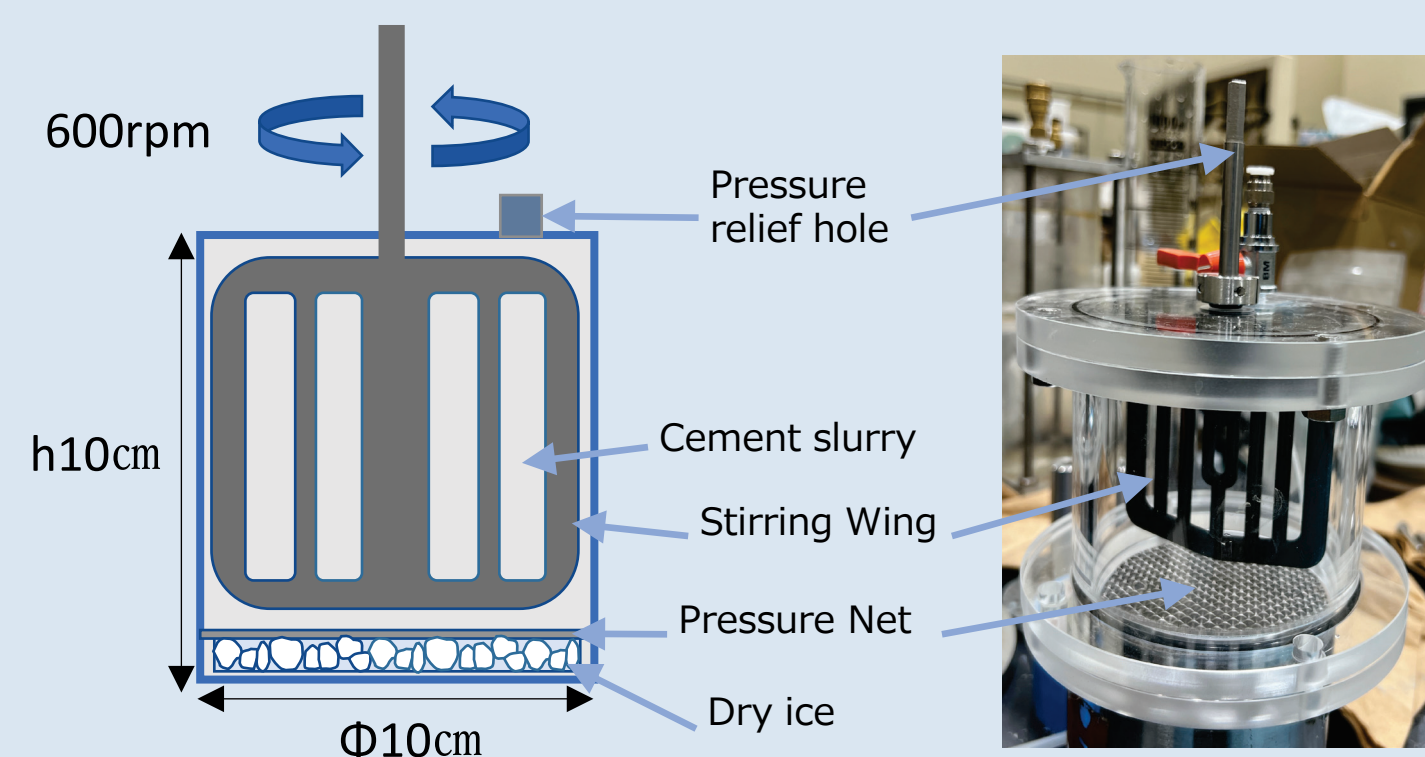
Laboratory-scale and full-scale experiments were conducted on CO₂ injection and fixation in cement slurry using dry ice, assuming application at the agitator section. The following findings were confirmed: An optimum CO₂ injection amount exists for effective CO₂ fixation. CO₂ supplied to the cement slurry was confirmed to be fixed within the improved ground.

■ CO₂ supply and fixation to cement slurry Laboratory experiment

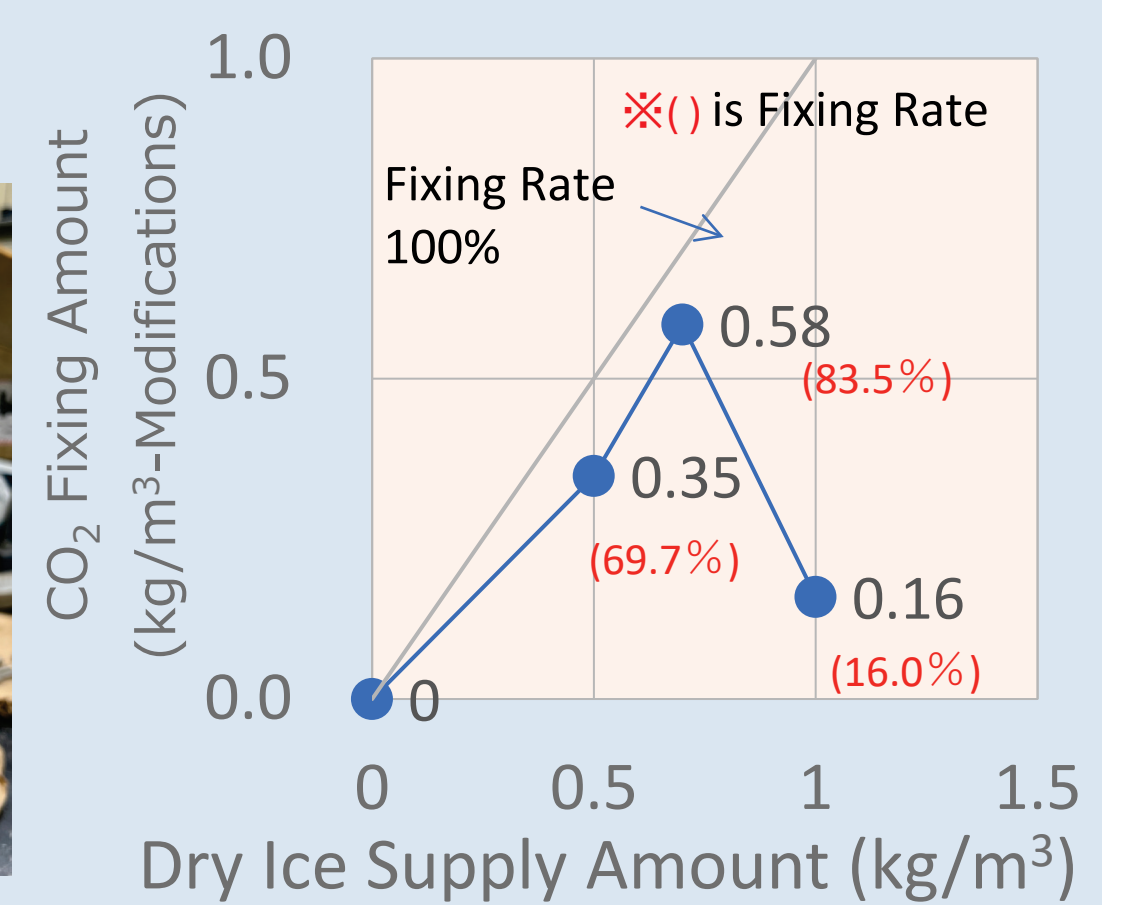
Laboratory Experiment Case

Case Name	BL	DI 0.5	DI 0.7	DI 1.0
Amount of dry ice added (kg/m ³)	-	0.5	0.7	1.0
CO ₂ Fixation amount (kg/m ³)	-	0.35	0.58	0.16
CO ₂ Fixation Rate(%)	-	69.7	83.5	16.0

BL : CO₂Non-feeding blank
DI : Dry ice supply case



Small Model of Agitator



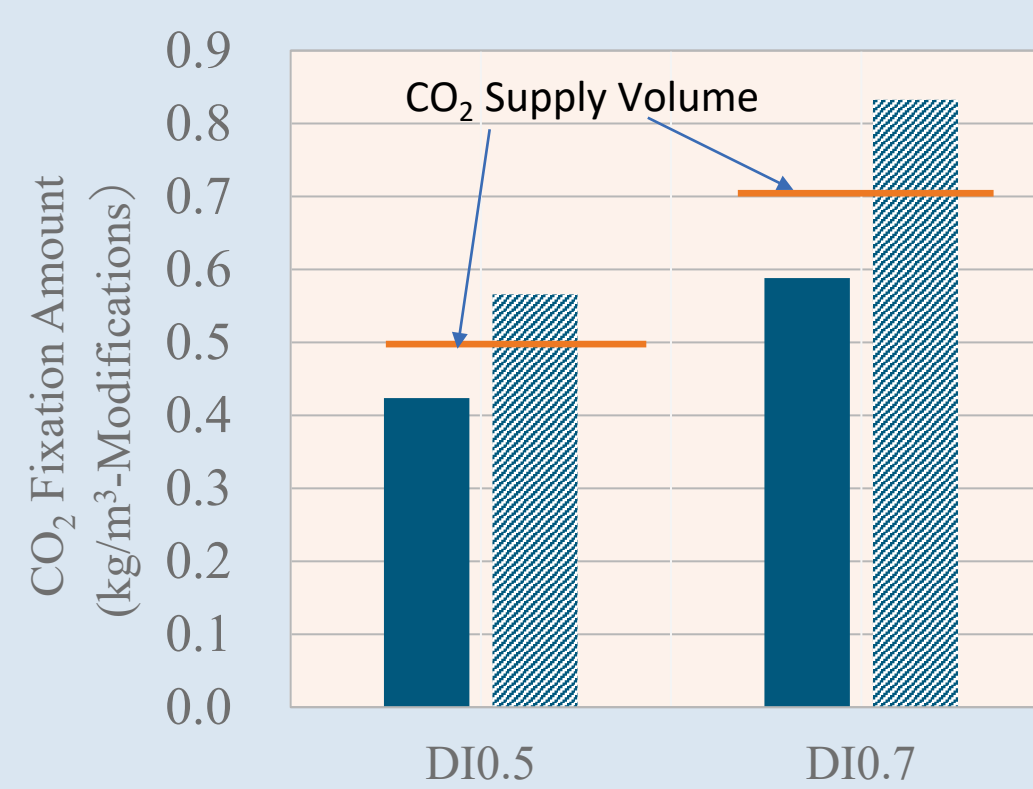
CO₂ Fixation in Cement Slurry

■ CO₂ supply and fixation of cement slurries Field-scale experiments

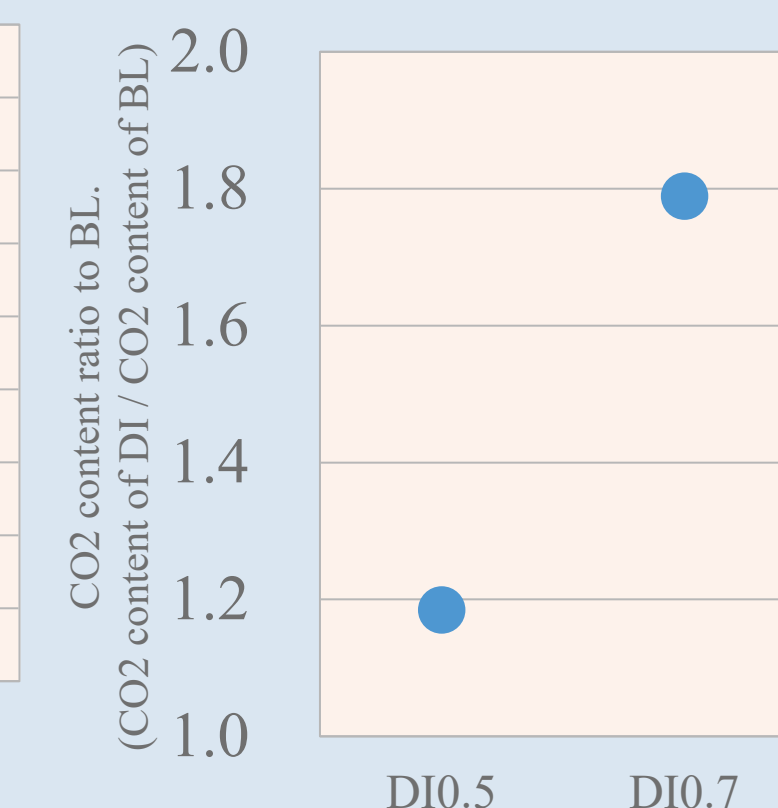
Real-scale experimental case

Case Name	DI 0.5	DI 0.7
Gas pressure quantitation method (kg/m ³)	0.42	0.59
TC Analysis (kg/m ³)	0.57	0.89

BL : CO₂Non-feeding blank
DI : Dry ice supply case



CO₂ fixation per 1m³ of slurry



Measurement results of the CO₂ content of the improved product



Ground Improvement Using the CDM Method