

GEOPOLYMER Concrete for Resilient Coastal Protection Structures



総合建設コンサルタント

土木地質株式会社

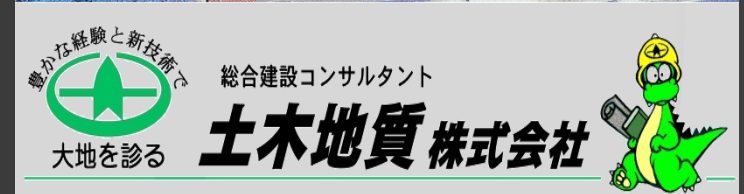


DobokuChishitsu Co., Ltd.

Dr. Masahiro Okabayashi

Company Overview

- Corporate Name : DobokuChishitsu Co.,Ltd.
- CEO : Takeshi Hashimoto
- Business Category : Construction Consultant
- Address : Sendai, Miyagi, Japan
- Establishment : June 13,1973
- Employees : 22
- Share Capital: 40 million Yen
- Business Activities
 - Geotechnical Investigation,
 - Geological Survey,
 - Groundwater Survey,
 - Environment Protection, Disaster Prevention
 - Soil Testing, R&D

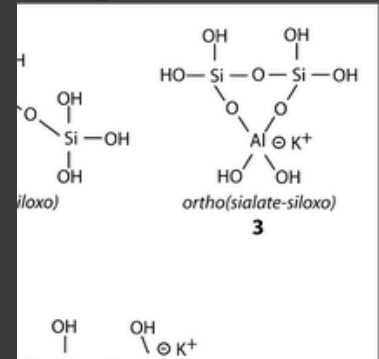


What is Geopolymer ?

Alternative to Portland Cement (PC)

PC : Ionic bond of Calcium Silicate Hydrate (C-S-H)

Geopolymer : Covalent bond, polycondensation of silicates or alumino-silicates.



Reduce CO₂ emissions

- The production of Portland cement emits large amount of CO₂ (*) in combustion and calcination of limestone (CaCO₃). (* 700-800 kg-CO₂ per ton of cement production.)
- In geopolymer production, CO₂ emissions are less than one-fifth of cement production because there is no calcination process.

Hexavalent Chromium (Cr(VI)) Free

- Hexavalent chromium is generated while combustion and calcination of limestone. When using Portland cement as a soil stabilizer for ground improvement, there is a risk of soil pollution problem by hexavalent chromium elution.
- It is safe using geopolymer as a soil stabilizer because it contains no hexavalent chromium.

Acid Resistant Concrete

While Portland cement concrete is erosive to acids, geopolymer concrete is resistant to acids.

Development History of GEOPOLYMER Binder at DobokuChishitsu Co., Ltd.

- ◎ “Yohgas”



Mixture of ground granulated blast furnace slags and sodium silicate solution (“water glass”), developed in 1998.

- ◎ “Haidegas”



A product that uses powdered alkaline material instead of sodium silicate solution used in Yohgas to improve workability. Patented in 2006.

- ◎ “Earth Silica”



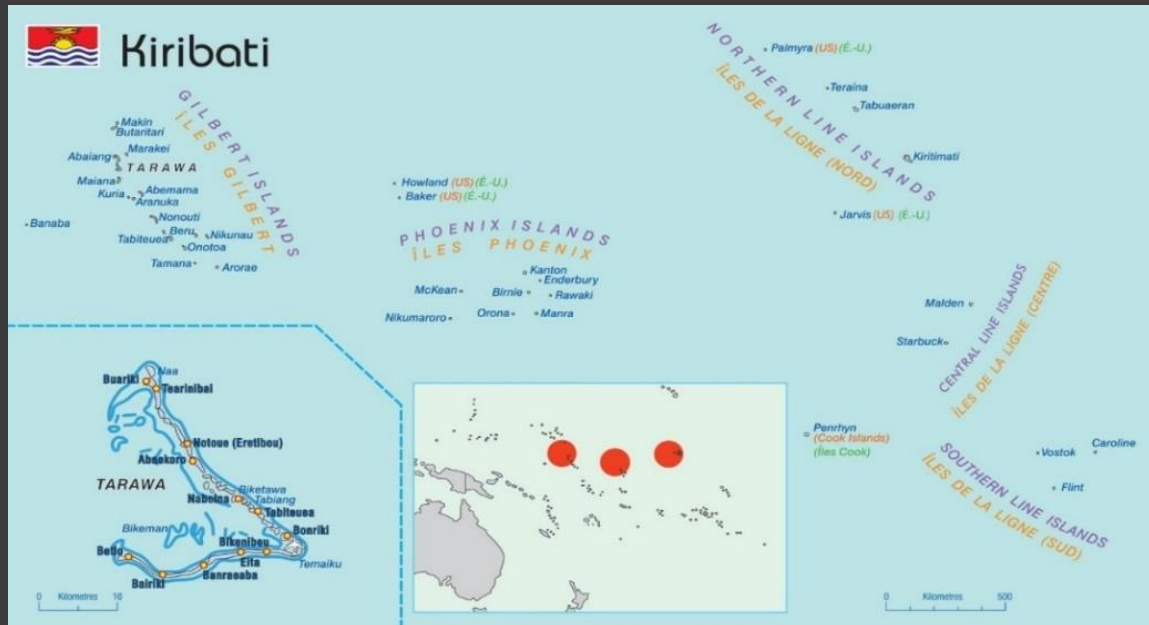
Developed for soil stabilization material for ground improvement based on Haidegas, in collaboration with Geotechnical Engineering Laboratory, Shibaura Institute of Technology. Patented in 2021.

At the island countries whose living environment is threatened by climate change

Seawater–Mixable Concrete

JICA Feasibility Survey with the Private Sector for Utilizing Japanese Technologies in ODA Projects 2016

— Feasibility Survey for an Application of Hydraulic Solidifying binder “Haidegas” to Climate Change Adaptation in Kiribati —



Republic of Kiribati in the Pacific Ocean

Seawater-Mixable Concrete

Climate Change

- sea level rise
- high tide
- Cyclone



Geopolymer Concrete

- mixable with seawater
 - high durability
- feasibility study on seawall restoration

Seawall erosion

Narrow roadway on the coral reef. Demonstration for residents.



Acid Resistant Concrete

Zao Onsen Hot Spring, Yamagata, Japan.
Strong Acid Hot Spring Water River.

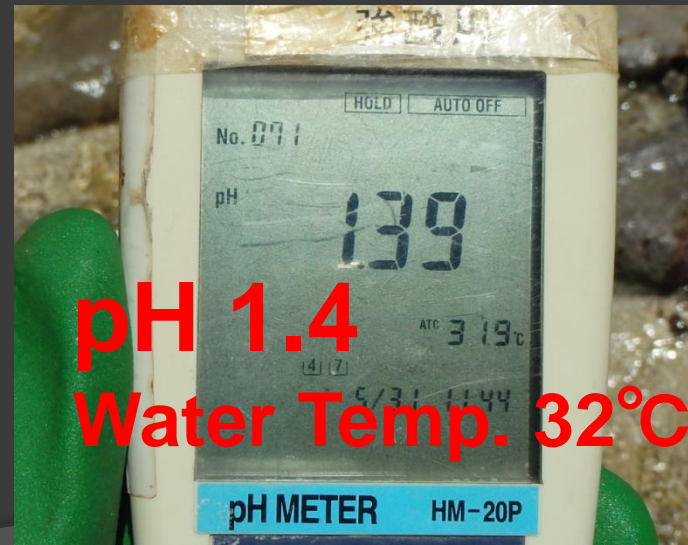
⇐ under construction
Streambed Protection



⇐ In Use



Left : PC Right : Geopolymer
Laboratory Experiment,
Soaked in 5% Sulfuric Acid
21 weeks



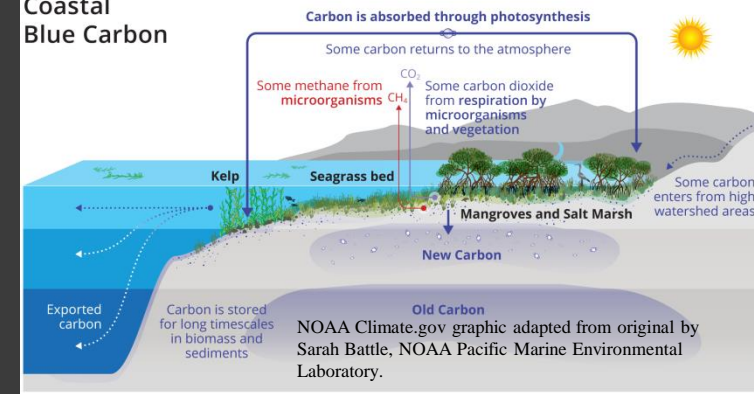
pH 1.4
Water Temp. 32°C

Petroleum was created by marine ecosystems 100 million years ago.

BLUE CARBON



Coastal Blue Carbon



Blue Carbon :

Biologically driven carbon fluxes and storage in marine systems (seagrasses, tidal marshes, mangroves etc.)

“Rocky-shore denudation” (*sea desert*) has become a global environmental problem.

Japan Ministry of Land, Infrastructure, Transport and Tourism conducted

“Blue Infrastructure Expansion Project for Ports that Foster Life”

The Resources Environment Consortium

(School of Food Industrial Sciences, Miyagi University, Professor Masafumi KITATSUJI *et al.*) participated in the project.

At Sakata Port, Yamagata Prefecture, Blue Infrastructures Demonstration Experiments have held in October 2023.

A fish reef made of geopolymer concrete using “Earth Silica” as binder instead of Portland cement was installed.

● Please **try** to use

"Earth Silica"

the Geopolymer from

DobokuChishitsu Co., Ltd.

Thank You