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Press Release

From Decarbonization to “Utilized Carbon”: Launching Joint Research Into Next-Generation Concrete Technologies

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Kajima Corporation (President: Hiromasa Amano, "Kajima," hereafter), Takenaka Corporation (President: Masato Sasaki, "Takenaka," hereafter) and Denka Company Limited (President: Toshio Imai; "Denka," hereafter) have agreed to jointly research techniques to create carbon-negative concrete[*1] by combining the three companies' technologies.

With efforts to achieve carbon neutrality by 2050 picking up speed around the world, reducing CO_2 emissions has become an urgent domestic issue. Cutting CO_2 emissions is also a pressing challenge for the construction sector. Concrete is widely used in the sector as a construction material, and since the concrete manufacturing process generates significant CO_2 emissions, reducing those emissions would have a tremendous effect.

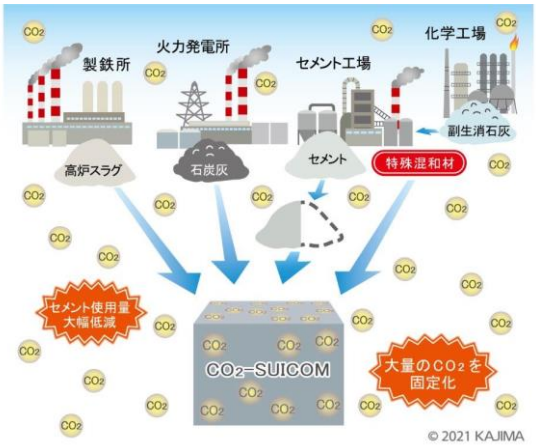
The joint research aims to create and promote the full-scale adoption of a higher level general-purpose carbon-negative concrete by utilizing CO_2-absorbing concrete and CO_2-absorbed concrete materials based on concrete that significantly reduces CO_2 emissions.

For the concrete that significantly reduces CO_2 emissions, Takenaka, Kajima and others have jointly developed ECM (Energy - CO2 Minimum), which can cut CO_2 emissions by sixty percent. As a concrete that absorbs CO_2, Kajima and Denka were part of a group that developed CO_2-SUICOM, the world’s only CO_2 absorbing concrete that has been put to practical use. Meanwhile CCU material[*2] technology, currently under development by Takenaka, will be utilized as a CO_2-absorbed concrete material. Also note that the LEAF carbonating admixture developed by Denka is utilized as a key material in CO_2-SUICOM.

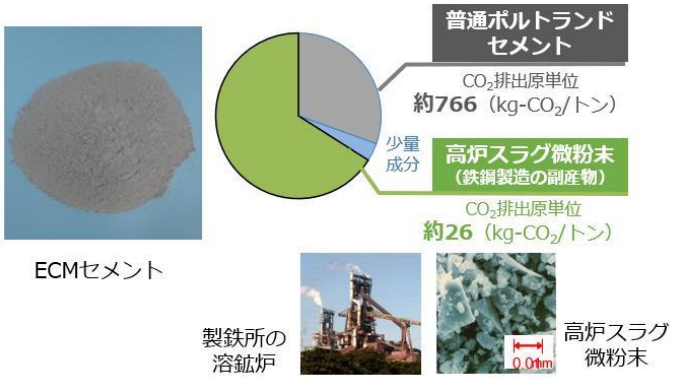
By combining and developing these three technologies, the companies will develop carbon-negative concrete to a level that could not be achieved through any one technology alone, evolving the combination into an innovative technology.

This joint research represents a shift from decarbonization to “utilized carbon”, giving a new shape to the concrete that is an essential building block of the construction sector and creating a concrete of the future that helps reduce CO_2 emissions the more it is used.

*1: Carbon-negative concrete: A type of concrete that absorbs more CO_2 than the CO_2 emissions produced during its manufacturing.
*2: CCU: The acronym for Carbon Capture and Utilization



Conceptual diagram of CO_2-SUICOM



Materials contained in ECM cement

セメント工場	Cement plant
セメント	Cement
特殊混和材	Special admixture
化学工場	Chemical plant
副生消石灰	By-product calcium hydroxide
大量のCO_2を固定化	Fixing large amounts of CO_2
セメント使用量大幅低減	Significantly reduce cement usage
普通ポルトランドセメント	Ordinary portland cement
CO_2排出原単位	CO_2 emissions per production unit
約766（kg-CO_2/トン）	Approx. 766 (kg-CO_2 / ton)
少量成分	Small quantity ingredients
高炉スラグ微粉末	Ground granulated blast-furnace slag
（鉄鋼製造の副産物）	(By-product of steel manufacturing)
CO2 排出原単位	CO2 emissions per production unit
約26（kg-CO_2/トン）	Approx. 26 (kg-CO_2 / ton)
高炉スラグ微粉末	Ground granulated blast-furnace slag
製鉄所の溶鉱炉	Steel mill blast furnace
ECM セメント	ECM cement

<Reference>

■ Features of ECM https://www.takenaka.co.jp/solution/environment/ecm/

- By using ECM cement, which replaces 60-70% of cement with ground granulated blast-furnace slag, a by-product of steel manufacturing, concrete CO_2 emissions can be reduced by 60 percent.
- In addition to significantly cutting CO_2 emissions, this reduces the drying shrinkage that causes cracking and improves resistance to deterioration from acids and salts, striking a balance between high quality and high durability.

■ Features of CO_2-SUICOM https://www.kajima.co.jp/tech/c_eco/co2/index.html#!body_02

- More than half of the cement is replaced with LEAF, the carbonating admixture developed by Denka which uses by-products as a raw ingredients, and other industrial by-products such as ground granulated blast-furnace slag. In addition, by fixing large amounts of CO2 in the concrete during the manufacturing process, CO_2 emissions from manufacturing are effectively reduced to zero or lower. In other words, this is the world's first concrete that is able to reduce the amount of CO_2 in the atmosphere.
- The current CO_2-SUICOM product can reduce 18 kg of CO_2 in the atmosphere per $1m^3$.

■ Features of LEAF

LEAF is a carbonating admixture composed mainly of calcium and silica. It actively reacts with CO_2 to produce chemically stable calcium carbonate. In addition, the carbonation reaction promotes structural densification when mixed with cement or concrete, increasing strength and durability.

■ CCU Materials https://www.nedo.go.jp/news/press/AA5_101332.html

- CCU Materials are powders and granules that contain large amounts of calcium carbonate. They are being developed as part of research being conducted by Takenaka into CO_2 fixing processes utilizing cement waste materials and technologies to utilize by-products in the construction sector as part of a project promoted by the New Energy and Industrial Technology Development Organization (NEDO).

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