

DENKA CSA#20

Shrinkage-Reducing and Compensating Additive

Description

DENKA CSA#20 is a shrinkage-reducing high-performance additive made with calcium sulfoaluminate consisting mainly of limestone, gypsum and bauxite mixed proportionally.

Hauyne



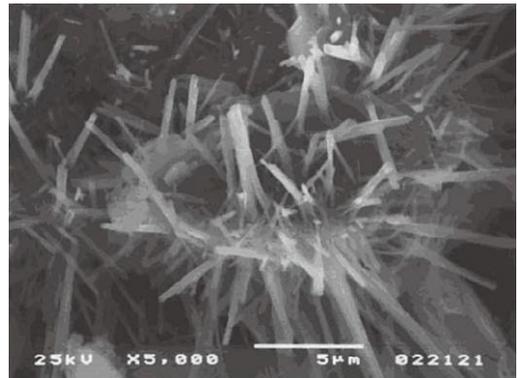
Free lime



Gypsum



With the above mineral composition, ettringite formation due to hydration reactions (refer to the following page for reaction pathways) are achieved. Miniscule micron-sized crystals are formed during the cement hardening process (in the colloidal state) within the fine spaces of the gel matrix. Gel hardening shrinkage as well as thermal shrinkage is mitigated; with expansion occurring as well. IT should be noted that the type of expansion here is that of expansion deformation associated with strength development. This is fundamentally different from the type of expansion that occurs prior to strength development; for example, gas evolution from alumina powder, or due to volume increase caused by quicklime hydration.



As such, for concrete incorporating **Denka CSA#20**, a denser structure afforded by ettringite formation can be achieved; mitigating drying shrinkage as well as introducing chemical compressive prestress to concrete structures that are restrained (expansion restraint).

Due to the above performance of **Denka CSA#20**, in addition to mitigating concrete cracking due to shrinkage, the water-tightness of concrete structures themselves is increased.

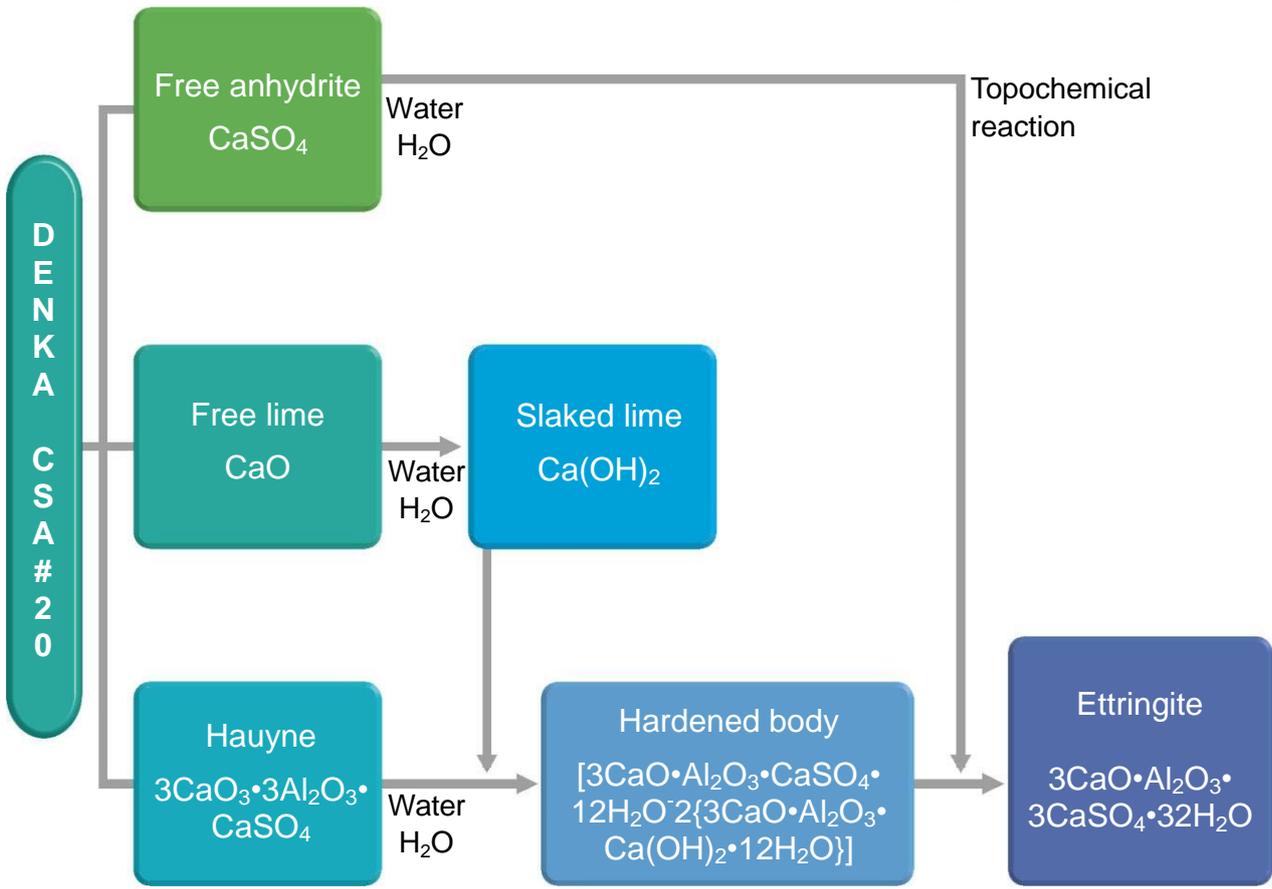
Features

- Drying shrinkage mitigation
 - By means of hydration reactions of **Denka CSA#20**, ettringite is formed. Spaces within the concrete matrix are reduced; mitigating drying shrinkage as well as increasing water-tightness.
- Expansion
 - Ettringite crystal formation introduces expansion to concrete. The expansion is restrained by rebar or existing structures, introducing compressive strength (chemical prestress) to concrete; increasing the resistance of concrete to cracking. Strength is also improved with restrained expansion.

Chemical Composition and Reaction Pathway

Type	lg-loss (%)	Insol (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	MgO (%)	SO ₃ (%)	CaO (%)	f-CaO	Alkali content			Cl (%)
										Na ₂ O	K ₂ O	Na ₂ O _{eq}	
CSA#20	≤3	0.2~2.0	1.0~2.0	12.0~25.0	0.3~0.8	0.4~2.3	27.0~31.0	50.0~53.6	17.5~22.9	-	-	≤0.75	≤0.05

Ettringite Reaction Pathway



Applications

- Precast concrete products (hume pipes, box culverts, sheet piles)
- Steel pipe/cast iron linings



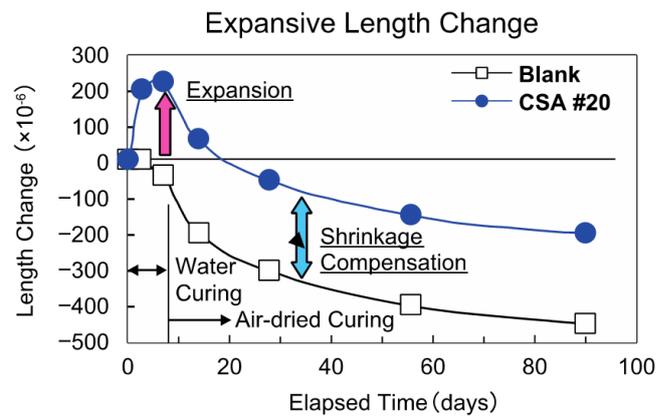
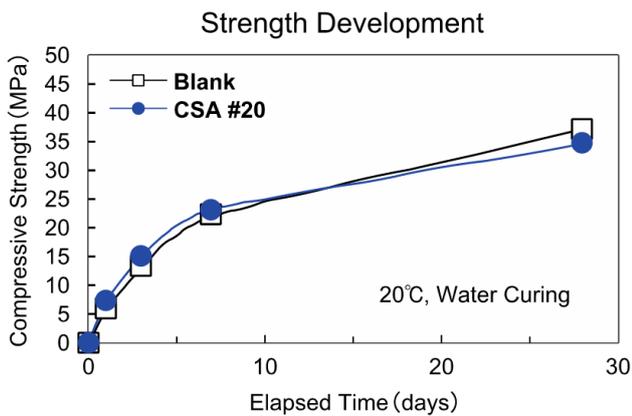
Packaging

- 25kg paper bags
- 1000kg bulk bags

Shelf Life

- 12 months from production date
- Determine the production date by reference to the lot number. A lot number of “1AXXX” corresponds to production in Jan 2001; “2BXXX” to Feb 2002 and so on.

Technical Information (Arbitrary Values)



Concrete Mix Proportions	
Ordinary Portland Cement	295kg/m ³
CSA#20*	25kg/m ³
W/(cement+ CSA#20)	50.0%
Sand-Aggregate ratio	44.6%

*Typical Mix Proportion: 10~15% by cement weight

Handling Precautions

- Refer to the Safety Data Sheet (SDS) before use.

Mix design calculations and mixing considerations

- Although **Denka CSA#20** is not cement, treat **Denka CSA#20** as though it were cement when calculating concrete/mortar mix proportions.
- During concrete mixing, charge cement and **Denka CSA#20** at the same time into the mixer. Take special care to avoid any delay. Perform mixing for the specified time after the material is completely charged. Also, avoid mixing by hand. If the mixing is not done thoroughly, localized expansion may occur causing pop-out.

Curing, restraint

- If excessive expansion additives are used, or rebar restraint is not present (free expansion), there may be cases where concrete strength is decreased.
- Use a stainless steel or iron agitating blade. Do not use an aluminum blade because hydrogen gas evolution can occur while mixing the mortar; resulting in explosions.
- Mix grout with the specified quantity of water. Using quantities outside the specified range may affect the performance of the non-shrink mortar.
- Use clean water free from oils, salts, or organic compounds.
- Before beginning injection work, optimize water quantity in mixing trials and remove oily residues, laitance, and mud from the surface of structures.
- Wear protective gear (goggles, mask, gloves, and rubber boots) while handling the product. Do not dispose of the product in drains.
- As the product is more hygroscopic than standard cement, as much as possible, it should be stored in a dry area, indoors, and out of direct sunlight. Once opened, the product should be used up completely.
- For further information, please contact DENKA.

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