

Creating Stronger, More Durable Concrete



ICT Flexisil™ Colloidal Silica Creating Stronger and More Durable Concrete	
Flexisil colloidal silica is a highly stable, water-based, nano silica particle with the highest reactivity in concrete.	
Flexisil colloidal silica reacts with calcium hydroxide to form Calcium Silica Hydrate (C-S-H).	
Features	Benefits
Increases the amount of Calcium Silica Hydrate (C-S-H) bonds	Flexisil increases the ultimate strength of concrete due to the higher amount of C-S-H bonds formed.
Reduce the amount of cement usage	Achieve the same or higher degree of ultimate concrete strength Reduce total concrete cost due to lower cement dosage
Nanoparticle size (2 - 50 nm)	High penetration into seals holes & pores, reducing concrete permeability Increases density and compression strength Blocks water penetration and water-related damage Minimizes chemical attack, such as salts containing chloride ions (Cl) or acid rain Denser, harder, and thicker surface layer for wear & tear resistance
Higher early strength due to early formation of C-S-H by higher reactivity	Improve 28-day compression strength Shorten construction time
Higher surface density	Higher wear strength Durable and longer service life Reduces concrete efflorescence
Reacts with residual Ca(OH) ₂	Prevents corrosion by carbonic acid (CO ₂) and sulfate (SO ₃)
Reduces porosity in concrete and surface water penetration	Prevents corrosion of steel bars due to water attack
Reduces the amount of entrapped air and air bubble size inside the concrete	Inhibits the formation of ASR
	Improves the freeze/thaw stability of concrete
	Minimizes cracking
	Extends concrete life
High resistance to environmental attacks	Minimizes adverse effects of Carbon dioxide, Chlorites, acids, and sulfates
Environmentally Friendly	Water-based, Neutral pH, Non-hazardous

Flexisil Colloidal Silica Portfolio:

- Wide range of sodium stabilized particles ranging from 2-50 nm
- Silane surface-modified products available for best chemical compatibility, but slower reaction rates
- Aluminum (Al) surface-modified products available for slightly better compatibility in some applications

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APPLICATION GUIDE

Ensure homogeneous dispersion of Flexisil colloidal silica in the concrete matrix before the cement hydration starts. To apply **colloidal silica into concrete for strength improvement**, one can use it either as an **integral admixture** or a **surface densifier**. For **strength enhancement**, the **integral method** (mixing into fresh concrete) is the most effective.

1. Integral Mixing (Best for Strength Improvement)

◇ Step-by-Step Application:

1. **Select the right colloidal silica**
 - Use **concrete-grade**, amorphous, nano-sized colloidal silica (particle size ~5–50 nm)
 - Solid content of colloidal silica product typically is between 15–40%
2. **Determine dosage**
 - Typical: **2–10% by weight of cement**
 - For most strength gain: **4–7% bwoc (by weight of cement)** is common
 - Higher dosages may increase viscosity; trial batching is advised
3. **Mixing sequence**
 - Add colloidal silica **as part of the mix water** or **after initial wetting** of cement
 - Ensure it's well-dispersed using standard mixing equipment
 - Maintain proper **mixing time** (usually 3–5 minutes longer if added separately)
4. **Admixture compatibility**
 - Colloidal silica is generally compatible with:
 - Superplasticizers (especially PCE-based)
 - Air-entraining agents (check compatibility)
 - SCMs like fly ash, slag, or silica fume
 - Avoid overdosing high-range water reducers that may lead to segregation
5. **Adjust water-to-binder ratio if needed**
 - Colloidal silica slightly **increases water demand** due to high surface area
 - Target **w/b ratio ≤ 0.45** for optimal strength and durability
6. **Curing**
 - Follow **standard moist curing** practices (at least 7 days for strength gain)
 - C-S-H formed by colloidal silica continues to densify over weeks

◇ Expected Strength Gains

Property	Improvement
Compressive strength (7/28 days)	+10 to 30% (depends on mix)
Early strength (1–3 days)	Strong improvement for fast-track use
Flexural strength	Moderate improvement due to matrix densification

2. Topical Application (Surface Densifier – Not for Full-Depth Strength)

Used mainly for **surface hardening**, **polished concrete**, or **dust-proofing**. It slightly enhances surface strength but **not structural strength**.

◇ Step-by-Step Application:

- Apply to **hardened concrete** via spray or broom
- Allow to soak in, then scrub or squeegee off excess
- May require multiple coats for maximum effect

🔑 Pro Tips

- Always do **lab trials or trial batches** before large-scale pours
- Colloidal silica works **synergistically** with supplementary cementitious materials (SCMs) like **fly ash** or **slag**
- Store at room temperature to prevent agglomeration or gelling
- Avoid exposure to freezing temperatures in storage or application

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