

Future Global Development of Concrete Embraces 'Green, Smart, and Circular' as Three Core Directions

Green, smart, circular future concrete: low-carbon binders, self-healing tech, AI construction. Cabr-Concrete by TRUNNANO leads lightweight admixtures.

LUOYANG, HENAN, CHINA, August 26, 2026 /EINPresswire.com/ -- The latest updates from international research institutions, top universities, and industry conferences indicate that the global [concrete](#) industry is at a critical turning point. Driven by dual carbon goals and digital technologies, the future direction of concrete development has clearly converged on low-carbonization, high performance, and intelligentization, and is rapidly moving from laboratories to commercial applications.

Simplified Summary Table of Three Core Directions

Direction	Key Technology	Core Benefit
Green Revolution	Low-carbon binders (GPC, steel slag-based), CO ₂ -cured concrete	Carbon footprint reduced by up to 90%
High Performance & Self-Healing	Biomimetic additives, microbial healing, UHPC	Lifespan extended by 50% ; strength > 150 MPa
Smart Construction & Maintenance	3D printing, topology optimization, embedded sensors + AI	Material savings of 30%~50% ; real-time health monitoring

Simplified Summary Table of Three Core Directions



cabr-concrete logo

1. Core Direction 1: Green Revolution from "Carbon Emitter" to "Carbon Sink Resource"

Reducing the carbon footprint is the industry's top priority, with diversified pathways:

Disruptive Cementitious [Material](#) Substitution: Traditional Portland cement is facing reinvention. Alternatives include cement-free low-carbon concrete made from steel industry waste (e.g., steel slag), and geopolymers concrete (GPC), which utilizes industrial by-products such as fly ash or slag to significantly cut carbon emissions.

Integration of CCUS Technology into Production: Carbon capture, utilization, and storage (CCUS) technologies are being deeply integrated with concrete production. For instance, Chinese startup "Carbon Capture Zero" demonstrated its carbon-storing concrete technology at COP28, where captured CO₂ is injected into concrete during curing. This not only enhances strength but also transforms concrete into a permanent carbon sink, reducing the carbon footprint by approximately 90%.

Accelerated Investment and Commercial Deployment: Although venture capital activity peaked in 2022–2023 and has since stabilized, landmark large-scale financings (such as Sublime Systems' \$200 million and Terra CO₂'s \$124 million funding rounds), along with long-term procurement commitments to low-carbon cement from tech giants like Microsoft and Amazon, are becoming key forces in bridging the "commercialization gap" for next-generation cementitious materials.

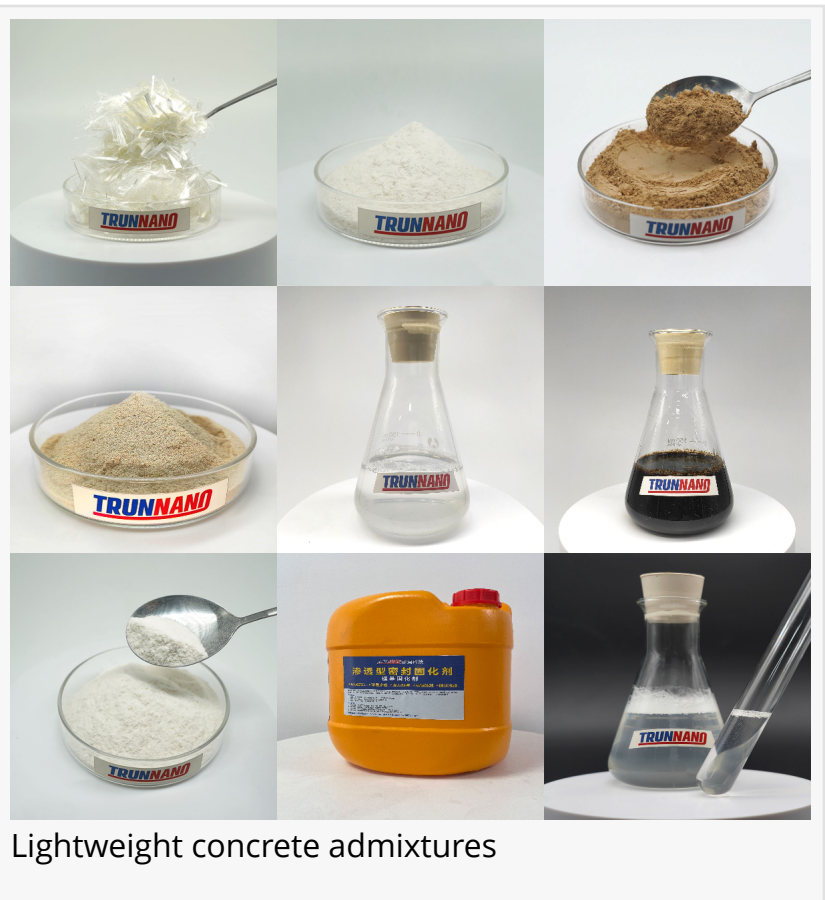
2. Core Direction 2: High Performance and Self-Healing Inspired by Both "Ancient" and "Modern" Wisdom

Extending the service life of buildings is itself the greatest form of carbon reduction. This field showcases a parallel approach of "learning from antiquity" and "innovation":

Biomimetic Self-Healing Technology: Technologies inspired by ancient Roman concrete are gaining momentum. DMAT, a startup incubated at MIT, has developed additives that mimic the self-healing mechanism of "lime clasts" in Roman concrete, extending the lifespan of modern concrete by 50% while reducing carbon emissions to 40% of traditional products. The technology has already been applied to infrastructure projects such as underground storage tanks and road barriers in Europe, and is set to enter the U.S. market.

Microbial "Healing" of Cracks: Another self-healing pathway is realized through biotechnology. The "multi-microorganism-loaded ceramsite self-healing concrete" technology developed by a team at Tianjin Chengjian University in China uses bacteria to induce calcium carbonate precipitation for active crack repair, and won a gold medal at the International Exhibition of Inventions in Geneva. By magnetically guiding the migration of microorganisms, the technology doubles the crack repair rate.

Ultra-High Performance Concrete (UHPC): By optimizing aggregate gradation and incorporating steel fibers, UHPC can achieve compressive strengths exceeding 150 MPa—several times that of traditional concrete. This allows structural components to be designed thinner and lighter, with broad application prospects in scenarios demanding high strength and durability, such as bridges and thin slabs.



3. Core Direction 3: Digitally Empowered "Smart" Construction and Maintenance

Digital technologies are transforming the way concrete is produced, constructed, and maintained:

3D Printing and Topology Optimization: The EU's CARBCOMN project is demonstrating a future construction approach: using low-carbon concrete made from industrial waste for 3D printing, while abandoning complex steel reinforcement in favor of a "compression-dominated structure" design (similar to the principle of ancient stone arch bridges) that relies on form for load-bearing, thereby drastically reducing material usage. Meanwhile, iron-based shape memory alloys (Fe-SMA) are embedded as post-tensioning tendons, enabling structures to be disassembled and recycled.

Smart Monitoring and Full Lifecycle Management: By embedding sensors into concrete, real-time monitoring of stress, temperature, and other health indicators is possible. Combined with AI algorithms for lifespan prediction and early warning, this enables a shift from "reactive maintenance" to "proactive prevention."

The future of concrete development will no longer be merely a competition of strength, but a deep synergy across materials science, environmental science, digital technology, and engineering practice. The new benchmarks for success will be: lower carbon cost, longer service life, and higher construction and maintenance efficiency.

In this wave of transformation, specialized companies in the field of lightweight concrete admixtures are playing a crucial role.

As a national high-tech enterprise with over 15 years of industry experience, Luoyang Tongrun Technology Co., Ltd.'s flagship brand, [Cabre-Concrete](#), boasts a full range of lightweight concrete admixtures. This product line covers at least 25 categories, from core foaming agents to polycarboxylate-based high-efficiency water-reducing agents, water-based release agents, and fast-dissolving sodium silicate, forming a comprehensive solution system.

Its nano-modified protein foaming agent exhibits superior performance: it can reduce the minimum bulk density of foamed concrete to 180 kg/m³, increase strength by 15%–20%, and reduce dosage per cubic meter by 20%–25%. Simultaneously, its crack-resistant agent effectively addresses industry pain points such as large shrinkage deformation and poor impermeability in lightweight concrete, significantly improving engineering durability.

With 9 patented technologies and ISO quality system certification, TRUNNANO has achieved stable mass production of its entire product line. The company provides efficient and low-carbon technical support for the application of lightweight concrete in green buildings and prefabricated building components worldwide through a systematic "materials + equipment" solution.

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