VICON: the Next Big Thing?

New VICON cement from SCI Con Technologies

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VICON, a new type of cement produced with a complex admixture during grinding, has very high strength, and can be produced with low clinker content.

Applying the latest advances in concrete science to cement manufacturing process, a high-performance concrete has been developed. This highly efficient product can be used for the production of super-concrete competing in new market niches not only with conventional concrete, but also with steel, natural stone, ceramic, and construction polymers.

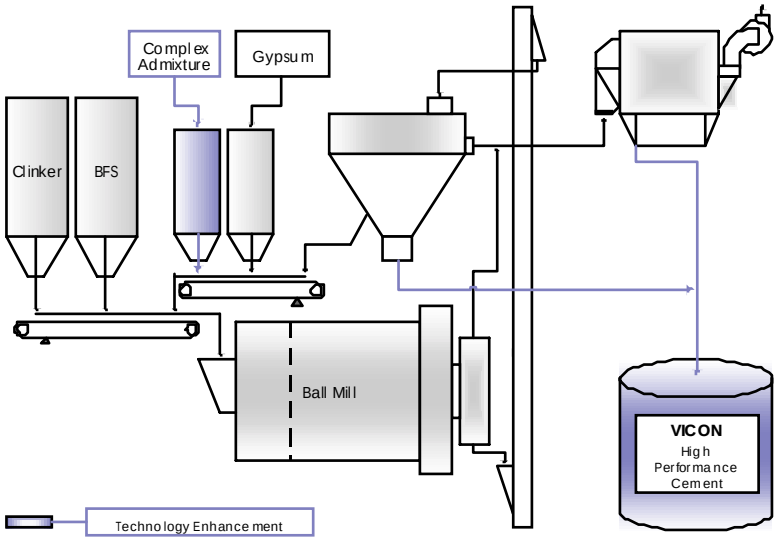
High-Performance Cement

The VICON technique uses a special admixture during the cement grinding process which significantly improves cement properties. This approach has resulted in the development of a new high-tech product: high-performance cement or VICON. VICON is versatile and is expected to be a widely used material in future construction.

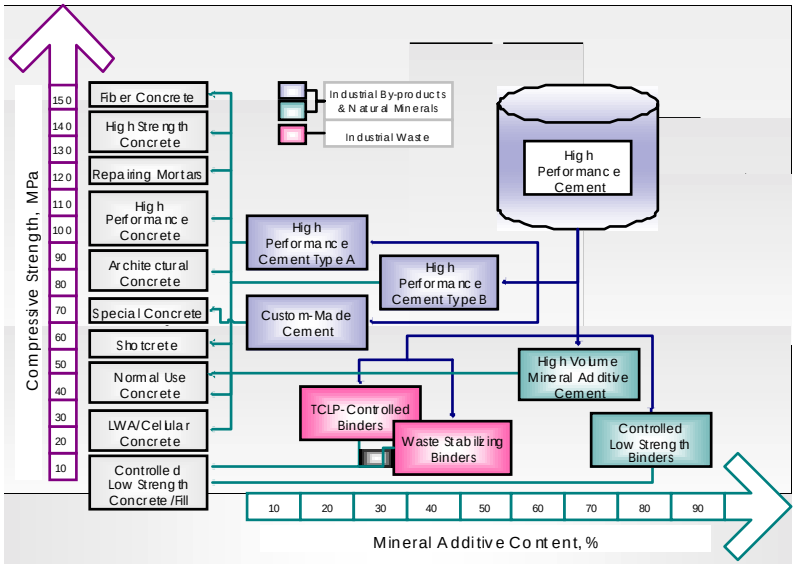
The main idea of VICON is the addition of a new reactive silica-based complex admixture during the grinding of the portland cement. Thus, in the case of VICON cement, the clinker is ground in a ball mill together with mineral additives, gypsum and the newly invented admixture. The resulting cement is then available for the production of high-performance concrete.

Importantly, in the production of VICON the amount of clinker can be dramatically reduced. Even at high volumes of mineral additives the special qualities of the admixture produce a blended VICON cement that is far superior to ordinary cement. Up to 70% of the cement can be replaced by cheaper local additives: sand, limestone, natural pozzolanic or volcanic materials, fly ash, granulated blast furnace slag, and even waste ceramics or glass. All these can be used as low cost indigenous mineral additives.

In blended VICON cement, the use of granulated blast-furnace slag provides excellent resistance to chemical attack and high temperatures as well as the addition of high strength. Because of low permeability and more resistant chemical structure, the blended VICON cement should easily exceed standard requirements for sulfate-resistant cements.



Right: VICON's production process involves the addition of the complex admixture during grinding



Key Ingredients

To be most effective, the pre-made complex admixture requires a reactive silica-based component. Different types of available clinker can be used in the proposed process, but the best results are achieved with high C_3S and mineralized clinkers.

As a result, optimized samples of high-performance cement achieved a 28-day compressive strength of up to 95 MPa (13,775 psi). The 1-day compressive strength of VICON cement was found to be as high as 44 MPa (6,380 psi). In contrast, normal cement requires one month to reach this value. Similarly, compressive strength of VICON at 2, 3, 7 and 90 days was far higher than normal cement.

Accuracy Crucial

To ensure a high level of performance modern concrete technology requires an application of a variety of chemical admixtures and mineral additives in exact doses; and precise control is the key to the high performance. The latest technology in high-performance concrete plants is becoming highly sophisticated, like a chemical or pharmaceutical process.

In case of VICON these changes are mainly concentrated at the cement production stage and high-performance concrete can be manufactured in a conventional batching plant. This extends the availability and supply of high-performance concrete. From precisely upgraded production centers VICON can be delivered in standard shipments to any construction site, ready mixed or precast concrete factories. This ensures a remarkably high quality of the final products.

Environmental Matters

It is generally agreed that the production of cement clinker is expensive and ecologically damaging. Carbon dioxide, a principle gas contributing to the "greenhouse effect", is a hazard generated by the conventional portland cement process, where approximately 1 t of CO_2 is generated for every 1 t of cement.

Blended VICON cement incorporates a wide range of mineral additives or industrial by-products, which partly replace the cement clinker. Indeed, VICON uses about 50% less clinker than standard cements, and so it creates less ecological damage. In this way VICON contributes to the reduction of carbon dioxide at source; it economically uses waste materials that otherwise would transported to landfill sites.

Cement Plant Expansion

The manufacture of clinker consumes the bulk of capital investment and yields a slow return. Therefore expanding an existing plant requires a proportionally high rate of investment. In the case of blended VICON cement, new investments are required only to upgrade the grinding complex. This can help to increase production capacity by 30-50% due to the savings on clinker.

The installation of grinding and control equipment requires extra investment. The complex admixture brings an additional operational cost. At the same time there is an immediate reduction in the cost of cement because less clinker is used. The increased capacity can effectively double revenues.

Application and Advantages

Concrete made with VICON can be applied in high-rise buildings, pre-cast reinforced concrete structures, airport runways, bridges, marine and offshore structures, tunnels, parking decks, in shotcrete and repairing of structures, underwater concrete, and special floors and many others.

Furthermore, it could become the product of choice and specification in earthquake zones. The containment of nuclear and hazardous waste is another promising area. We look forward to hearing from interested parties.

Table 1 VICON Properties

VICON		Type - A	Type - B (Blended)
Blast-Furnace Slag Content, %		<5	45
Specific Surface Area, m^2/kg		570	580
Normal Consistency, %		18.5	17.5
Setting Time, *minutes*	Initial	100	175
	Final	145	225
Compressive Strength, *MPa (psi)*			
	1-day	44.3 (6,424)	35.2 (5,104)
	2-day	55.9 (8,106)	44.8 (6,496)
	3-day	62.2 (9,019)	54.2 (7,859)
	7-day	74.1 (10,745)	65.6 (9,512)
	28-day	94.4 (13,688)	92.7 (13,442)
	90-day	96.2 (13,949)	105.5 (15,298)