

LEADER IN WHITE CEMENT

The Cementir Group is the world's leading producer and exporter of white cement, with production facilities located on four continents and a production capacity of over 3 million tons.

The Group markets its white cements in more than 70 countries worldwide under the global product brand AALBORG WHITE. Production plants are located in Denmark, Egypt, Malaysia, China and the United States (in partnership with other companies).

The Group also owns the largest white cement production facility in the world based in Egypt.

Constant investment in innovation of industrial processes and raw materials of the finest quality, have contributed to the current positioning of the Group as the global leading player in white cement. Cementir Group's production facilities benefit from being located close to large resources of high-purity limestone and other key raw materials needed for the

special production of white cement. The state-of-the-art plants enable the Group to produce with consistent chemical features, uniform white colour and high mechanical performance.

In addition to the consistency and high performance of the products, Cementir Group supports its partners by providing value-adding services into the customers' supply chain, extensive technical and customer support, and potential cooperation in developing new applications using white cement.

The Management has clearly identified the need to strengthen its leadership and further develop white cement as a key strategic pillar in the current 2017-2019 business plan, leveraging on a unique competitive position with its global widespread. By being directly present in key markets, Cementir benefits from a diversified customer base in terms of size, business, culture, tradition and technological levels.

Pursuing innovation: the 'In White' project

The Group aims at differentiating its value proposition on white cement globally, by re-defining and developing sustainable solutions that will support the growth of its clients' business through customized services, knowhow sharing, advisory and strategic partnering. Assessing mega trends in the Society and specifically in the construction industry, as well as understanding the "Voice of Customer" and the "Jobs to be Done", Cementir wants to challenge the traditional way of looking at white cement as mainly an aesthetic and architectural building material. There is an untapped potential to further develop the customers' business with white cement that, as a global leader, Cementir has to make available to its partners.

Cementir Group has established a global innovation engine for white cement, InWhite, with the purpose of generating a prioritized and actionable pipeline of high potential customer value proposition global initiatives, bringing new solutions for well-known applications, or completely new applications for white cement based products.

InWhite benefits from the Group's global knowledge on both well-established and emerging applications for white cement and technical knowhow of its internationally acclaimed Research and Quality Centre located at Aalborg, Denmark. It is aligned to megatrends detected in the society, such as customization, circular economy and high-energy efficient and sustainable solutions.



The sustainable applications of AALBORG WHITE cement

The technical characteristics of the white cements in the Cementir Group are unique on the market. AALBORG WHITE® is already used for many applications like dry mix products, tiles, artificial stones, precast concrete elements, terraces, etc.

Some emerging, but rapidly expanding applications for AALBORG WHITE® cement, are related to the chemical purity and excellent mechanical properties of concrete made with advanced production technologies, like e.g. UHPC (Ultra-high Performance Concrete) and GRC (Glass Fibre Reinforced Concrete). Such technologies are fully supporting the megatrends in society, including:

- Low specific weight per m²;
- Reduced thickness to enable more efficient use of the interior spaces of the building;
- Surfaces produced in a single process to avoid additional treatments;
- Modular and combinable for reuse of materials.

AALBORG WHITE® is also here reinforcing its leading position, enabling the best-in-class performance of the finished concrete products.

The whiteness of the cement provides further value-adding contributions to the Society, such as thermal comfort of homes and energy saving. Light-coloured surfaces reflect the sunlight more efficiently than dark ones. Providing more reflective surfaces (such as light-coloured roofs, walls and pavements) will result in more energy reflected and consequently lower the temperature in buildings, reducing the need of artificial cooling. High reflection surfaces as e.g. obtained by white cement plasters, panels and floorings, will also reduce the need for artificial lighting in tunnels, industrial warehouses, etc., contributing thereby to energy saving cement plaster or panels reduce the need for artificial lighting in tunnels, contributing therefore in energy saving.

The light-reflecting property of white concrete integrated in the road environment as kerbs, tunnel ramps, pavement and road barriers has also proven to increase traffic safety. The white surface of road barriers increases visibility and improves safety compared to barriers made with steel or painted grey cement, because these white

barriers maintain a bright colour under wet and dark conditions.

Developing UHPC (Ultra-High Performance Concrete)

The use of the term UHPC without any further clarification could become misleading. Many acronyms are used to categorise cement-based composites with very high compressive strength. Originally, the term UHPC was introduced to differentiate from high performance concrete (HPC), thereby introducing a compressive strength higher than 140-150 MPa. Most of such concrete includes fibre to add ductility, and are therefore usually characterized as UHPFRC (ultra-high performance fibre reinforced concrete).

In real life, most UHPC or UHPFRC based products and commercially available premixes (both with and without fibres) have a compressive strength level of around 110 MPa or higher (Eurocode cylinder). Higher compressive strengths are rarely needed, as high tensile capacity, high durability, low water permeability and high workability, etc. become more decisive parameters.

Providing significantly higher strengths than this will result in the use of special aggregates not available locally, adding high costs on the production. Although UHPFRC, in its strict definition, may be required for some special applications will be well-covered by compressive strength levels of approximately 110 MPa or higher.

A global tendency that has been observed, and is aligned with the earlier mentioned megatrends in society, is the development of new market possibilities during recent years based on advanced aesthetic UHPC based cladding/rain-screen systems and integrated prefabricated façade panels. In terms of volume growth, these types of application are expected to lead the development of global consumption of UHPC.

The Research and Quality Centre in Aalborg, Denmark is intensively designing, testing and documenting new binder formulations to meet requirements and challenges revealed through our global reach and strong customer relations. This

represents some of the first steps towards a further global spread on the use of UHPC and UHPFRC exploiting AALBORG WHITE® within InWhite.

Supporting GRC ***(Glass-Fibre Reinforced Concrete)***

Glass Fibre Reinforced Concrete is one of the most versatile building materials available to architects and engineers. Composed primarily of cement, sand and special alkali resistant (AR) glass fibres, GRC is a thin (down to 10-15 mm), high strength and environmentally friendly composite with many applications in construction. It has a flexible ability to meet performance, appearance and cost parameters. The technology was developed in the seventies. However, the global low focus on architectonic value of buildings in the period from 1970-2000 limited its use to markets with very low costs of labour. The material and the technology around it, has now matured into a great potential to serve very high and complex requirements in society, that by far outweigh

the relatively higher production costs, following the high extent of craftsmanship.

The Group, among other memberships, has joined the International GRC Association from 2016, to co-lead and play an active role in supporting the future development of this technology. This membership is coherent with the strategic intent to focus on developing market/customer driven technologies and applications for AALBORG WHITE®.

During the last year, and as part of an ongoing activity within InWhite, Cementir Group has initiated an extensive global study on the challenges and possibilities for the use of this technology through, among others, interviews and visits to customers and decision makers globally, to reveal key focus areas for the further expansion of the use GRC. Furthermore, the Group started extensive innovation programs in the Research and Quality Centre in Aalborg, Denmark to further develop the technology itself and its application, with the purpose of providing knowledge and assistance to the customers globally, facilitating and supporting thereby their growth.