

CEMENT ADDITIVES LIMESTONE CEMENTS

ENABLING A REDUCTION IN CLINKER FACTOR

SUPPLEMENTARY CEMENTITIOUS MATERIALS (SCM)

Reduction in clinker factor



Use and demand for **alternative** SCMs is exponentially growing.

Limestone as an SCM – A Strategic Material for **Sustainable Cement Production.**

Tailor made solutions **enable** the cement industry to make the transition towards lower CO₂ cements.

MODERN SOCIETY is facing extremely challenging conditions, such as limited access to certain raw materials, increasing energy prices, more complex supply chains, and higher environmental regulations. Moreover, demanding quality requirements are forcing a redesign of well-established and traditional production processes.

Cement remains the largest manufactured product on earth by mass. Taking into account its global CO₂ emissions, it is necessary to consider how to reduce its impact on global warming by optimizing and developing new production processes, as well as adopting alternative fuels and raw materials.

The trend of using more environmentally friendly supplementary cementitious materials (SCMs) is growing exponentially. Cement producers are in the process of developing new binders with reduced clinker, including the use of higher dosages of lower-quality SCMs or experimenting with new, alternative cementitious materials.

Considering that SCMs are typically not reactive and contribute little to the early strength development of concrete, the dilution of clinker with SCMs in blended cements generally leads to a decrease of performance. This must be compensated with the use of more powerful quality improvers during cement production.

At Sika, our commitment is the continuous development of customized and high-performance chemical additives, specifically designed for the cement industry. Through our innovations, we enable the cement industry to make the transition to lower CO₂ cements.



LIMESTONE

Abundant availability, low cost and positive technical performance

While other supplementary cementitious materials (SCMs) may face limitations in availability, limestone is abundant, geographically widespread, and chemically stable over long periods. It also requires minimal processing, making it a cost-effective and sustainable option. By replacing a portion of Portland clinker with limestone, manufacturers can achieve a significant reduction in both production costs and the overall CO₂ footprint of cement.

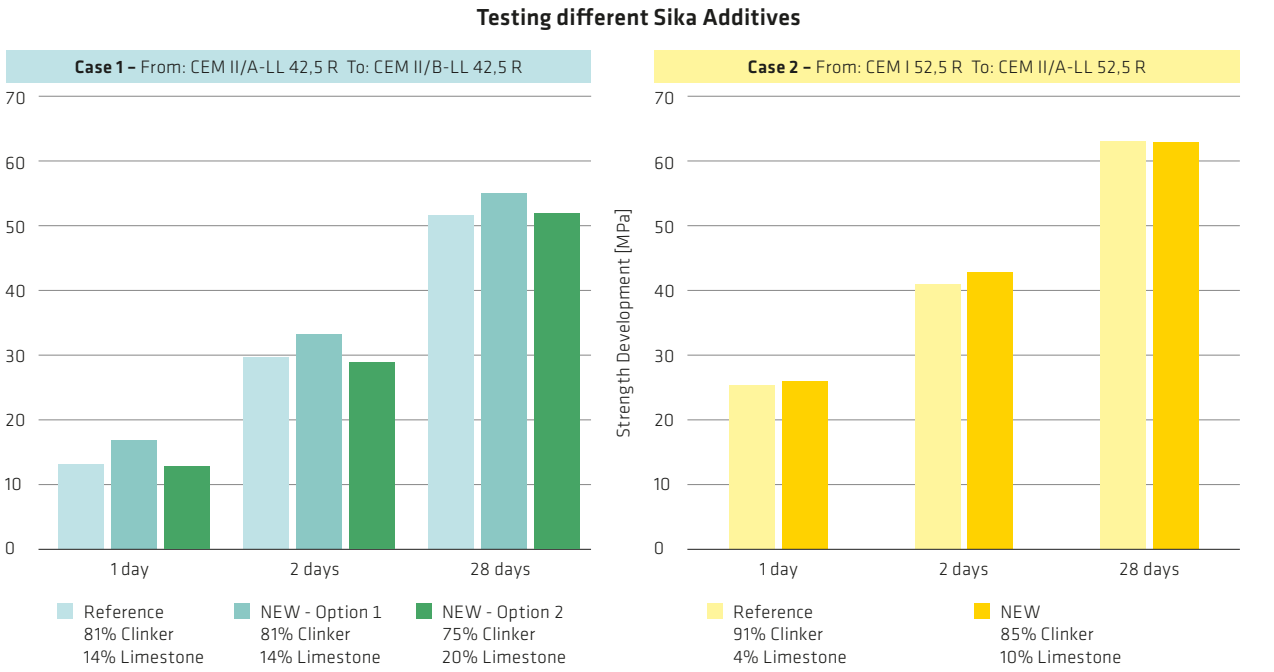
However, incorporating higher volumes of limestone into cement formulations requires careful process control and the use of innovative additives to mitigate potential reductions in strength, workability and durability. These challenges can be effectively addressed through an intelligent combination of process optimization, precise control of particle size distribution, and the application of performance-enhancing chemical admixtures. This integrated approach ensures that the sustainability benefits of increased limestone content do not come at the expense of technical performance.

Limestone influences cement strength through a combination of physical and chemical mechanisms. At contents of up to approximately 5%, limestone contributes to early strength development through the filler effect, which improves particle packing and hydration kinetics. However, when the limestone content exceeds 10–15%, a reduction in strength is typically observed, unless this is offset by strategies such as fine grinding to enhance reactivity or the use of chemical additives to boost hydration and performance.

Fineness plays a critical role when incorporating limestone into cement, as limestone is softer than clinker and tends to be ground finer during the co-grinding process. This leads to a shift in particle size distribution and an increase in specific surface area, which can enhance reactivity and contribute to early strength development. However, excessive fineness can also raise the water demand of the cement, requiring higher dosages of plasticizers and potentially reducing concrete workability. To counter these effects, it is essential to optimize mill operation, particularly through the targeted use of cement additives, in order to maintain both production efficiency and high product quality. Where maximum flexibility is needed, separate grinding of clinker and limestone followed by blending allows producers to precisely tailor cement properties and improve overall process efficiency.

The **SikaGrind®** series includes a range of cement additives specifically developed for limestone cements. These additives incorporate tailored chemical building blocks that enhance both early and late strength development. In addition, high-performance quality improvers help to reduce water demand, while also addressing challenges related to flowability and durability of the final product

Field tests with various customers have been conducted to meet a wide range of performance requirements. These trials focused on reducing the clinker factor. The newly developed cements were benchmarked against the customers' standard products and the results confirmed the viability of low-clinker formulations in real-world applications.



A GLOBAL COMPANY BUT LOCAL PARTNER



FOR MORE INFORMATION ON LIMESTONE CEMENTS:



WE ARE SIKA

Sika is a specialty chemicals company with a globally leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing, and protection in the building sector and industrial manufacturing. Sika has subsidiaries around the world and produces innovative technologies for customers worldwide. In doing so, it plays a crucial role in enabling the transformation of the construction and transportation sector toward greater environmental compatibility.

Any product name or reference reflects the Sika product name at the time of creation of this document and may differ from the product name or reference during past events.

Our most current General Sales Conditions shall apply.

Please consult the most current local Product Data Sheet prior to any use.



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