

# SikaGrind<sup>®</sup> Technology



Innovation & Consistency | since 1910



# SikaGrind® Technology

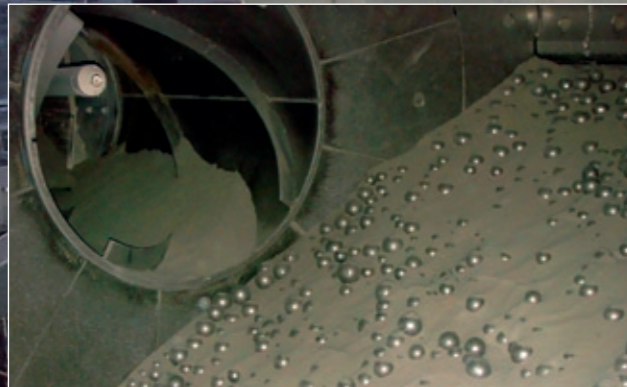
... creative solutions for today's challenges!



Fundamental research work



Customer oriented laboratory trials



Tailor made products

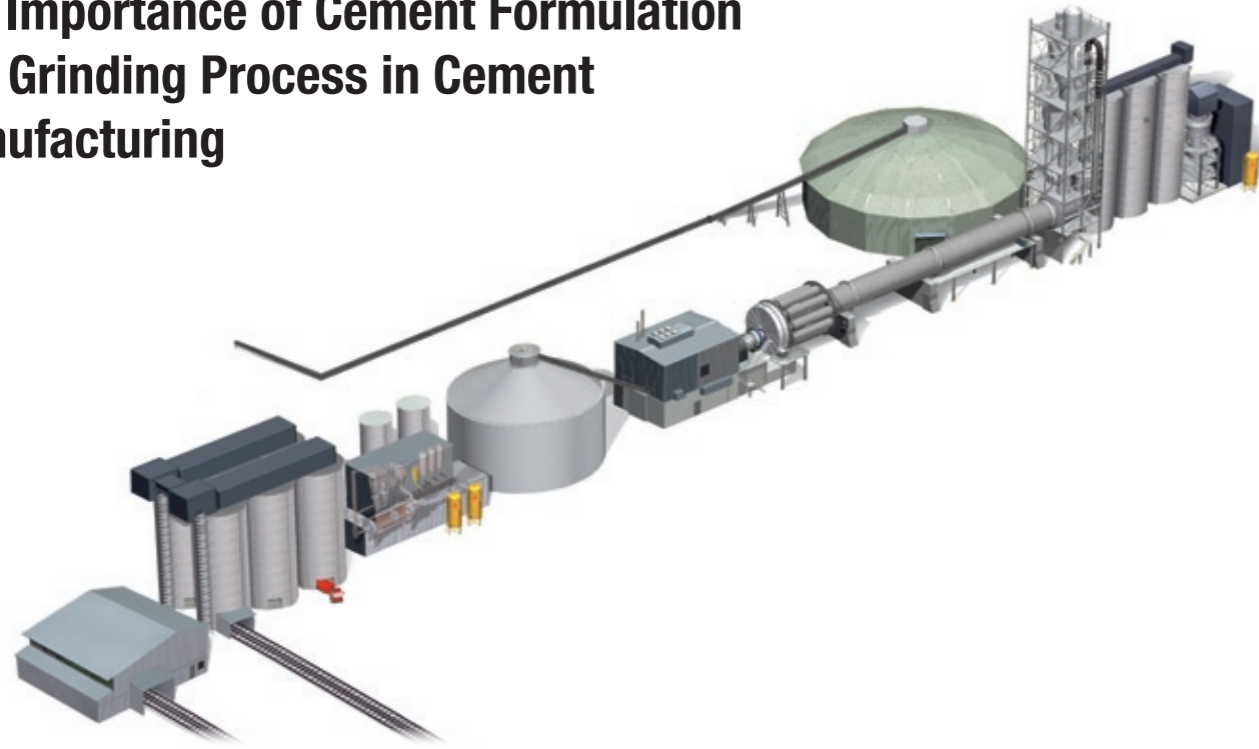


Support in all relevant topics





# The Importance of Cement Formulation and Grinding Process in Cement Manufacturing



Cement manufacture is a highly technical process in which every part has a decisive impact on the product quality as well as on economical and ecological production parameters. From the origin of the necessary raw materials, the clinker burning and cooling, to the careful adjustment of the cement formulation, cement manufacturers constantly strive for homogeneous quality of their products.

The cement grinding process is the final chance to adjust the cement quality to meet the demands set by relevant standards and cement customers. It combines influences from different areas like the mechanical grinding process, the chemical and physical raw material properties and the cement formulation itself. Interactions between these effects result in a very challenging process which needs skilled and experienced people on all sides.

Optimization of the cement formulation and the cement grinding process creates value. Application of the **SikaGrind®** Technology can help you to further improve your process and profitability.



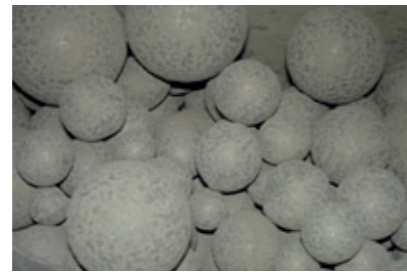


# SikaGrind®-Technology: Small Drops with a Huge Impact

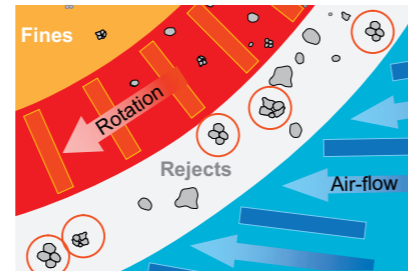
During cement grinding, unsatisfied charges develop on the newly created particle surfaces, which then cause an electrostatic attraction of the cement particles. The higher the targeted fineness, the more surface charges are generated. Increasing electrostatic attraction forces agglomerate ground particles and lead to three basic actions:



■ Cracks in the cement particles which have started to develop close again.



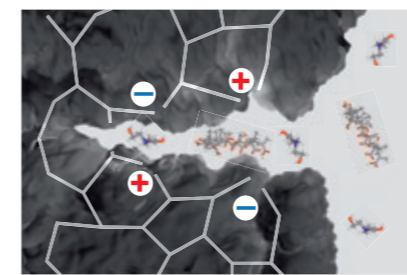
■ Ground particles stick on grinding equipment (coating effect) and soften the impact of the grinding media.



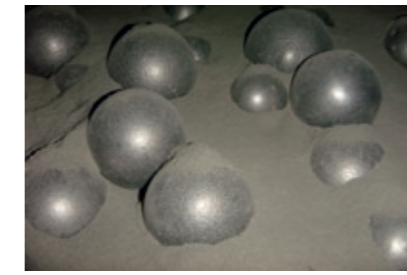
■ Agglomerates of sufficiently ground particles are detected by the separator as coarse particles and consequently return as reject to the mill.

Production values as well as cement quality itself are adversely affected by the resulting lower grinding and separating efficiency. At constant specific surface, increasing amounts of overground particles cause lower production rates in parallel with weaker strength development and higher water demand in the final product.

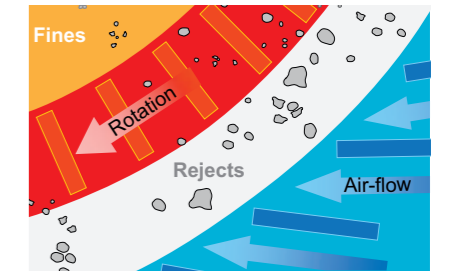
Grinding aids are usually added at low dosages, typically in a range of 0.02% - 0.05%, either onto the mill feed or directly into the mill itself. They are based on substances of high polarity. While being adsorbed on the existing and newly created cement particle surfaces, they neutralise the surface charges. As a consequence, the particle surfaces do not attract each other any more. Three different effects can be observed:



■ **SikaGrind®** ensures that the fracture surfaces stay separated, thus enabling crack formation in cement particles to continue. This leads to a faster comminution.



■ The use of grinding aids reduces the coating effect and leads to blank mill internals. The resulting intensified impact of the colliding balls enhances the grinding efficiency.



■ Particles treated with **SikaGrind®** are better dispersed when entering the separator. The higher the powder dispersion, the greater the probability that the particles are detected with their actual dimension.

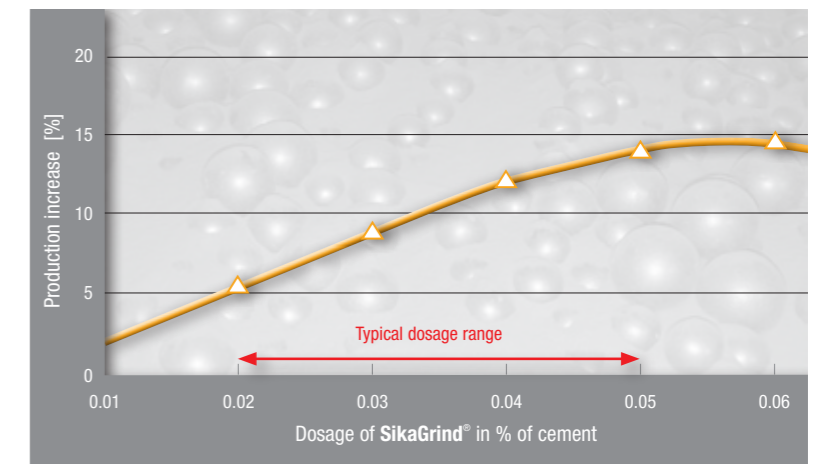
Grinding aids enhance the grinding and separating efficiency which leads to an increased production rate. Additionally, the resulting lower content of over ground particles meets the characteristics of a more favourable particle size distribution with better cement quality. **SikaGrind®** allows producers to economically achieve the desired fineness and quality of cement.



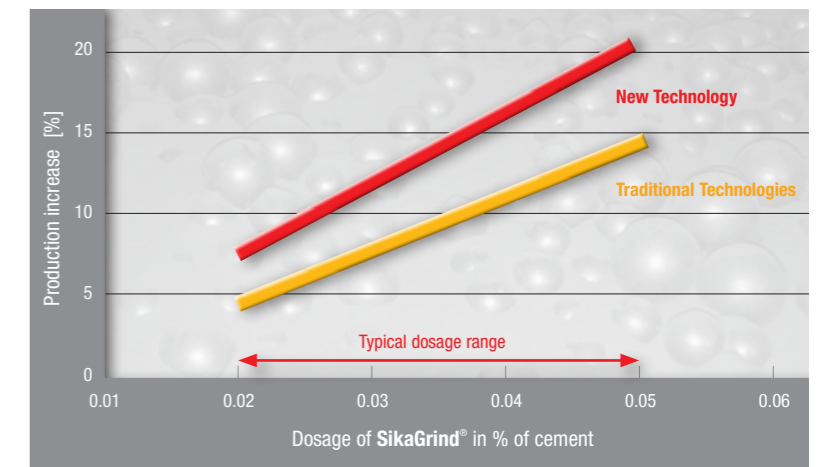




The magnitude of the production increase is related among others to the grinding aid dosage. Up to the maximum reasonable dosage of a specific grinding aid, the production rate increases and the separator rejects decrease. Further increased dosage results in a shorter time for the cement to pass through the mill. If the mill retention time is reduced too much, the cement is insufficiently ground which leads to increased separator rejects and hence a reduced production rate.

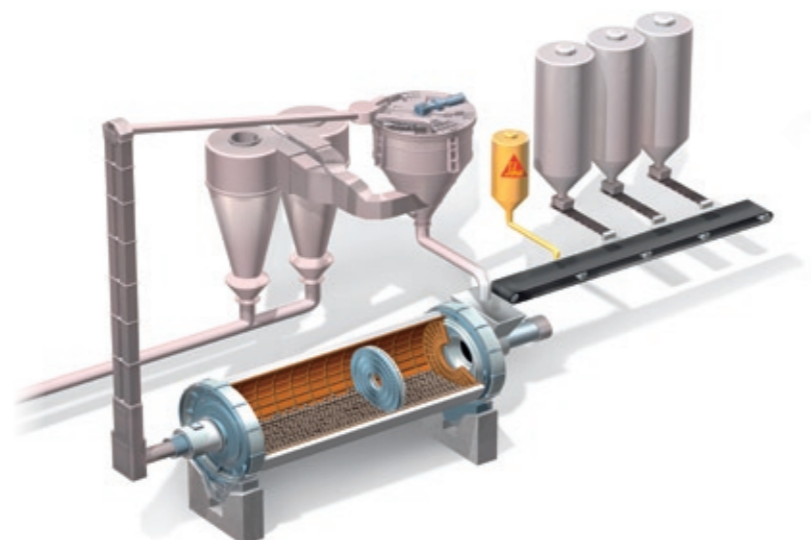


Traditional grinding aids are based on amino alcohols and glycols which can be used in formulated products, but also as pure raw materials. Sika has developed a polycarboxylate polymer powered grinding aid technology which is able to improve the performance of traditional technologies. The major benefit of this new technology can be measured in a distinct production increase which arises from an intensified particle dispersion.



## SikaGrind®-Technology for an Optimized Cement Grinding Process

Cement grinding consumes a major part of the total energy used for the cement manufacturing. The absolute energy demand of the grinding system in relation to the adjustable production rate of the mill is expressed as specific energy consumption. Higher cement production rate leads to lower specific energy consumption per ton of cement. **SikaGrind®** has a positive effect on the production rate, and thereby helps to reduce the specific energy consumption.



The improved efficiency of the cement grinding and separating process resulting from the use of the **SikaGrind®**-Technology contributes to economically optimized cement production. It can be used to

### Optimize production costs

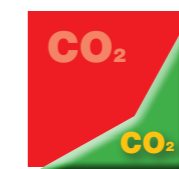
- Further increase production volume of the mill
- Additional reduction of specific energy consumption



**Absorbed power [kW]  
Production [tons/hour]**

### Reduce environmental impacts

- Improved cement quality with increased cement fineness and a more favourable particle size distribution while maintaining production rates
- Increase amount of clinker replacement



**Carbon footprint [tons CO<sub>2</sub>/tons clinker]  
x clinker amount**

### Provide a competitive edge

- Generate additional sales and contribution
- Greater flexibility to market demands



**Additional cement production [tons]  
x Contribution [money/ton]**



# SikaGrind®-Technology for Sustainable and Cost Optimized Cement Manufacture



Cement is a major part of today's construction industry, which demands for solutions that consider both economical and ecological aspects. Cement manufacturers are continuously striving to achieve more efficient and environmental friendly production methods.



The fact remains that cement production leaves a footprint on the environment. The CO<sub>2</sub> emissions resulting from the calcination process during clinker production are unavoidable. Today's challenge of reduced carbon footprint leads the industry to more cost-efficient and ecologically friendly cement designs.



At present, the focus is on the substitution of clinker by supplementary cementitious materials (SCM) like granulated blast furnace slag, fly ash, natural pozzolanes and lime stone. The higher the amount of these clinker replacements the more pronounced the adverse effect on early strength development. Additionally, reduced final strength can occur. **SikaGrind®** can compensate loss of strength and hence contribute achieving a sustainable and economic cement manufacture.

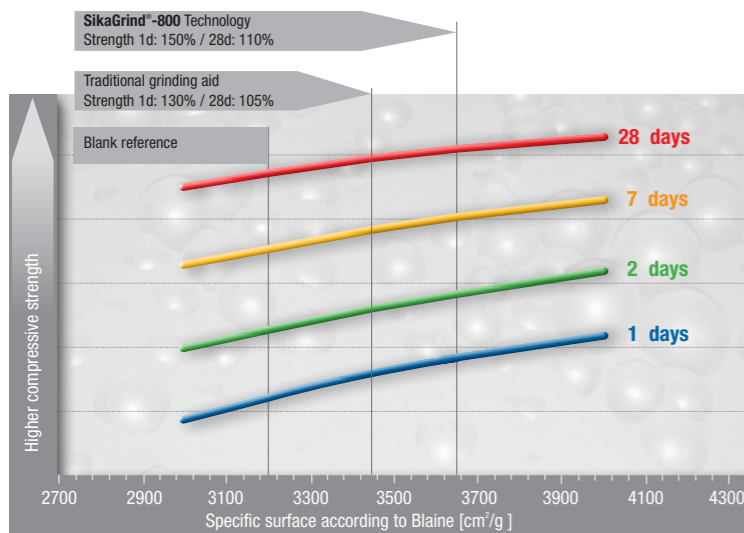




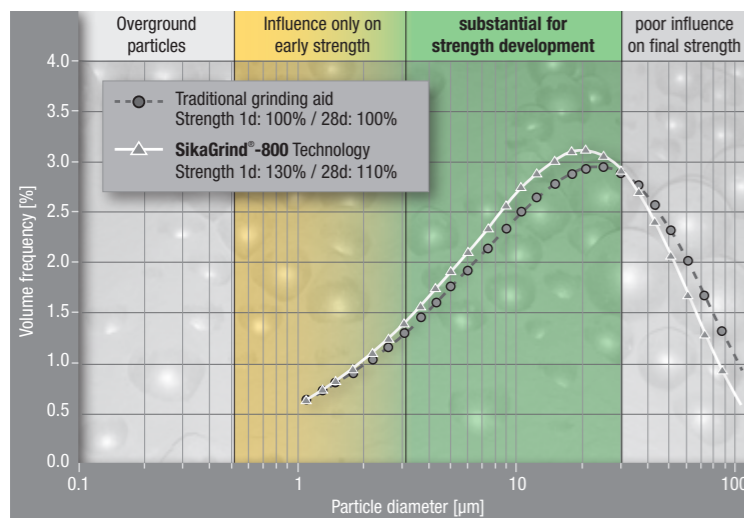


**Improved cement fineness**  
measured as

- Higher specific surface according to Blaine
- Optimized particle size distribution of the cement, especially targeting the particle fraction 3-30 µm



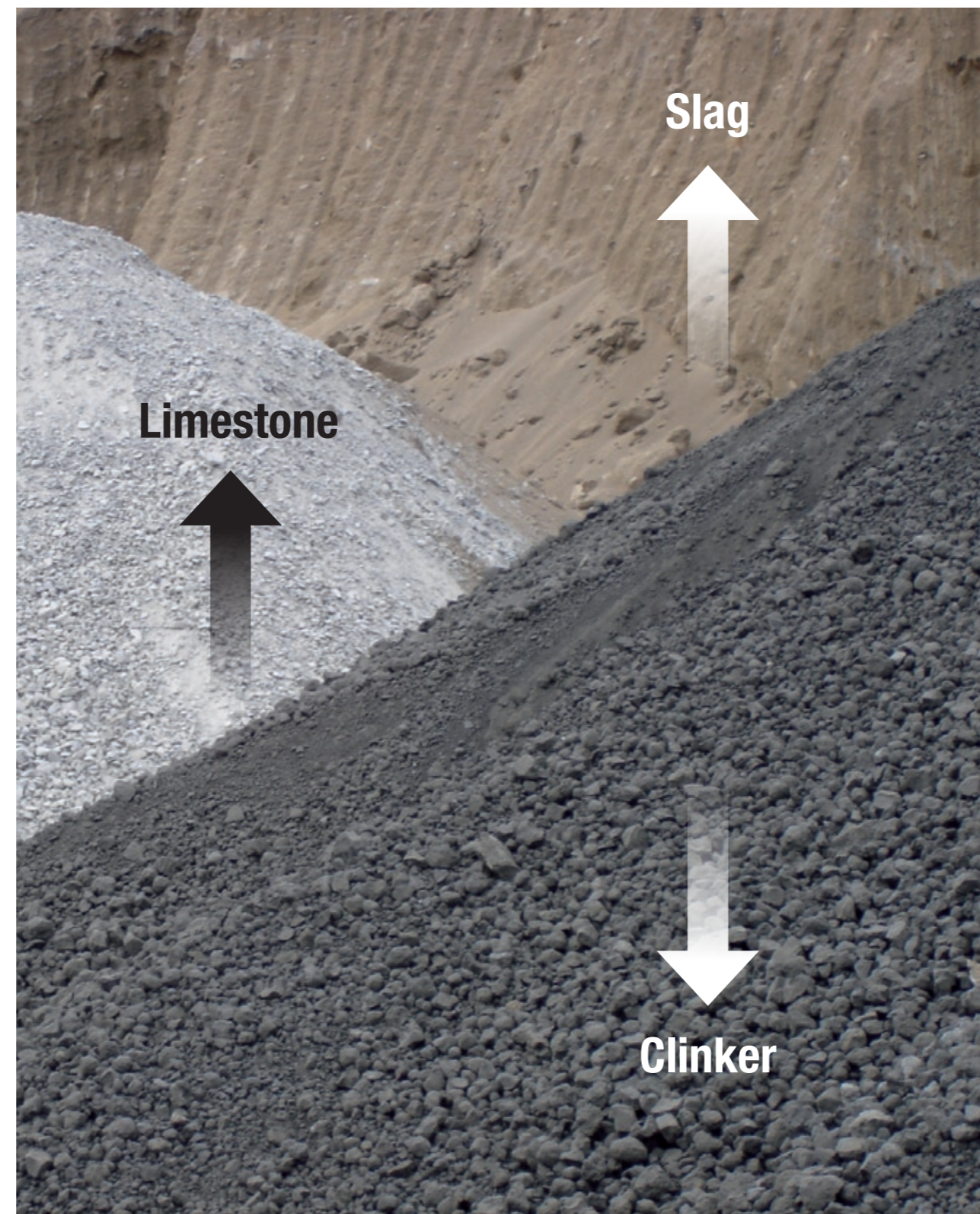
Strength enhancement with **SikaGrind®** due to increased fineness at constant production



Strength enhancement with **SikaGrind®** due to optimized particle size distribution at constant production

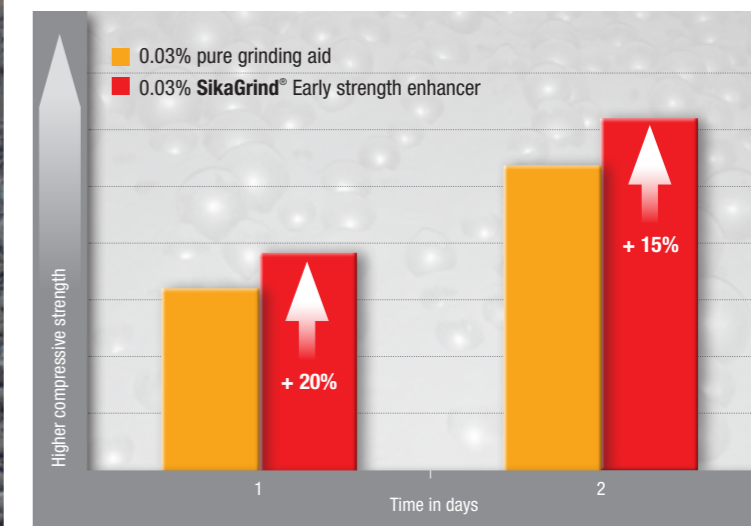
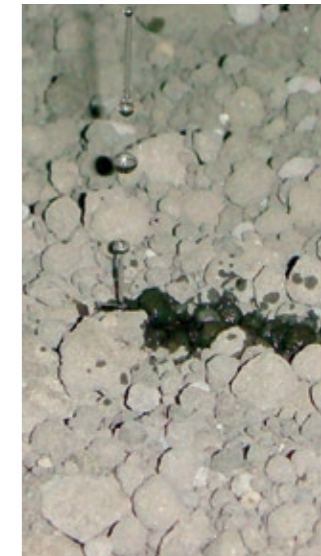
## SikaGrind®-Technology to Achieve the Desired Strength Development

The most significant options to improve strength development and strength potential of cement under existing local conditions are improved cement fineness and chemical activation of the hydration process with cement additives. Grinding aids and performance enhancer of the **SikaGrind®** range, as well as tailor made products, allow using these technological principals while achieving highest possible production values.

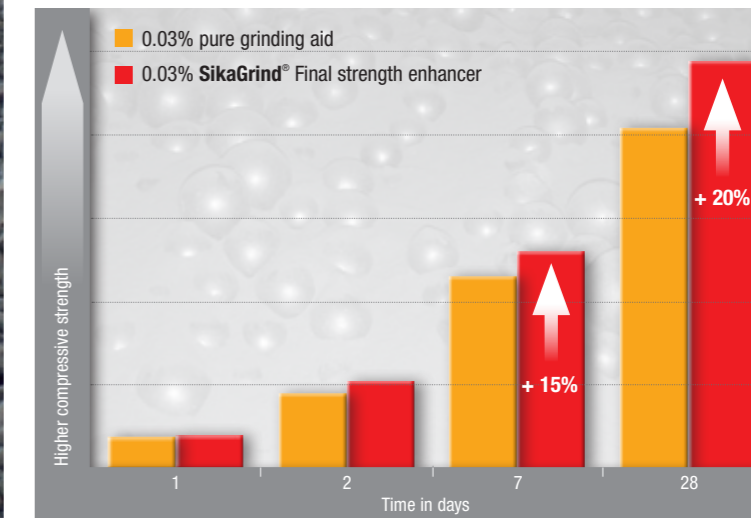


**Chemical activation** of the hydration process with **SikaGrind®** which results in enhanced

- Early strength
- Final strength
- Combination of both early and final strength



Early strength enhancement with **SikaGrind®** at increased production



Final strength enhancement with **SikaGrind®** at increased production



# SikaGrind®-Technology for an Outstanding Cement in a Challenging Market

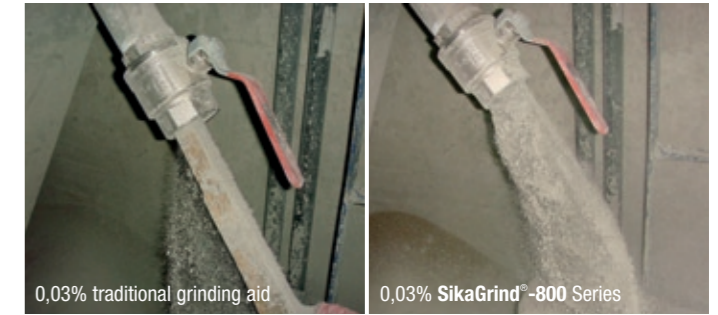
In today's competitive market, cement manufacturers as well as cement users are aiming for cost reduction with the target to increase profitability and improve market share.

Cement producers need to supply the cement quality as defined by local standards, and at the same time meet customers' demands. Strength development is surely the most important and most controlled property. Other influences of the continued increasing use of clinker replacements are often out of the main focus. The potential problems range from low concrete workability to variations which adversely affect the appearance of concrete.

Additives which positively influence properties during production of concrete can become the decisive factor to choose one particular cement and help to differentiate yourself versus the competition. The **SikaGrind®** range offers products and tailor made solutions for individual challenges, providing additional opportunities to optimize cement production, cement quality and profitability.

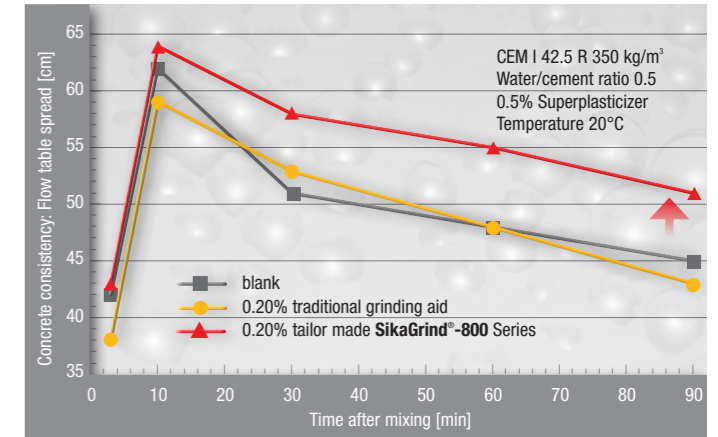
## Adjustable Powder Flowability (cement handling)

The cement grinding process results in unsatisfied charges on the newly created surfaces. With increasing fineness electrostatic attraction of cement particles becomes more severe. These inter-particle forces reduce cement powder flowability which adversely affects the flow characteristics in air slides and can result in no-flow condition during discharge of silos and transportation vessels. Special products from the **SikaGrind®** range allow for the adjustment of the cement powder flowability to meet your demands.



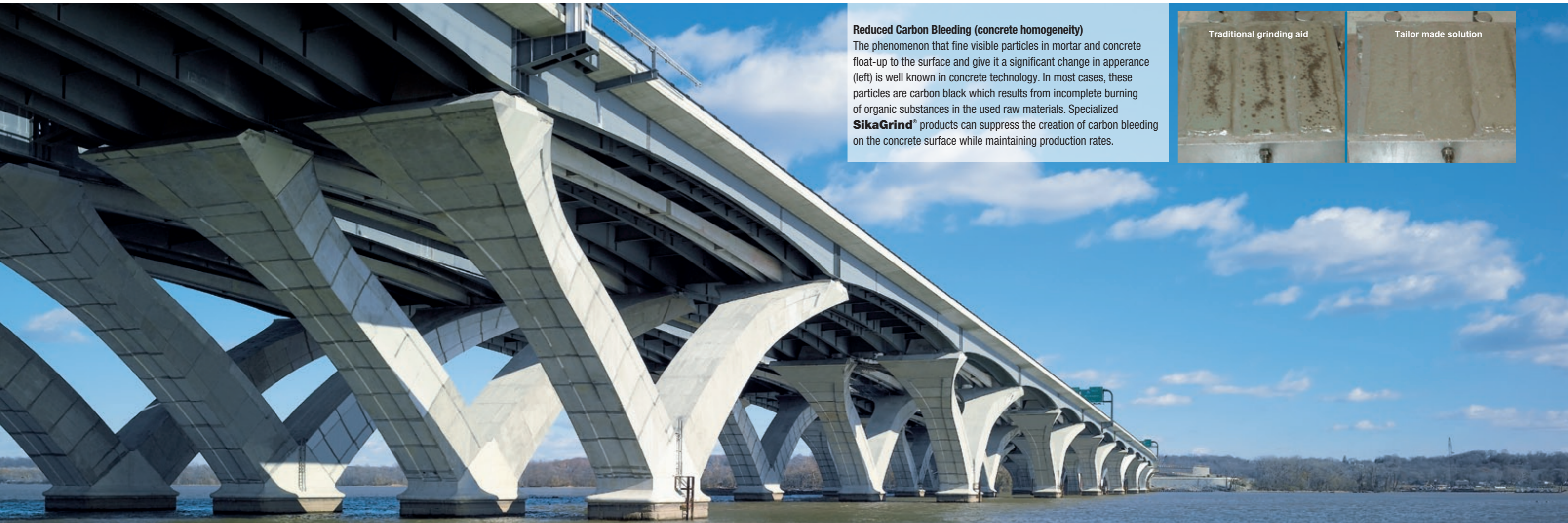
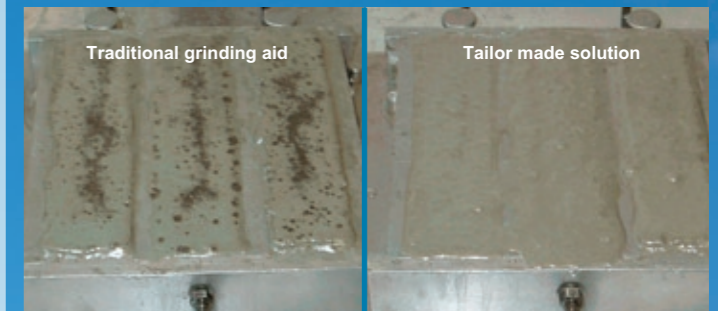
## Improved Consistency (concrete workability)

At constant fineness, increasing the amount of supplementary cementitious materials, like interground limestone and puzzolanes, leads to decreasing strength of the blended cement. In order to keep the strength unchanged, the cements or at least the clinker component have to be ground finer. Such changes increase the water demand and reduce the concrete workability. Improved workability and extended slump life can be achieved with polycarboxylate polymer based **SikaGrind®** technology.



## Reduced Carbon Bleeding (concrete homogeneity)

The phenomenon that fine visible particles in mortar and concrete float-up to the surface and give it a significant change in appearance (left) is well known in concrete technology. In most cases, these particles are carbon black which results from incomplete burning of organic substances in the used raw materials. Specialized **SikaGrind®** products can suppress the creation of carbon bleeding on the concrete surface while maintaining production rates.







Individual characteristics of local materials



Conditions during the cement grinding process



Demands of standards and construction industry



## SikaGrind®-Product Range for Your Local Challenges

The characteristics of the local raw materials, the availability of possible clinker replacements and the conditions during the cement grinding process are different in every individual cement plant. In addition, the demands of standards and customers regarding the cement performance vary due to different climate and construction methods. Therefore, the solution for highest possible production rates or maximized use of supplementary cementitious materials needs to be adjusted individually.

### Sika offers all types of products:

- **Basic grinding aids**
  - Achieve a constant cement production at a higher level [ton/hour]
  - Reduce the specific energy consumption of cement [kWh/ton]
- **Grinding aids with quality enhancing properties**
  - Enhance early and/or final strength, which allows for higher clinker replacements and hence less CO<sub>2</sub> emissions
  - Accurately entrain air in masonry cements
- **Special tailor made products**
  - Adjusting cement powder flowability
  - Suppress carbon bleeding
  - Improve concrete workability

Cement additives are classified into different product groups which can be adjusted to tailor made solutions using the latest SikaGrind® Technology to meet your local demands.

- **SikaGrind®-100 Series**  
chloride containing grinding aids with improved early strength
- **SikaGrind®-200 Series**  
efficient grinding aids with improved early strength
- **SikaGrind®-300 Series**  
cement additives for speciality cements
- **SikaGrind®-400 Series**  
efficient grinding aids with low to zero amine content for brown discolouration sensitive cements
- **SikaGrind®-700 Series**  
very efficient grinding aids with improved early and final strengths
- **SikaGrind®-800 Series**  
polycarboxylate polymer powered grinding aid technology for maximised mill production, adjustable cement powder flowability and improved strength development





## SikaGrind®-Service for Maximized Benefits

Our target to improve your profitability starts before we first meet: research work is constantly in progress to further enhance the product performance and enable Sika to offer you the latest technology.

We understand and support your business. Therefore, in whatever situation, being confronted with a special problem or in the daily challenge to improve your profitability, Sika will assist you in reaching your targets.

Local conditions and demands vary strongly which makes it necessary to handle every plant individually. Sika can offer tailor made solutions, designed to meet individual challenges. This implies the necessity to work together as partners with one joint target.

As a starting point of a product and process optimisation, well-defined and technically feasible targets related to the present production and quality parameters are agreed upon. Based on our experience in cement production process and product know-how, one or two **SikaGrind®** products are recommended for plant trials. If necessary, laboratory pre-trials can be arranged in one of our regional cement laboratories.

Preparation and execution of plant trials are handled by Sika staff in cooperation with plant personnel. The production data as well as the results of the cement analysis which are determined in our specialized laboratories are then discussed between you and Sika's cement specialists to agree upon the target fulfilment and to define the next steps.

In case of inconclusive results or the need for further optimization work, another plant trial cycle with potential product modification and laboratory pre-trials might be necessary. After reaching the desired targets, Sika proactively supports the implementation of the optimized production and/or quality concept including all necessary logistic topics. Finally, Sika's follow-up strategy will ensure that we continue to work together to support your business .

- 1 Constant research to further enhance performance
- 2 Understand local situations and define targets
- 3 Laboratory pre-trials to evaluate trends
- 4 Execution of plant trials by Sika experts
- 5 Evaluation of cement quality in Laboratory analysis
- 6 Discussion of results with customer
- 7 Implementation process including logistics
- 8 Continuous follow-up to further improve your business



# Sika – a Global Player in Specialty Chemicals for Construction and Industry



- 5 continents
- over 70 countries
- 90 production and marketing companies
- approx. 12 900 employees

Sika is a leading Swiss company, globally active in specialty chemicals. Its local presence worldwide links with customers directly and ensures the success of Sika and its partners. Every day highly motivated people strive to provide the best customer service.

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prior to any use and processing.



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