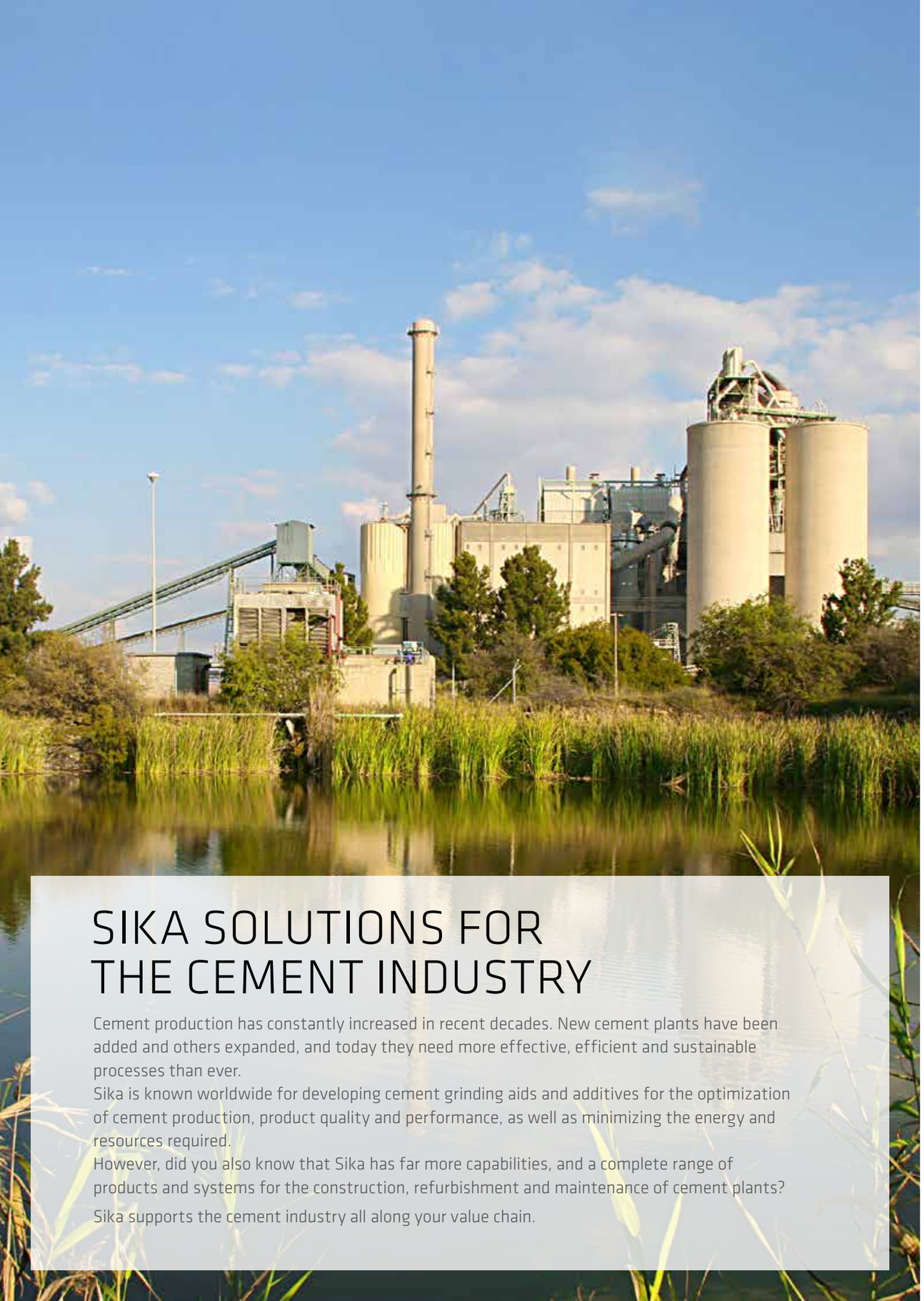
CEMENT
SOLUTIONS FOR THE CEMENT INDUSTRY

CEMENT ADDITIVES AND ASSOCIATED SOLUTIONS

BUILDING TRUST



SIKA SOLUTIONS FOR THE CEMENT INDUSTRY

Cement production has constantly increased in recent decades. New cement plants have been added and others expanded, and today they need more effective, efficient and sustainable processes than ever.
Sika is known worldwide for developing cement grinding aids and additives for the optimization of cement production, product quality and performance, as well as minimizing the energy and resources required.
However, did you also know that Sika has far more capabilities, and a complete range of products and systems for the construction, refurbishment and maintenance of cement plants?
Sika supports the cement industry all along your value chain.

CONTENTS

CEMENT INDUSTRY

Market, Trends and Challenges

CEMENT IS ESSENTIAL FOR CONSTRUCTION. Cement use has increased more than thirty-fold since 1950, and almost four-fold since 1990. Optimized production for consistent quality and cost reduction to meet customer demands and standards, as well as increasing sustainability, are challenges for every cement plant today and in the future.

In 2021,
4 BILLION
tons of cement were produced worldwide.

Around
7%
of the world's CO_2 emissions are due to cement production.

The amount of net CO_2 per ton of cement has been reduced from 800 kg to
650 KG
between 1990 and 2021

ADDRESS MARKET TRENDS AND CHALLENGES WITH SIKA SOLUTIONS

Sika provides innovative solutions to positively influence production processes and cement quality.

SikaGrind® technology gives commercial benefits with less environmental impact while improving cement application.

Sika's expertise in cement production allows expanding the capacity of cement plants. At constant cement production the use of the whole range of available clinker replacements helps meeting the performance criteria.

The reduced energy and resource demands, plus a lower carbon footprint, contributes to the profitability of your business.

GLOBALIZATION
Sika is the world leader in construction chemicals with production facilities and a local presence in over 100 countries.

EFFICIENCY
SikaGrind® additives reduce clinker requirements and maximize the volume of lower cost supplementary cementitious materials (SCM) that can be added.

SUSTAINABILITY
Sika is fully committed and focuses on sustainable development, creating lasting value for people and the environment, whilst minimizing energy and natural resource usage.

COST – PERFORMANCE RATIO
Sika's cement additives allow for a substantial increase in productivity of the cement milling operations, which reduces energy consumption and overall production costs.

SOLUTIONS FOR CEMENT PLANTS

From additives to other construction materials for building & operating cement plants

CEMENT MANUFACTURE IS A HIGHLY technical process in which every component has a decisive impact on the product quality as well as on economic and ecological production parameters.
During the construction and maintenance of cement plants, as well as throughout the manufacturing operations, a high degree of technical expertise and experience is required.
Sika's professional team provide reliable and innovative system solutions.

INTEGRATED, FULLY COMPATIBLE SOLUTIONS FOR RELIABLE AND HIGHLY EFFICIENT CEMENT MANUFACTURING

1
a) Cement Additives
b) Vertical roller mill/ bal mill
c) Raw mill additives

2
CC / LC³ Additives

3
Belt repair

4
Waterproofing, sealing, protection and concrete repair

SMALL BUT WITH HUGE IMPACT

For better quality cements

THE CEMENT GRINDING PROCESS is the final chance to adjust the cement quality and 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.

Production quantities as well as cement quality are strongly affected by the grinding process and the separating efficiency.

WHY GRINDING AIDS ARE NECESSARY IN CEMENT PRODUCTION

Finely ground particles are attracted together forming agglomerates and release energy (agglomeration energy). These attraction forces are also the reason ground particles stick on the insides of the mill (coating effect), which softens the impact of grinding media. Agglomerates of sufficiently ground particles are detected by the separator as coarse particles and consequently return as reject to the mill.

Grinding aids are added at low dosages, typically in the range of 0.02 – 0.05%, to the mill feed or directly into the mill itself. Grinding aids reduce or even neutralize the surface energy by shielding the polarity to different degrees. Therefore, the particles do not attract each other anymore and the production process is optimized.

SURFACE ENERGY AND SURFACE TENSION

Atoms, molecules and ions always interact with one another. **Within homogeneous solids and liquids, the internal forces of opposite direction with equal magnitude cancel each other out. The formal energy is zero in the bulk.**

At the interface, there is a resultant force directed inwards due to cohesion (air-liquid interface). The energy of the top layer of surface atoms is above zero due to less binding sites. Solid materials possess surface energy and liquids also have surface tension. Nominally, these two are identical due to same value and dimension. Surface tension is a common phenomenon. **Therefore, small droplets are round and water striders as well as other small water-shedding objects do not become wet but "float" on the top of water.**

SikaGrind® ALLOWS PRODUCERS TO ECONOMICALLY ACHIEVE THE DESIRED FINENESS AND QUALITY OF CEMENT.

APPLICATION OF THE SikaGrind® TECHNOLOGY CAN HELP YOU TO FURTHER IMPROVE YOUR PROCESS AND PROFITABILITY.

THE EFFECT OF GRINDING AIDS

- They ensure that the particles stay separated. This enables fine ground particles to leave the mill, creating space for more coarse particles to be refined.
- Using grinding aids reduces the particle coating effect and leads to cleaner internal surfaces in the mill. This intensifies the crushing impact and friction for coarse material between the steel balls, what finally reflects a higher grinding efficiency.
- Particles treated with grinding aids are better dispersed when they enter the separator. The higher the powder dispersion, the greater the probability that the particles are detected faster.

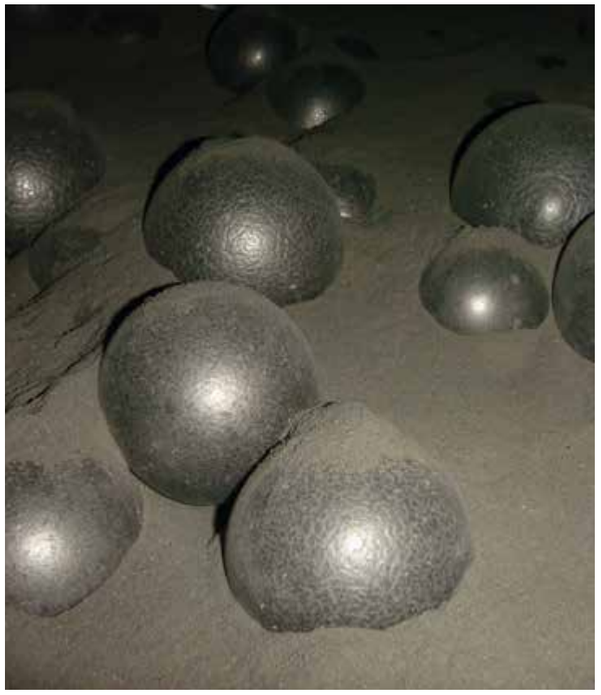
THE VALUE OF SIKA GRINDING AIDS

Grinding aids enhance 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 favorable particle size distribution with better cement quality.

Traditional grinding aids are based on amino alcohols and glycols used in formulated products, and also as the pure raw materials.

Sika has also developed polycarboxylate polymer powered grinding aid technology which is able to improve on the performance of the traditional technologies. The major advantage of this technology can be measured in production increase which arises because of even higher particle dispersion.

Fine particles tend to stick together.



Grinding aids reduce the attraction of the fine particles and keep surfaces cleaner.

EFFICIENT GRINDING PROCESSES

Production optimization for energy savings

CEMENT GRINDING CONSUMES A MAJOR PART OF THE TOTAL ENERGY USED IN CEMENT MANUFACTURING. Higher cement production rate leads to lower specific energy consumption per ton of cement. SikaGrind® products increase production rates and therefore reduce energy consumption.

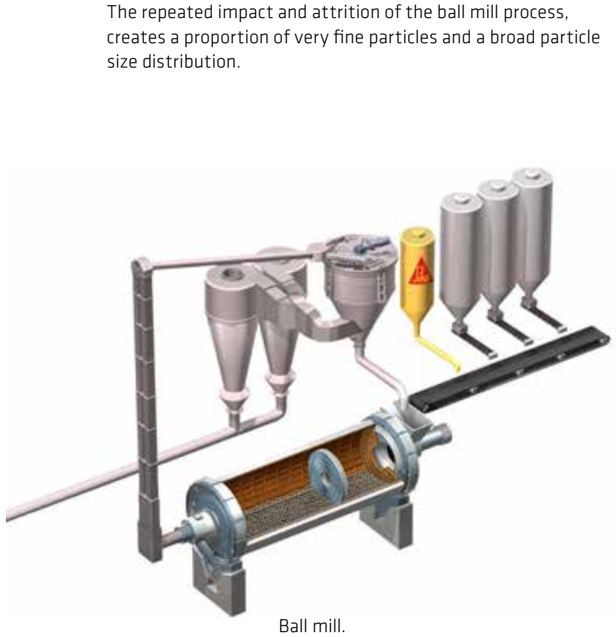
As not all cement plants and systems are the same, the best type and amount of grinding aid needs to be assessed for each one to correctly optimize costs and output. The type of mill needs to be considered as some equipment are more energy efficient than others. Also, the analysis of the full production processes is a key in the selection of the most appropriate grinding aid.

BALL MILLS

In a ball mill, the particles are ground by repeated impact forces. The material usually takes more than 20 minutes from mill entrance to outlet – unlimited impacts take place during this journey. Depending on the efficiency of the separator and the grinding aid, any remaining coarse grains or agglomerates of fine particles are rejected and fed back into the ball mill. The repeated impact and attrition of the ball mill process, creates a proportion of very fine particles and a broad particle size distribution.

VERTICAL ROLLER MILLS

In a vertical roller mill (VRM), the grinding process is by pressure and shear forces. The clinker passes very rapidly between rollers and a table. The energy input to the material during its passage between these is relatively low. The thickness of the material bed between roller and table is important to define for the particle size. Thanks to the integral separator, the material is separated and graded after each passage, unlike in a ball mill. The separation and particle size distribution is sharper and narrower in VRMs, which usually also have a faster and larger production than ball mills.



Ball mill.

Vertical roller mill.

The grinding of the finished cement consumes approximately one third of the total electrical energy of a cement plant. Some newer types of equipment such as vertical roller mills (VRM), have a higher energy efficiency than traditional ball mills.

Sika is a global company and fully committed to sustainable development, enhancing customer value, reducing environmental impact and assuming social responsibility. We provide sustainable solutions for energy-efficient, highly productive and low-carbon-footprint cement industry.

CEMENT ADDITIVES

The SikaGrind® product range

THE SikaGrind® RANGE OFFERS products and tailor-made solutions for the specific challenges of individual plants, with opportunities to optimize the production, quality of cement and its profitability.
The production and supply of blended cements is related to challenging conditions and the potential impact on the final concrete. Additives which positively influence cement handling as well as properties during concrete production can become a decisive factor.

Cement additives are classified into different product groups which can be adjusted to tailor made solutions.
With the SikaGrind® technologies, Sika meets specific requirements of local plants.

Sika provides the full range, including products of the following types:

BASIC GRINDING AIDS TO:

- Achieve a consistent higher level of cement production [tons/hour]
- Reduce the specific energy consumption [kWh/ton of cement]

QUALITY ENHANCING ADDITIVES WHICH:

- Enhance early and/or final strengths
- Allow clinker replacement lowering CO_2 emissions
- Accurately entrain air in masonry cements

ADDITIONAL SPECIAL ADDITIVES TO

- Adjust cement powder flowability
- Suppress carbon bleeding
- Improve concrete workability

SikaGrind® HELPS OPTIMIZE ENERGY USE IN CEMENT PRODUCTION

-10%
of kWh per ton cement produced

+15%
increase in cement production

GRINDING AIDS

Depending on the components and production conditions for each cement different types and quantities of grinding aid may be required. The grinding process costs and outputs can be optimized accordingly.

Sika solutions can be adapted to fulfill specific requirements.

SikaGrind® Optimizer / Stabilizer:
Products specially designed for production processes with:
- Ball mills – to optimize energy consumption and productivity.
- Vertical roller mills – to stabilize the cement bed and reduce vibrations in the mill.
- Roller press systems – to balance the operations and equalize flux.

QUALITY IMPROVERS

Market trends and global expectations require a strong reduction of clinker during cement production. In addition, increasing environmental standards demand significant reductions of CO_2 in the cement industry.

Power pack systems (with or without influence on grinding properties) can be used to influence the cement strength, as well as the setting and hardening performance.

SikaGrind® Activator
This range of products is recommended to grind and activate traditional range of blended cements.

Some of these products may be used to boost and reduce clinker and lower the CO_2 emissions during cement production.

Other products may improve the robustness and the strength, as well as the setting performances of the cement.

SPECIALITIES AND ESSENTIALS

This rage of products has been developed to fulfill specific local requirements from the cement producers, trying to influence the performance of cement in different applications.

“A la carte” performance by design with multiple solutions for the cement production process.

SikaGrind® Air
These special additives increase the air-entrainment capabilities of masonry and plastering cements.

SikaGrind® Control
Additives to modify the setting times of cements.

SikaGrind® Fluid
Specially formulated products to modify the cement rheology.

ENVIRONMENT

Growing environmental restrictions and sustainability requirements for the cement industry, such as reduction of emissions or the amount of specific components (e.g. chromium VI), have driven the development of special products.

The need to recycle and enter circular economy systems remains one of the goals with this type of products.

SikaGrind® Dust
Product range to inhibit dust emissions during the production process.

SikaGrind® Recarb
This range of cement additives has been specifically developed trying to recycle specific and discarded materials.

SikaGrind® Reducer
Additives formulated to reduce the level of chromium ions present in cement.

SIKA CEMENT ADDITIVES AS ENABLERS OF SUSTAINABLE CEMENTS

Calcined clay cements – the innovative technology to reduce CO_2 emission

CEMENT IS ONE OF THE LARGEST manufactured product on earth, by mass, with over 4.0 billion tons of cement produced yearly worldwide. As cement production accounts for up to 7% of global CO_2 emissions, it needs to play its part in achieving a carbon neutral industry.

CC stands for Calcined Clay in cement, and together with the well-known Limestone Calcined Clay Cement (LC^3), are two of the promising new technologies that will help the cement industry reduce emissions and work towards a more sustainable environment. CC and LC^3 offer similar performances to 100% Portland Cement, with a reduced CO_2 footprint, and are composed of widely abundant materials.

LC^3 is typically made up of 50% clinker, 30% calcined clay, 15% limestone and 5% gypsum, e.g. CEM II/B (Q-LL); Q=CC. It substantially reduces the amount of clinker and lowers the CO_2 emissions during production. It uses alternative materials during cement production which may be cheap and more accessible than traditional components, reducing also the production costs.

LOW CARBON

CC and LC^3 can save 30 – 40% of CO_2 compared to Ordinary Portland Cement (OPC).

READY TO BE IMPLEMENTED

CC and LC^3 are used similar to ordinary Portland cement (OPC), yet they are better in performance.

RESOURCE SAVING

CC and LC^3 use abundantly available materials and can save scarce resources.

COST EFFECTIVE

CC and LC^3 technologies reduce cement production costs.

GLOBAL SCALABLE

Suitable clays for CC and LC^3 are sufficiently available all over the world.

DURABILITY

Performance can be adapted to specific requirements.

The calcination of the new added clay requires lower burning temperature than the traditional process to produce clinker.

Additionally, the limestone is not calcined and there is a considerable reduction of CO_2 emissions for this type of cements.

Compared to existing cements, CC and LC^3 show some challenges in cement and concrete: namely it has a higher water demand and sometimes results in a reduced early strength development.

SikaGrind® CC range helps improving specific characteristics of the new types of cements compared to traditional formulations.

Sika's success in this field is reflected by fulfilling the requirements of the cement industry being able to supply calcined clay cements which are an alternative for the construction industry.

Around 7% of the world's CO_2 emissions are caused by cement manufacturing.

Clinker production contributes to high CO_2 emission during cement manufacturing.

Scientists developed the calcined clay technology to reduce up to 50% of clinker in cement and up to 40% CO_2 emissions during cement manufacturing.

Sika's innovative SikaGrind® CC additives enable cement producers to manufacture limestone calcined clay cement, reducing CO_2.

SOLUTIONS FOR CONVEYOR BELTS

RUBBER CONVEYOR BELT SYSTEMS ARE USED EXTENSIVELY FOR RAW MATERIALS TRANSPORT IN CEMENT PLANTS. These belts are subject to heavy impact and wear, causing downtime and extra costs during repairs and replacement. Sika's expertise can provide superior cost-performance options for bonding and repair of rubber belts and components.

REPAIR OF CONVEYOR BELTS
SikaBond® R&B-100 is ideal for fast conveyor belt repairs, with minimal downtime and a rapid return to service. This is a 2-component, high-performance, elastomeric, synthetic resin-based system, specially designed for the repair of both textile and steel reinforced rubber conveyor belts. The material is primarily used to repair commonly occurring, non-structural damage, such as holes, cuts and ripped edges caused by the rocks.

Its use significantly extends the service-life of the conveyor belts. When applied, it cures fasts and develops outstanding mechanical properties on a well-prepared substrate.

BONDING OF CONVEYOR BELTS
The vulcanization of rubber is time-consuming and can be an expensive business with a lot of hardware and special know-how involved. Sika is one of the few companies with global reach and patented knowledge in this field, able to supply rubber-conveyor belt bonding adhesives.

The SikaBond® technologies are fast curing, flexible adhesive systems, designed to replace mechanical fixings or fastenings, such as rivets, screws, welding or vulcanizing. SikaBond® systems are also suitable for bonding to rubber, metals, hard plastics, glass and wood.

NEW BUILD, REPAIR AND REFURBISHMENT OF CEMENT PLANTS

WATERPROOFING, SEALING AND REPAIR OF DIFFERENT STRUCTURES in the cement factories can be done with various complementary technologies from the diverse Sika product range.

WATERPROOFING SYSTEMS
Waterproofing protects structures against water infiltration which can cause expensive and irreversible damage. Building structures are exposed every day to intense fluctuations in moisture levels and temperatures, all contributing to their deterioration. Count on Sika to provide long-lasting waterproof systems to protect your cement plant structures.

Sika's solutions are suitable for even the most challenging requirements to keep water in or out of long-lasting structures. They have also been developed for special site conditions and requirements, including resistance to microbiological and chemical attack, plus products with high mechanical resistance, free of physically linked plasticizers and ecologically sustainable products.

CONCRETE REPAIR
Deterioration of concrete may happen due to corrosion, structural damage, water infiltration, seismic activity or other reasons. Many decades of focussed research and development, as well as practical experience all around the world, have enabled Sika to develop fully comprehensive solutions to repair and refurbish concrete buildings and structures.

Repair and renovation of concrete buildings and infrastructure is an important process – it helps us to provide a sustainable approach to building – prolonging the life of a structure and preventing demolition and reconstruction. The choice of the appropriate rehabilitation strategy, based on the root cause of concrete failure, can also significantly improve the overall performance of a structure. Sika has a wide portfolio of products and systems to solve many concrete repair needs.

CONCRETE PROTECTION
Depending on their location and use, concrete structures are subjected to a wide range of exposure conditions – from normal atmospheric carbonation to the aggressive influences in polluted urban and industrial environments, plus marine atmosphere and liquid or gaseous chemicals, along with influencers that can damage or attack the concrete and embedded steel reinforcement. With over 100 years of experience, Sika has global expertise in concrete repair and protection.

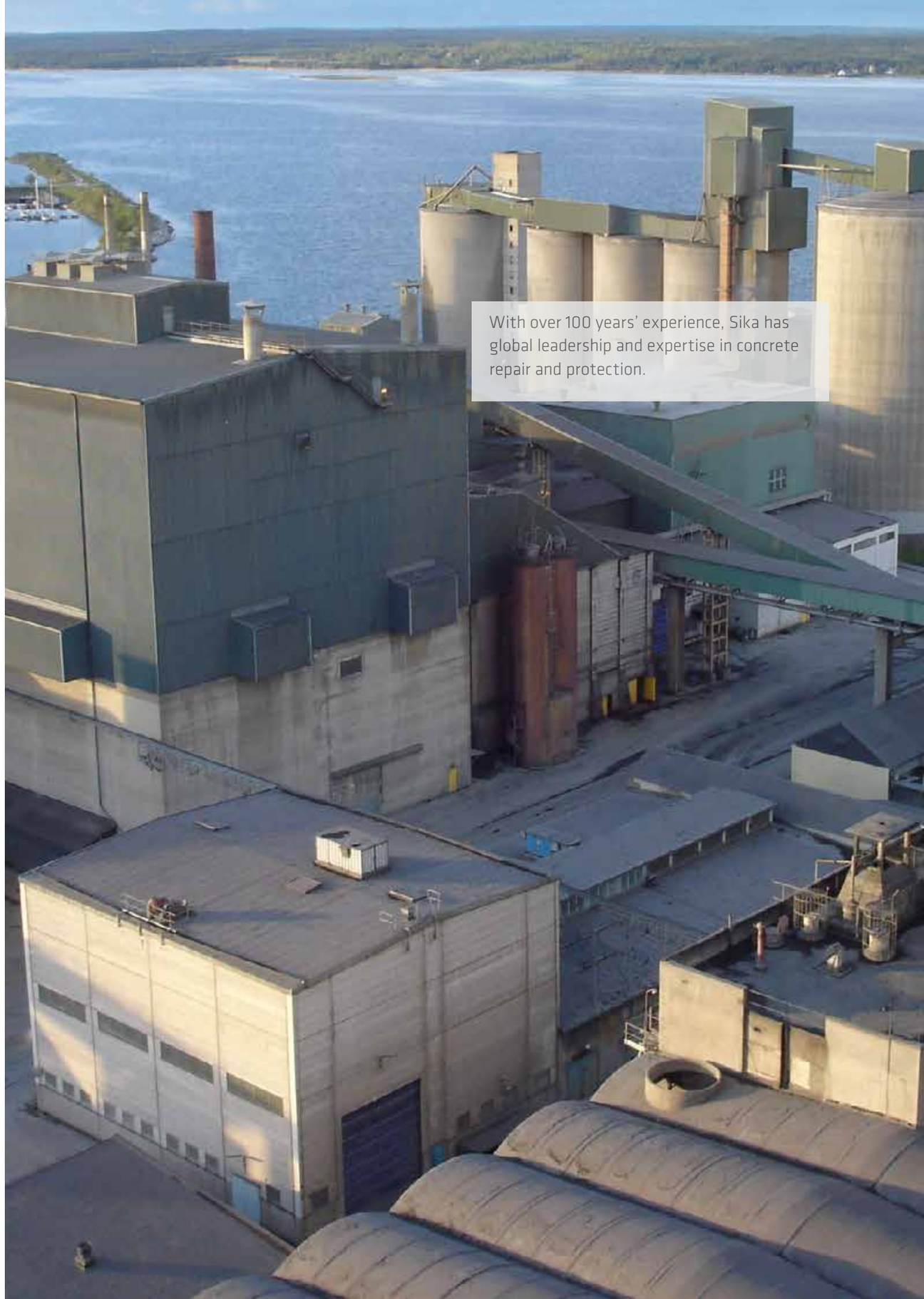
JOINT SEALING
At the joint, the different building elements, materials and trades meet. A joint occurs where two components meet and may occur within an element of construction or as part of an interface between two elements.

Joint sealing facilitates the construction process as many components made of different materials are used. Additionally, joints allow movement of the components but the elements must remain water, air, heat, cold and vapor tight.

Sika can support you, avoid making mistakes where your building is most vulnerable to leakage – the joint.

INJECTION SEALING
Injection is a procedure of pumping materials, which can be based on cement, polyurethane, epoxy or acrylate, into damaged or cracked structures to securely seal leaks, repair compromised structures and make them watertight again for the long term.

With all the necessary products and systems, Sika delivers high performance solutions.



RELIABLE SERVICE

Sika support for your cement production

OUR AIM OF IMPROVING YOUR PROFITABILITY STARTS BEFORE WE FIRST MEET,
as Sika's R&D is constantly in progress to further enhance technologies, products, and performance, for the best solutions to meet your needs.

At Sika, we understand and support your cement business. to fulfill your requirements and to solve any specific problems that arise.

As local conditions vary widely, and so do the demands these impose on the plant, it is necessary to handle every plant individually. Sika provides tailor made solutions, designed to meet the individual challenges.

After working together to identify feasible targets, including defined parameters, one or more Sika products / combinations are recommended for trials.

If necessary, laboratory pre-trials can be arranged in one of our regional laboratories.

The preparation and execution of trials is handled by Sika specialists in cooperation with your plant team. The results and the analysis are discussed to agree targets.

After trials and only by reaching the desired targets, Sika actively supports implementation of the agreed actions in the production process and/or quality concept, including all necessary logistical steps.

Finally, Sika's follow-up strategy ensures that we work together for constant improvement.

TECHNICAL AND SCIENTIFIC KNOW-HOW
We bring together scientists and engineering experts from different areas, offering technical and practical support to the cement producers.

To rapidly analyze and develop new additives for the cement industry, we use the X-Ray powder Diffraction (XRD) which is a powerful technique for characterizing materials.

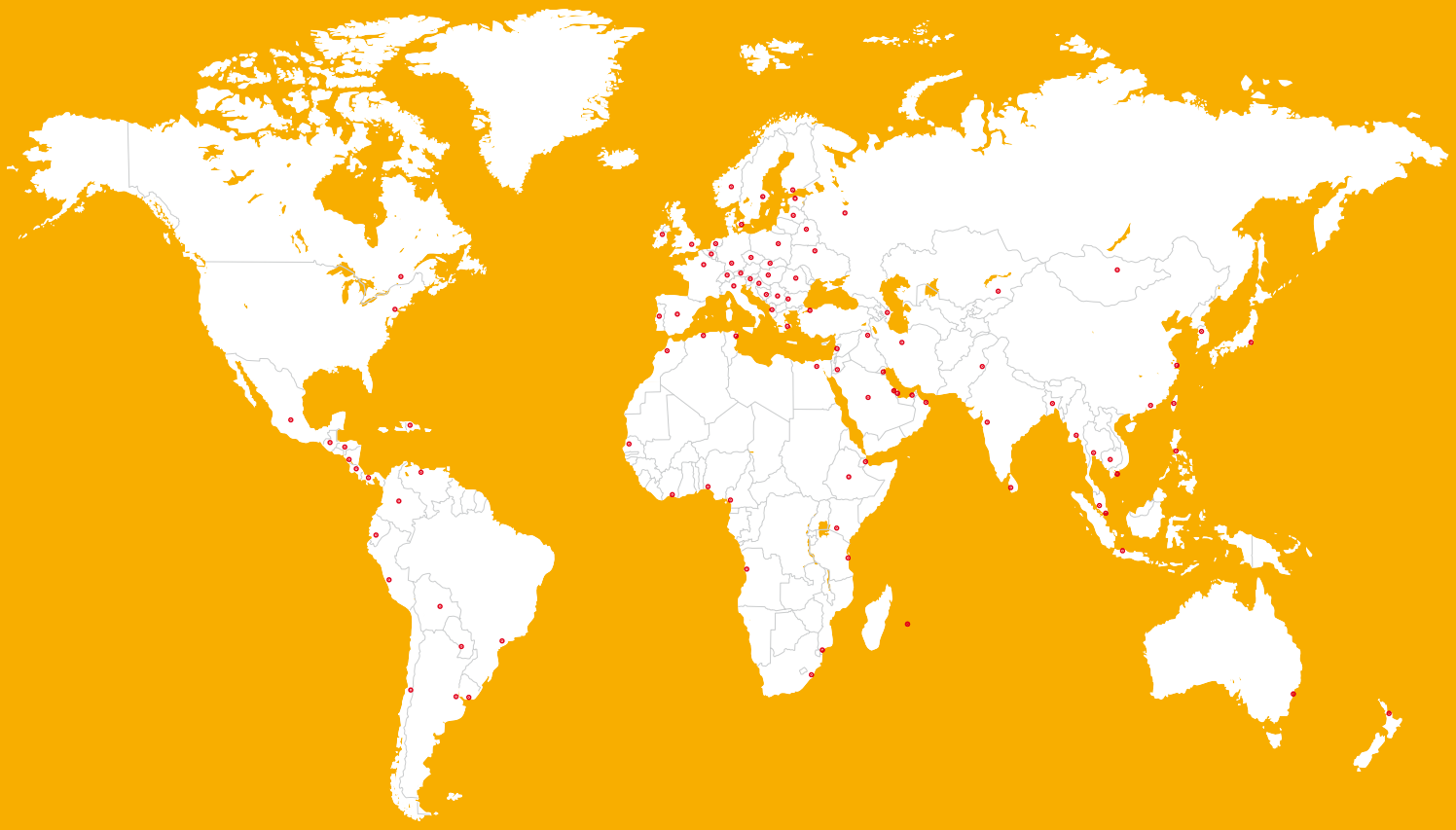
INNOVATION – VALUE FOR CUSTOMERS
Innovation has a long-standing tradition within Sika, and "Courage for Innovation" is one of the corporate values. Sika maintains exclusivity over its innovative and sustainable products for the cement industry.

Sika has:
- One corporate technology center in Switzerland, 20 Regional Technology Centers and 55 Local Technology Centers
- An international network of scientists, partners, suppliers and customers
- A goal to combine performance and sustainability in providing optimized solutions to our customers

GLOBAL PRESENCE AND LOCAL SUPPORT
Sika is recognized as a complete solution provider for cement producers throughout the cement production, the construction and the refurbishment of the facilities.

Our services include:
- Quality control processes
- Development of specific products
- Remote and on-field support during plant trials
- Trainings and workshops

GLOBAL BUT LOCAL PARTNERSHIP



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 automotive industry. Sika has subsidiaries in 103 countries around the world and, in over 400 factories, produces innovative technologies for customers worldwide. In doing so, it plays a crucial role in enabling the transformation of the construction and vehicle industries toward greater environmental compatibility. With more than 33,000 employees, the company generated sales of CHF 11.2 billion in 2023.

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