

Flotation collectors for optimized performance

Mining Chemicals

AkzoNobel



Winning together – delivering optimized performance for your mineral processing needs

Reliable supply, consistent quality and safe use

AkzoNobel is one of the world's leading specialty chemical manufacturers and its products have served the mining industry since the 1940s. Whether you need a tailor-made or standard flotation collector, we will partner with you to develop and deliver just the solution required.

Our core principles are safety, integrity and sustainability. We keep our commitments to you and our environment, and strive to be the best at everything we do, every day.

With our proven track record of delivering optimized solutions, as well as our world-class reliable supply chain, our technical knowledge and our flotation collector expertise, we are ready to partner with you for a sustainable future.



Headquarters

- Chicago, USA
- Stenungsund, Sweden
- Shanghai, China

Manufacturing

- Boxing, China
- Chattanooga, USA
- Houston, USA
- Fort Worth, USA
- Itupeva, Brazil
- Mons, Belgium
- Morris, USA
- Saskatoon, Canada
- Singapore
- Stenungsund, Sweden
- Stockvik, Sweden

R&D Centers

- Brewster, NY, USA
- Bridgewater, USA
- Chattanooga, USA
- Houston, USA
- Deventer, The Netherlands
- Itupeva, Brazil
- Mumbai, India
- Singapore
- Shanghai, China
- Stenungsund, Sweden

Together we succeed

We believe that by combining your expertise relating to your particular flotation process and ore with our expertise of chemicals and their function, we can maximize recovery and grade of your concentrates.

With over 50 years of surface chemistry experience and partnering with the industry, we are committed to finding the best solution for your specific ore.

Whether you need a tailor-made or standard collector, we approach each assignment individually, assuming the role of a partner rather than a traditional supplier. Our dedicated flotation specialists are ready to work with you to optimize your particular process.

Towards a sustainable future

Our focus is not only to support you in making the best use of natural resources, but also on ensuring that the flotation collectors are handled in a safe way.

We have extensive knowledge and experience of assessing the impact of our collector chemistry on the environment. To optimize the support we offer, we have developed unique methods of analysis for detecting very low levels of our products in water and air. We have an experienced team of toxicologists, a world-class analytical department and – last but not least – an accomplished mining team.

Regulatory Support – case description

A customer requested our support to ensure that the use of our product at their site would be safe for the environment. Since the plant had not been built yet, discharge water measurements could not be carried out.

Solution

Our ecotoxicologist and flotation technical team worked in close collaboration with our customer to understand the different flows of the mine to set up a risk assessment plan for this unique operation. A lab flotation program was put in place to simulate a full-scale process, and water samples were collected. The analytical department developed a water-analysis method for detecting the level of substances down to parts per billion, which was used on the samples. In the end, having compared the predicted exposure with the toxicity, the use of our product was deemed safe. After the plant was commissioned, additional water samples were taken, and these verified the risk assessment.



Serving a wide range of applications

How do you achieve successful flotation? By ensuring optimal interaction of all components of the process, where the flotation collector's performance plays a key role.

Ideally, collectors should be:

- strong enough to enhance recovery but weak enough to enhance selectivity
- able to provide a high rate of flotation and good froth characteristics
- non-sensitive to variations in the composition of the ore and the quality of the water
- designed to meet environmental requirements
- easy to ship, store and handle
- cost-effective

Our products are marketed under the following brands:

- Armac®
- Armeen®
- Armoflote®
- Armacflote®
- Atrac®
- Berol®
- Ethomeen®
- Lilafлот®

Mineral	Task
Phosphate/apatite	Beneficiation in systems containing silicates, carbonates and/or Fe- containing impurities
Magnetite/hematite/itabirite	Removal of silica and/or phosphorus
Potash	Removal of clays, direct flotation of sylvite or halite flotation
Calcite	Removal of discoloring minerals and/or silicates
Barite Magnesite Spodumene	Reverse flotation where impurities are silicates
Wollastonite Fluorspar Zinc Oxide Pyrochlore Kaolin Feldspar Scheelite Silica	Direct flotation of minerals



Flotation of potash

Potash is the most important source of potassium in fertilizers. Flotation is one of the major methods used to upgrade the potash.

We are the world-leading supplier of collectors to the potash industry which we have been serving for over 70 years. For the direct flotation of potash, we can deliver either standard amine produced from different types of fatty acids, or special formulations. In some cases, where clay minerals are present in the ore, a slime flotation step using flotation collectors is undertaken prior to potash flotation. We also offer collectors for reverse flotation where halite is floated to beneficiate carnallite.

Case description

A potash customer using direct flotation of sylvite contacted us with issues of flotation recovery, especially involving coarse sylvite. When brine temperatures went above 30°C, the recovery started to drop and it was not possible to compensate completely by increasing dosage.

Solution

To support the customer, we designed an experiment to evaluate the effect of temperature on recovery and to look at how different amine blends could stabilize the system. As a result, a new formulation was developed that improved the recovery by 4–5 percent at temperatures around 35°C.



For flotation of potash:

Armeen®
Armac®
Ethomeen®
Armoflote®

Flotation of phosphate

Phosphate ore is the most important source of phosphorus in fertilizers. To supply the phosphoric acid plant with phosphate, a high grade of phosphorus is essential, as well as reduced levels of impurities such as magnesium, iron and aluminum oxides.

Flotation is one of the key beneficiation methods. As ores become more complex, the need for tailor-made solutions increases. With over 30 years of experience in phosphate flotation, we have developed boosters as well as customized collectors where the traditional fatty acids are not working optimally for direct flotation. We have also developed direct flotation collectors that successfully float magmatic phosphate from gangue minerals such as silicates and carbonates. In cases where direct flotation is not feasible, we provide carbonate and silica collectors for reverse flotation. In our laboratory, in close collaboration with you, we can fine-tune our products to the particular requirements of your ore.

Case description

We were contacted by a phosphate company that wanted to improve its direct phosphate flotation process with the main impurities being silicates. There were extreme fluctuations in the flotation performance depending on the amount and complexity of the silicates in the feed, as well as a significant drop in performance as process water temperatures went below +15°C in winter time. At the time, the only available solution for improving performance at lower temperatures was heating the process water to more than 15°C, resulting in high energy costs. In order to deal with changes in ore quality, the fatty acid dosage needed constant adjustment over a wide range.

Solution

To improve the robustness of the flotation process and be able to perform flotation successfully at temperatures below 15°C, an anionic booster was proposed to be added to the fatty acid used. On evaluation of the plant, it was recognized that the addition of the booster removed the need for heating and also reduced the total collector dosage by 25 percent and improved the recovery by one percent. By using the booster year round, the collector blend dosage rate was kept stable and a slightly higher recovery was experienced.



For flotation of phosphate/apatite:

Atrac®
Berol®



Flotation of iron ore

The main objective of iron ore flotation is to upgrade the concentrate by removing silicates and/or phosphorus-containing minerals.

The use of silica flotation has increased in recent decades. The trend will continue as more complex ores have to be mined and higher-grade iron ore concentrates with fewer impurities are requested by the steel industry.

For more than 25 years, we have been developing flotation collectors in close collaboration with the industry both for magnetite and hematite systems. In recent years, we have developed new methodologies to study froth characteristics that complement the traditional float tests. This has improved our ability to successfully progress from the lab to full-scale plant conditions.

Case description

An iron ore company was looking for an alternative product for silica flotation. They requested a product that would achieve the same metallurgical results as the one they were using, but with improved froth characteristics.

Solution

Several different products were screened at the customer lab. A product was identified that fulfilled the requirements of the metallurgical results (it even surpassed them slightly) and at the same time offered improved froth characteristics. Another benefit of the product was that it caused less odor in the flotation plant, which has improved the working environment.



For flotation of iron ore:

Atrac®
Lilafлот®

Flotation of calcite

Our customized collectors remove silicates and graphite from calcite to improve its brightness and reduce its abrasiveness.

Natural calcite deposits contain various types of silicates and graphite. For applications like paper fillers, calcite characterized by a high level of brightness and low level of abrasive silicates is required.

Drawing on more than 40 years of experience from the field, we have developed several formulations to improve the performance of flotation collectors for calcite systems. The formulations are tailored to aspects such as ore complexity and particle size. In cases where discoloring minerals are present, we offer collectors that can be used independently or in combination with silica flotation collectors.

Case description

One of our customers approached us requesting an improved silica flotation collector for reverse flotation of calcite as their ore and needs were changing. The reason for the request was that the quality of the ore feeding the flotation plant had been reduced – resulting in lower recoveries – and that the current collector generated excessive froth in the flotation circuit as well as downstream from the flotation plant.

Solution

A large development program was initiated in close collaboration with the customer to develop a new silica collector. As a result, a new product was developed that – at the same collector dosage as the previous product – improved the froth characteristics in the flotation plant and resolved the froth issues downstream. The metallurgical results were also improved, resulting in a two percent better recovery at the same grade. An additional benefit was the liquidity of the new product, which reduced production downtime in winter.



For flotation of calcite:

Lilafлот®
Armoflote®
Armeen®
Ethomeen®



Delivering optimized performance

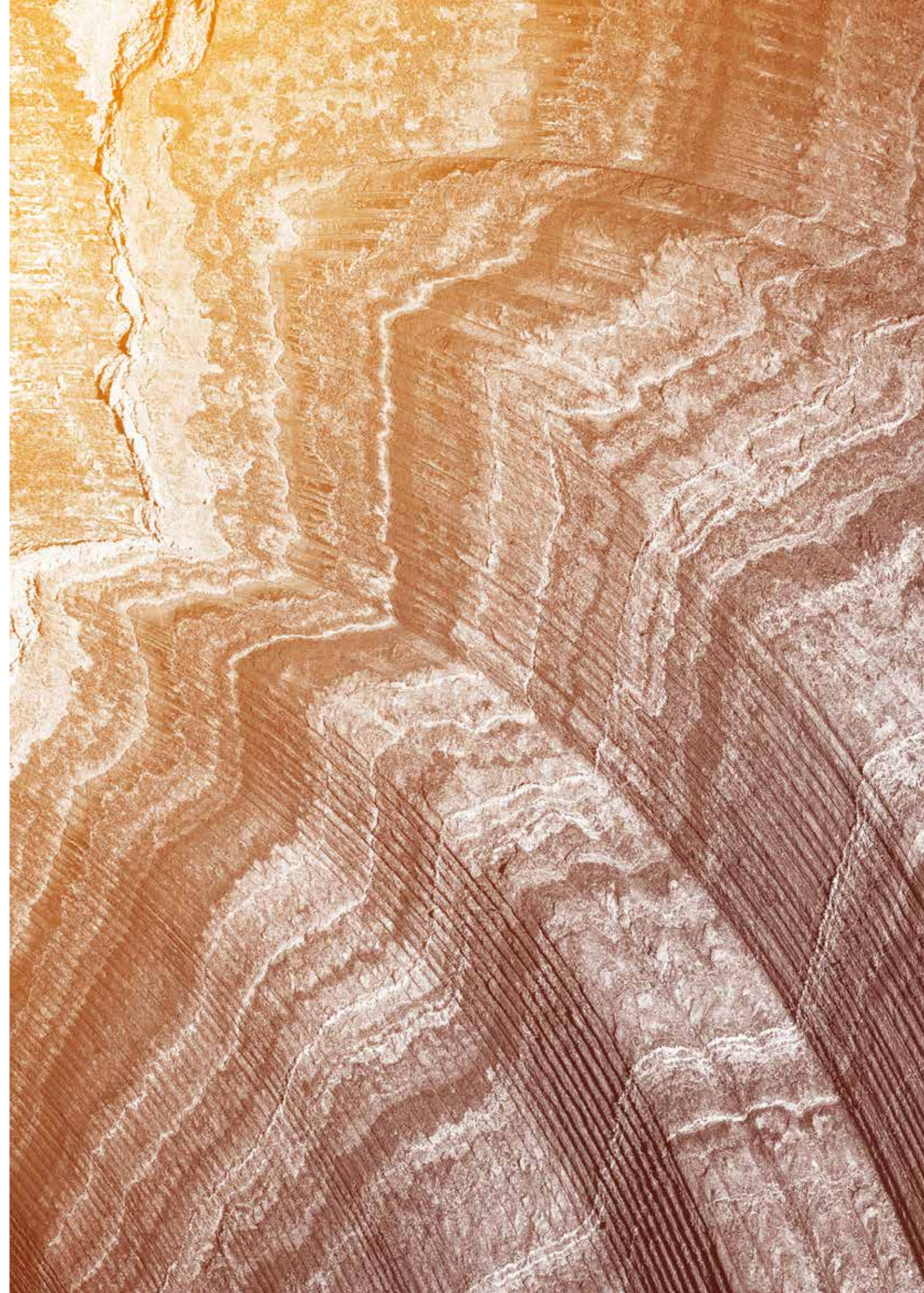
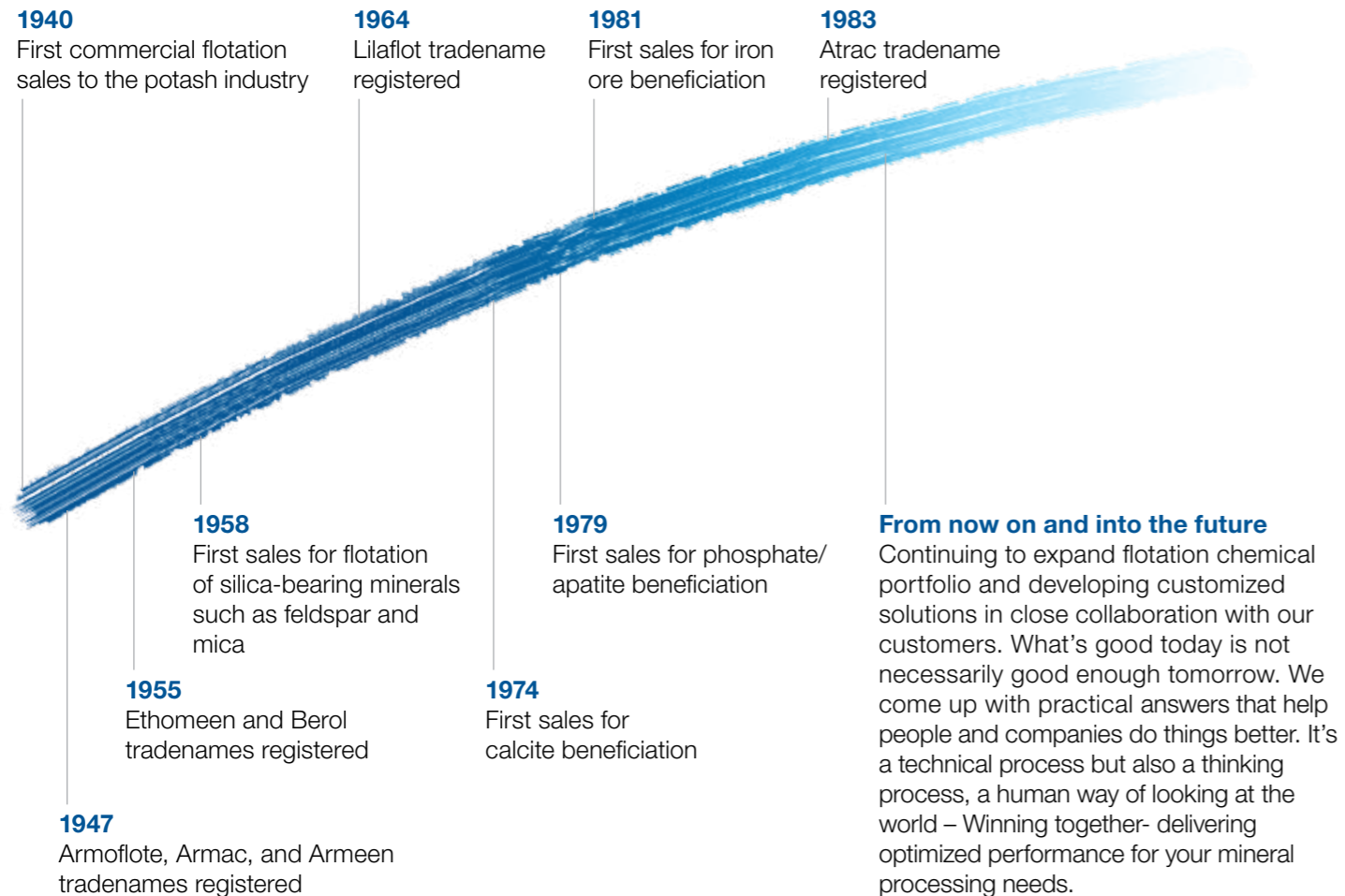
We conduct business all around the world. At AkzoNobel, we are proud to have dedicated teams that can support your needs.

Our global supply chain guarantees on-time delivery of products with consistent quality to meet your demand. Our responsive highly experienced mining team is ready to work with you to find the optimal solution for your ore. With our fully-equipped mining labs in Sweden, Brazil and the United States backed up by our highly experienced synthesis and analytical team, we are confident we can support you in maximizing your recovery and yield.

Mining laboratory capabilities:

- laboratory flotation equipment (Denver, Mechanobr, Agitair, etc.)
- ore characterization capabilities
- crushers
- wet and dry grinding capability
- froth characteristics equipment
- analytical, wet chemistry and chromatography
- microscopy techniques
- synthesis department
- design of experiments, multivariate data analysis
- flotation process optimization

AkzoNobel history in Mining



Planet Possible: Our commitment to doing more with less

Our success as a company depends on sustainability. At AkzoNobel we have sharpened our focus on sustainability by reviewing our sustainability risks and opportunities against global trends and evaluating how they will impact our customers by 2020. We express the outcome as our Planet Possible approach to sustainability. It's our commitment to creating more value from fewer resources.



We know only too well that our future hinges on our ability to radically do more while using less.

- More innovation, less traditional solutions;
- More renewable energy and materials, less fossil-based;
- More value chain focus, less introverted thinking.

Employing our new strategy of radical efficiency, we work with customers and suppliers to open infinite possibilities to a finite world. Learn more at www.akzonobel.com/planetpossible

Number 1

was our position in the Materials industry group on the 2015 Dow Jones Sustainability Index.

At least 20%

is the share of revenue we aim to achieve by 2020 from products with a sustainability advantage for customers.

More than 25%

is the reduction we aim to achieve in our cradle-to-grave carbon foot print per ton of product by 2020.

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AkzoNobel creates everyday essentials to make people's lives more liveable and inspiring. As a leading global paints and coatings company and a major producer of specialty chemicals, we supply essential ingredients, essential protection and essential color to industries and consumers worldwide. Backed by a pioneering heritage, our innovative products and sustainable technologies are designed to meet the growing demands of our fast-changing planet, while making life easier. Headquartered in Amsterdam, the Netherlands, we have approximately 45,000 people in around 80 countries, while our portfolio includes well-known brands such as Dulux, Sikkens, International, Interpon and Eka. Consistently ranked as a leader in sustainability, we are dedicated to energizing cities and communities while creating a protected, colorful world where life is improved by what we do."

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