Industrial Solutions

# POLYCOM® high-pressure grinding roll.

The economic and gentle processing solution.

thyssenkrupp

# POLYCOM® high-pressure grinding roll

**The high-pressure grinding roll has proven to be extremely effective for the grinding of mineral raw materials. With numerous POLYCOM® installations in different industrial sectors, ThyssenKrupp Industrial Solutions is the worldwide market leader for this technology. Thanks to the application of ultramodern production processes, the plants protect resources and the environment and guarantee plant owners maximum productivity and economy of operation. Sustainable product solutions that are required by clients all around the world.**

**The majority of high-pressure grinding rolls used in the minerals industry are made by ThyssenKrupp Industrial Solutions.** The POLYCOM® operates convincingly all around the world, comminuting copper ore, gold ore, iron ore, diamond ore, platinum ore, coal, granulated blast furnace slag, limestone, cement clinker and other mineral raw materials.

This type of mill offers the minerals industry numerous benefits:

- ✓ **Safe process technological design.**
- ✓ **Low operating expenses:** in comparison to other systems, both the power consumption and the costs for wear parts are significantly lower.
- ✓ **High throughput rates:** a high-pressure grinding roll can replace several reduction crushers. This reduces the space requirement.
- ✓ **Metallurgical advantages** in the downstream process stages.
- ✓ **Shorter delivery, assembly and commissioning times** than can be achieved with other systems.

POLYCOM® units are designed for throughput rates in excess of 5,000 tph.

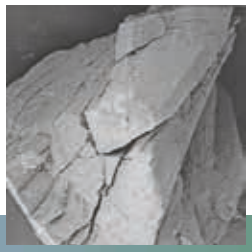
The mill feed material can be dry or moist, with particle sizes ranging from below 1 mm to 75 mm.

If required, the material can be dried in screens or air separators in a closed circuit grinding system.

The new low-maintenance wear protection systems for roll surfaces permit even the most abrasive materials to be efficiently ground.

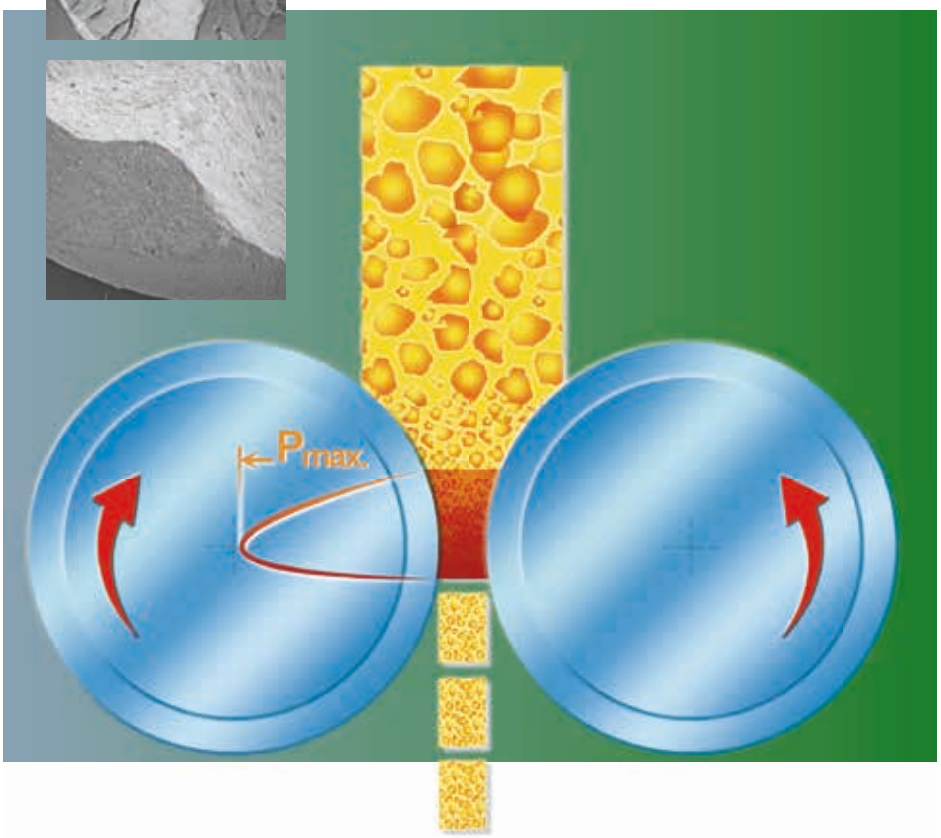
**Because of the short material dwell time in the mill, the machine settings can be quickly altered by the touch of a button, making the process easy to control and permitting rapid compensation for fluctuations in the properties of the feed material.**

Modern, user-friendly regulating, monitoring and control devices, combined with advanced process technology, ensure reliable and effective operation of the plant and an efficient process cycle.





Compared to the crusher product (lower picture) the POLYCOM® product (upper picture) is extensively cracked.



# The economic and gentle processing solution

**The following features distinguish the POLYCOM® high-pressure grinding roll from other grinding systems:**

- A hydropneumatic spring system builds up a pressure of up to 250 MPa in the layer of material between the rolls. During operation of the machine it is possible to alter the pressure and thus change the product fineness.
- Highly wear-resistant roll surfaces achieve service life times of up to 10,000 hours when grinding abrasive hard rock. When softer materials are involved, the service life can even exceed 20,000 hours.
- The feeding device ensures that the machine permanently runs with the optimum filling level – the precondition for efficient operation and a high service life of the rolls.
- The drive system can be equipped with variable speed motors in order to compensate for throughput variations in the upstream and downstream process.

Whereas the grinding action of a tube mill involves a mixture of compressive and shear forces, the POLYCOM® imposes virtually pure compressive force on the layer of material between the rolls. The compression stress thus caused in a particle of material is more than five times higher than shear stress would be.

Comminution in the POLYCOM® results in a product that has a far higher percentage of fines than could be achieved in a conventional crusher.

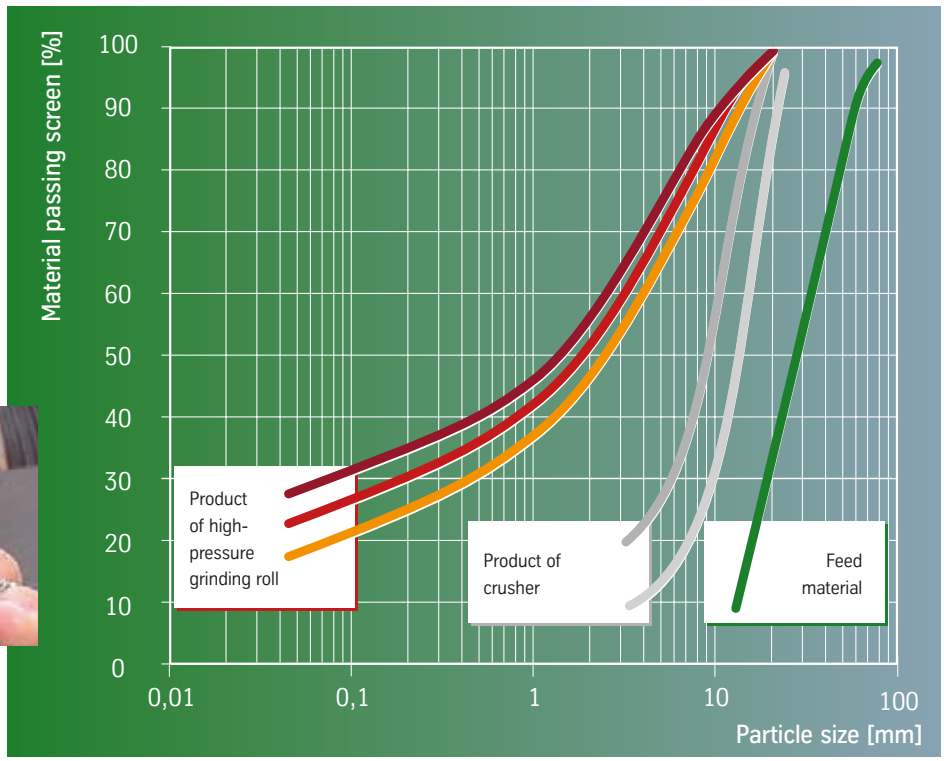
Moreover, the coarser particles show extensive cracking which reduces the amount of grinding work to be performed in the downstream mills and improves the liberation of metal from the ore.

The benefits are particularly noticeable in the heap leaching process, where the POLYCOM® product demonstrably increases the yield and thus the operating economy of the facility.

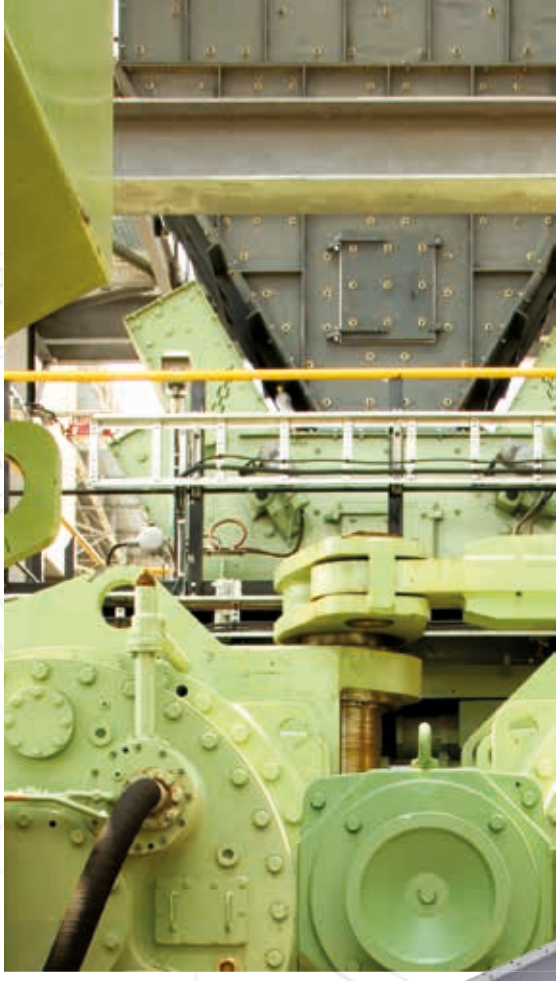
The grinding elements of the high-pressure grinding roll are two counter-rotating rolls, between which the material is crushed. One roll is designed as a fixed roll and the other one as a floating roll.

The required comminution pressure is transmitted by a hydraulic system via the floating roll.

POLYCOM® particle size distribution.



# Innovative POLYCOM® design



In order to fulfil the expectations placed on the high-pressure grinding roll, such as

- ❍ long service lives of the roll surfaces,
- ❍ optimum feed material pull-in capability for maximum throughput rates, even of moist materials and
- ❍ easy replacement of worn roll bodies,

the POLYCOM® rolls have a length to diameter ratio of between 0.3 and 0.7.

This provides the following advantages:

- ✓ large roll diameters allow the feeding of lumpy ores,
- ✓ minimised wear costs,
- ✓ thick roll tyres permit refurbishment of the roll bodies (a further wear-cost-reducing aspect),
- ✓ self-aligning roller bearings dimensioned for safe and reliable operation,
- ✓ quick and safe mounting and dismounting of the gear unit during roll changes because it is only bolted onto the shaft.

The fixed and floating rolls are both mounted in bearing blocks. The self-aligning roller bearings, which compensate for skewing of the rolls, have a multiple seal system to prevent dust penetration and grease loss. The bearing blocks of the fixed roll are bolted onto the machine frame, while those of the floating rolls travel in a longitudinal slideway. The fixed and floating rolls are of identical construction and can therefore be interchanged.

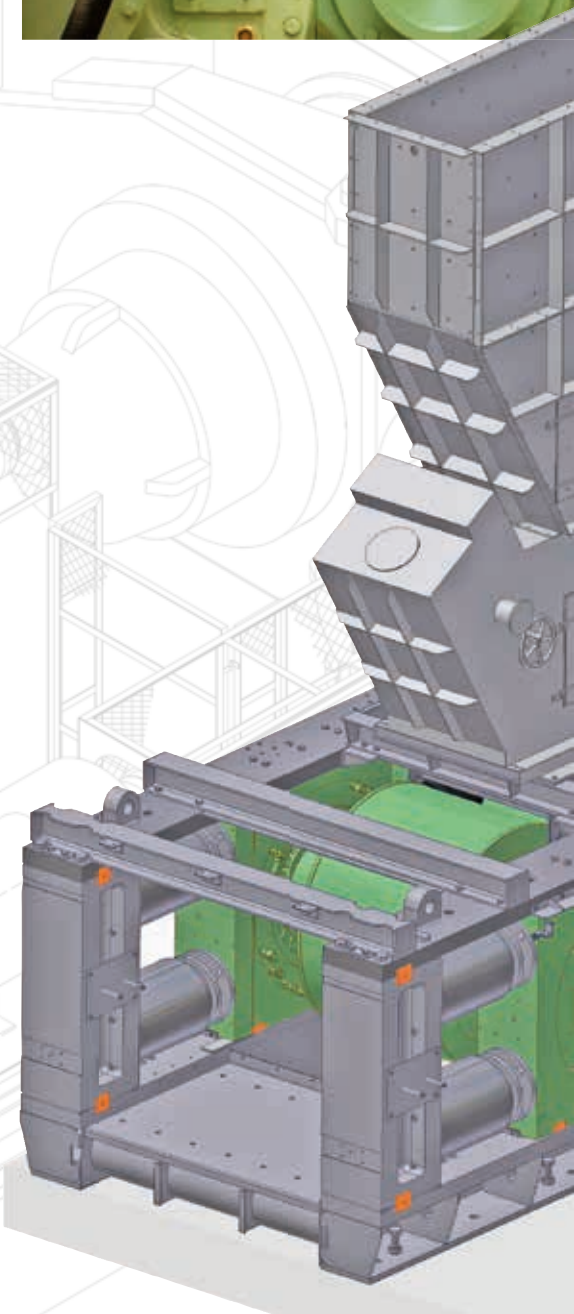
The grinding force is transmitted to the floating roll by four hydraulic cylinders. A hydropneumatic spring system allows the setting of different pressure characteristics and different control methods to enable optimum application of the grinding pressure in the roll gap and to protect the machine against possible overloading. The floating roll automatically accommodates to changes in feed material characteristics by moving outwards or inwards. Spacers prevent the rolls from touching.

Self-aligning roller bearings compensate skewing of the floating roll.

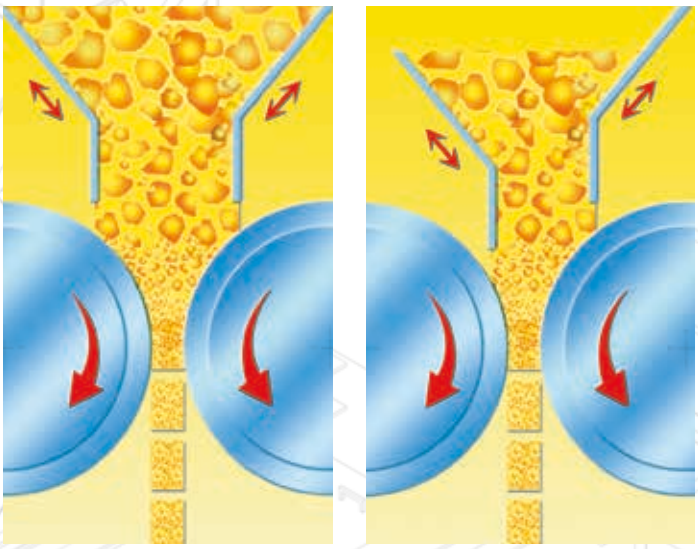
The roll drive system consists of:
❍ constant or variable-speed electric motors ❍ V-belt connection to the gear units up to a drive power of 300 kW per motor ❍ cardan shaft connection to the gear units > 300 kW ❍ mechanical overload coupling for protecting the gear unit and ❍ planetary gear unit.

The feed chute is an important component for the assurance of reliable and optimum operation of a high-pressure grinding roll.
❍ For moist and sticky feed materials (such as iron ore concentrates), ThyssenKrupp Industrial Solutions installs vertical feed chutes with straight walls.
❍ For lumpy feed materials, chutes that assure mass flow are installed.

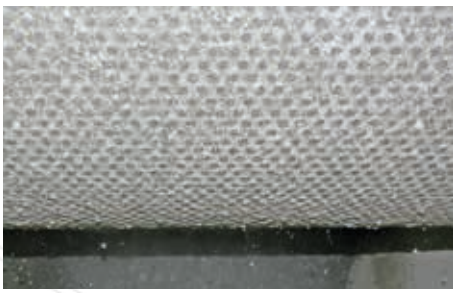
In order to ensure uniform distribution of the drive power to the two drive motors, the vertical feed shaft can be equipped with infeed guide plates to adjust the distribution of material flowing through the mill. If this feeding device is installed, the material filling level is monitored by means of load cells.



# A guarantee for high availability and for economical continuous operation



Principle of feed shaft adjustment.



Autogenous wear protection: ground material accumulates between the hard metal studs and thus minimises the wear of the roll surface.

Since the introduction of the POLYCOM®, the wear protection concept has been constantly improved and adapted to the requirements of the different industries.

ThyssenKrupp Industrial Solutions offers:

- forged, hardfaced roll bodies,
- chill cast alloy tyres made of bainite,
- roll bodies made of compound casting and
- roll bodies with hard metal studs.

For abrasive materials, roll bodies with surfaces protected against wear by hard metal studs are generally used.

This version ensures a long service life and therefore a high plant availability and the lowest maintenance requirement. It also enables moist and sticky materials to be ground.

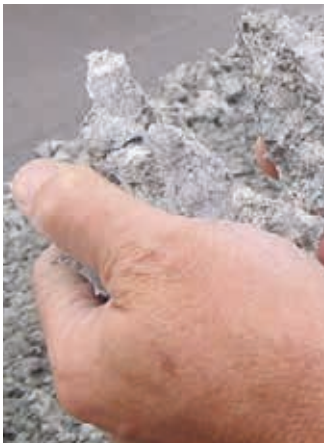
The design of the hard metal studs (geometry, hardness and metallurgical composition) and their arrangement on the roll surface are selected to suit the operating conditions and feed materials.

Nowadays, roll service lives of up to 10,000 h for hard rock, up to 12,000 h for diamond and iron ore and up to 30,000 h for iron ore concentrate applications are achieved. Depending on the operating parameters, higher values are also possible.

Roll body with hard metal studs.

# Application examples High-pressure grinding rolls in concentrator plants ...

Compared to crushers, the POLYCOM® produces a significantly higher percentage of fines. Moreover, the comminuted particles have a large number of micro cracks. These product features provide enormous economic and process technological benefits for the various minerals applications ...



Ground platinum ore.

For many ores the POLYCOM® is an economically superior concept compared to conventional systems, such as reduction crushers or SAG mills.

The prospect of achieving maximum increases in the throughput of existing grinding plants also make the POLYCOM® a popular machine for plant extensions. Thanks to its low space requirement and high capacity in relation to machine size, the POLYCOM® can be easily incorporated into existing plant configurations.

Used as a primary grinding unit upstream of ball mills, the POLYCOM® can boost the throughput by 20 to 30 %.

From mineral resource to finished product

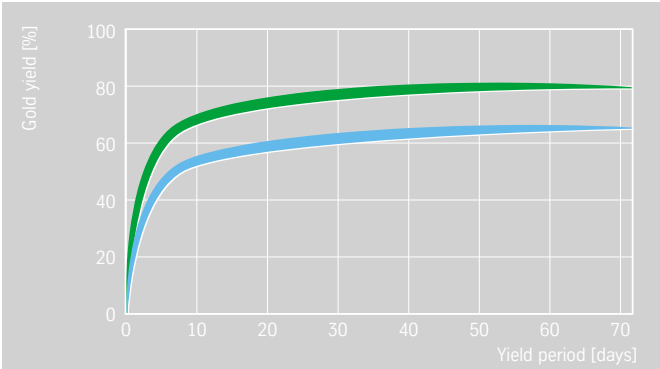
The first step on the way to gold jewellery is the liberation of gold particles.

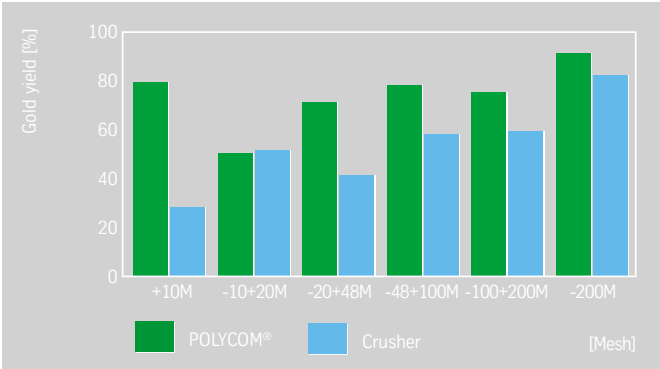
Copper ore comminution in South America: Four POLYCOM® systems are used for primary grinding. Four energy-saving, low-wear ball mills are used for the wet process final grinding – throughput 108,000 (!) tonnes of rock per day.

From the natural rock via liberated copper to the copper coin...

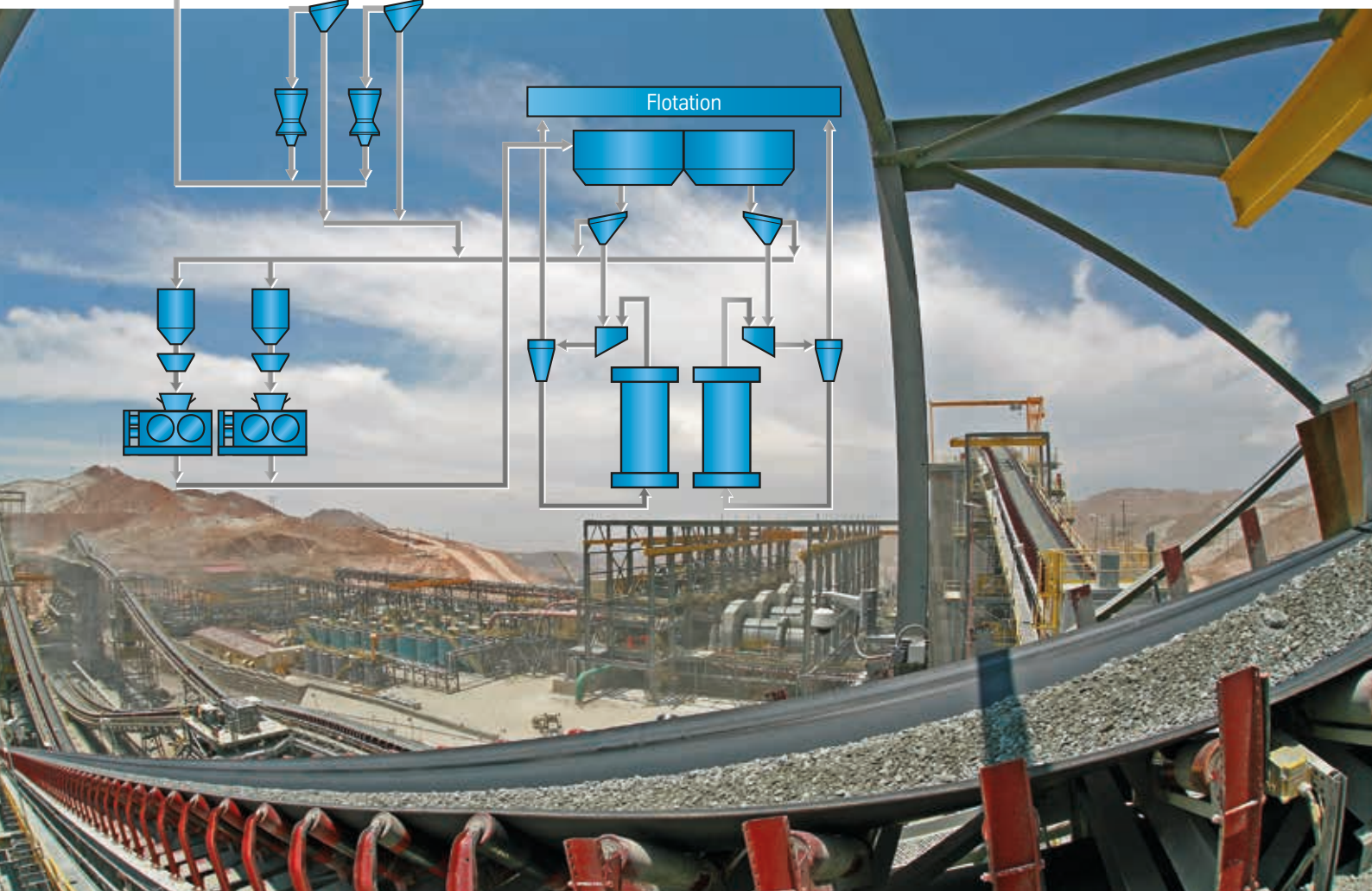
# ... for gold, platinum and copper ore

Comparison:
gold yield rate of a crusher
and of a POLYCOM®.




The POLYCOM® also brings substantial benefits to the heap leaching process. The yield of valuable substance and thus the operating economy of the facility are significantly raised. The ground material can either be conveyed directly to the heap or first go through an agglomeration stage. If finer qualities are required, the POLYCOM® product is first screened.



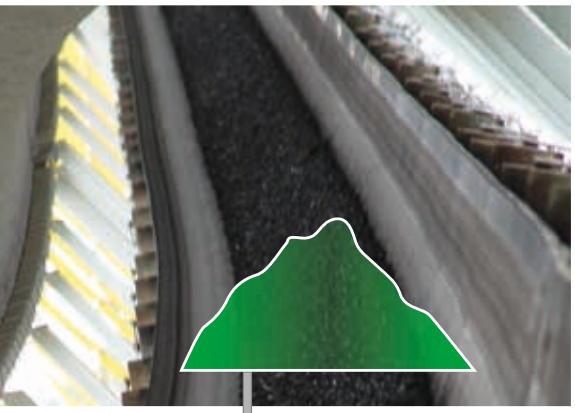
# … for diamond ore

Breaking the diamond-bearing rock in a high-pressure grinding roll is a gentle method of liberating the diamonds.

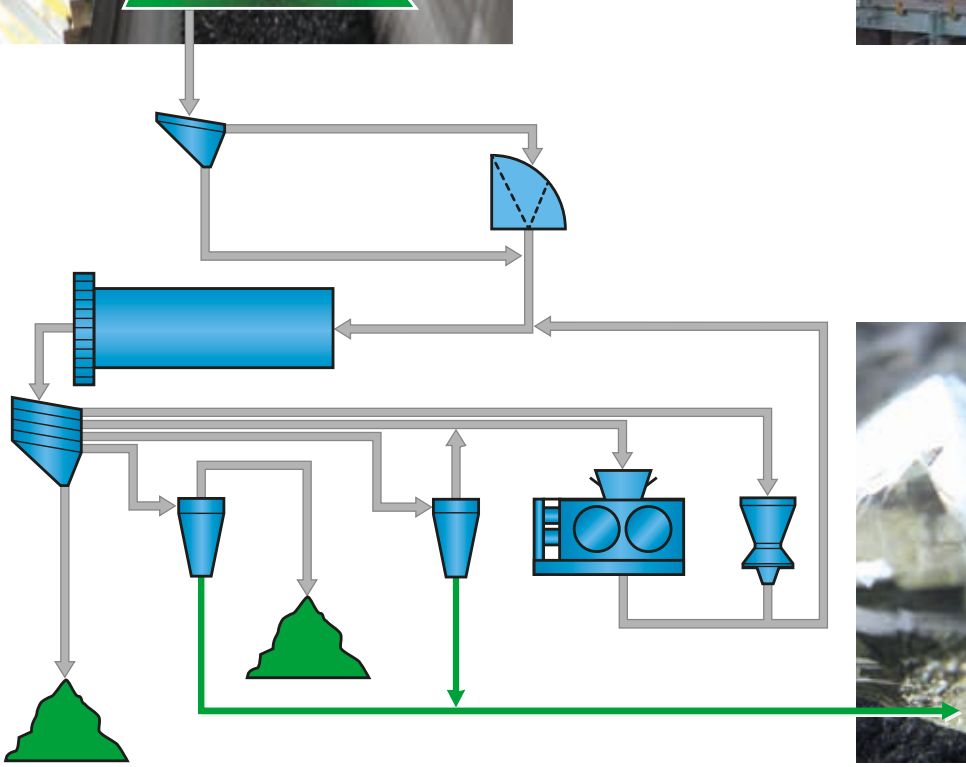
The surrounding rock is broken while the hard diamond remains undamaged and is recovered in a downstream process stage.

For scientists they may be just the material with hardness value 10, but for the ancient Greeks they were the “tears of the gods”. Today we know that every diamond was created billions of years ago by enormous underground forces. They only see the light of day if the lava of erupting volcanoes carries them to the earth’s surface.

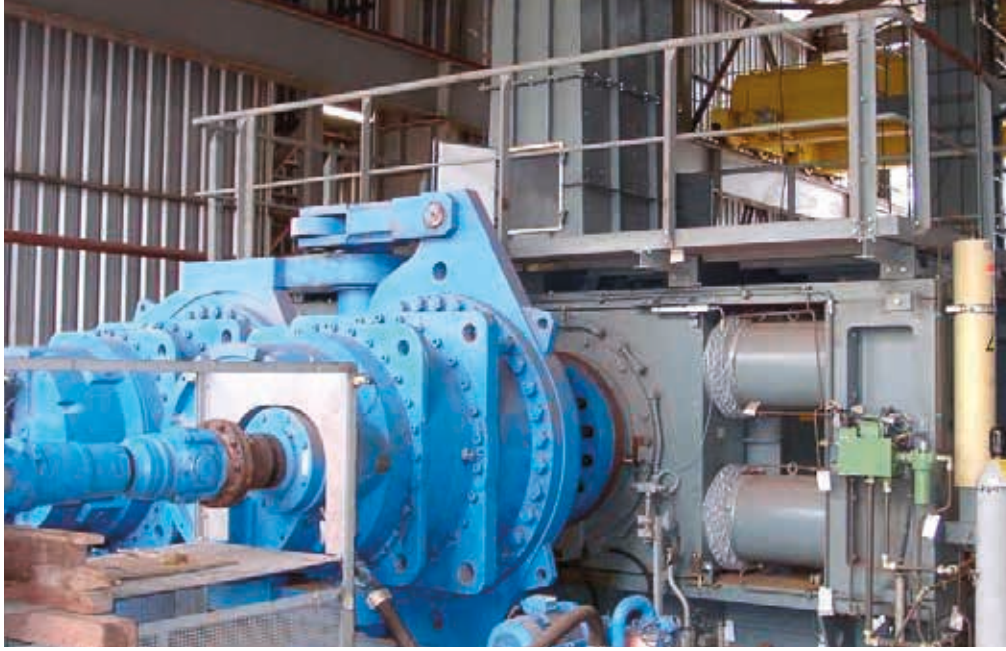
POLYCOM® for diamond ore liberation in South Africa.



POLYCOM® and scrubber from ThyssenKrupp Industrial Solutions: core process technological components of a diamond ore processing plant.



# … for iron ore



POLYCOM® for iron ore comminution in Brazil.

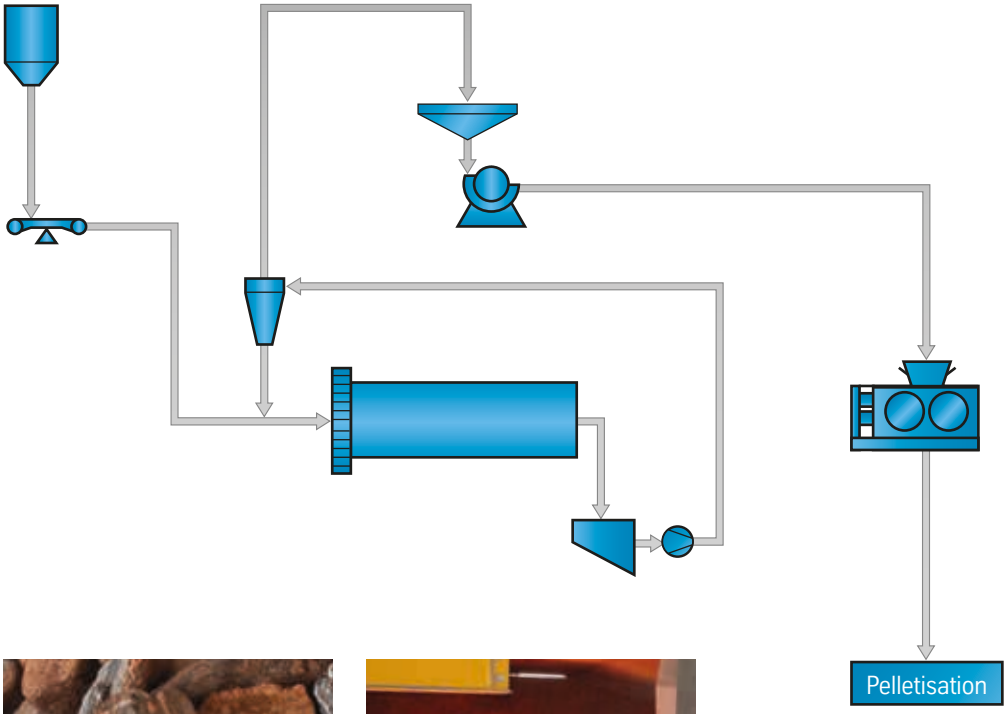
The iron ore industry uses the POLYCOM® as a reduction crusher for lump ore.

Its high throughput rates, combined with the production of a high percentage of fines, bring clear operating and capital cost benefits: one POLYCOM® can replace several crushers.

This also significantly reduces the maintenance expenses of the plant.

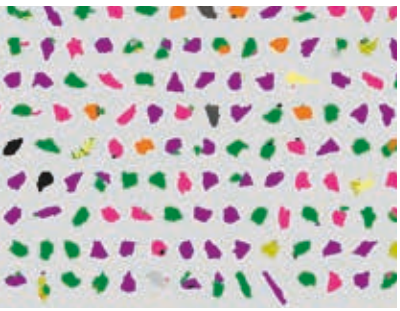
The main field of POLYCOM® application is the production of pellet feed: the high-pressure grinding roll, usually installed downstream of the ball mill and filtering stage, grinds the filter product.

The POLYCOM® product is the basis for manufacturing high-quality iron ore pellets.




From iron ore via the molten metal to the finished product.

# Securing the future



**Research and Development.** ThyssenKrupp Industrial Solutions has the knowhow and the equipment (the research centre with its ultramodern machines is one of the world's leading development establishments for basic material technology) to provide a suitable plant concept for the individual properties of the respective ore.

The mineral liberation analysis (MLA) specifies the mineralogical properties of different sample materials and provides important data for the layout and the design of the high-pressure grinding roll. It uses the scanning electron microscopy (REM) and the energy-dispersive X-ray spectroscopy (EDX).

The ThyssenKrupp Industrial Solutions research centre is equipped with POLYCOM® units of different sizes for grinding tests in open circuit or closed circuit grinding systems.

For the safe process-technological design of plants, it is often enough to grind a small sample material quantity. Material tests also provide definite predictions of wear.

**From laboratory-scale to industrial reality:**

Following the material analysis, the ores are compared with the comprehensive ThyssenKrupp Industrial Solutions material database to quickly and reliably obtain the data regarding their grindability, hardness, abrasiveness and agglomeration behaviour that are needed for designing the plant configuration.

High-performance simulation programs support the selection of machines and systems and forecast the energy requirements, mill circuit material balances, wear rates etc., thus assuring future-oriented, custom-tailored plant solutions with the lowest possible operating expenses.

No matter whether a new plant, the upgrading of existing facilities or the opening up of new fields of application for proven technologies and services is concerned.

**Service. Worldwide.** Our scope of the ThyssenKrupp Industrial Solutions services is so broad that customers all around the world are assured of comprehensive support for their achievement of profitable plant operation. Such support is the basis for permanently maintaining and strengthening the trust and loyalty of our customers.

Thanks to a global network of subsidiaries and service centres, ThyssenKrupp Industrial Solutions is able to refurbish POLYCOM® roll bodies quickly and without complications all around the world.

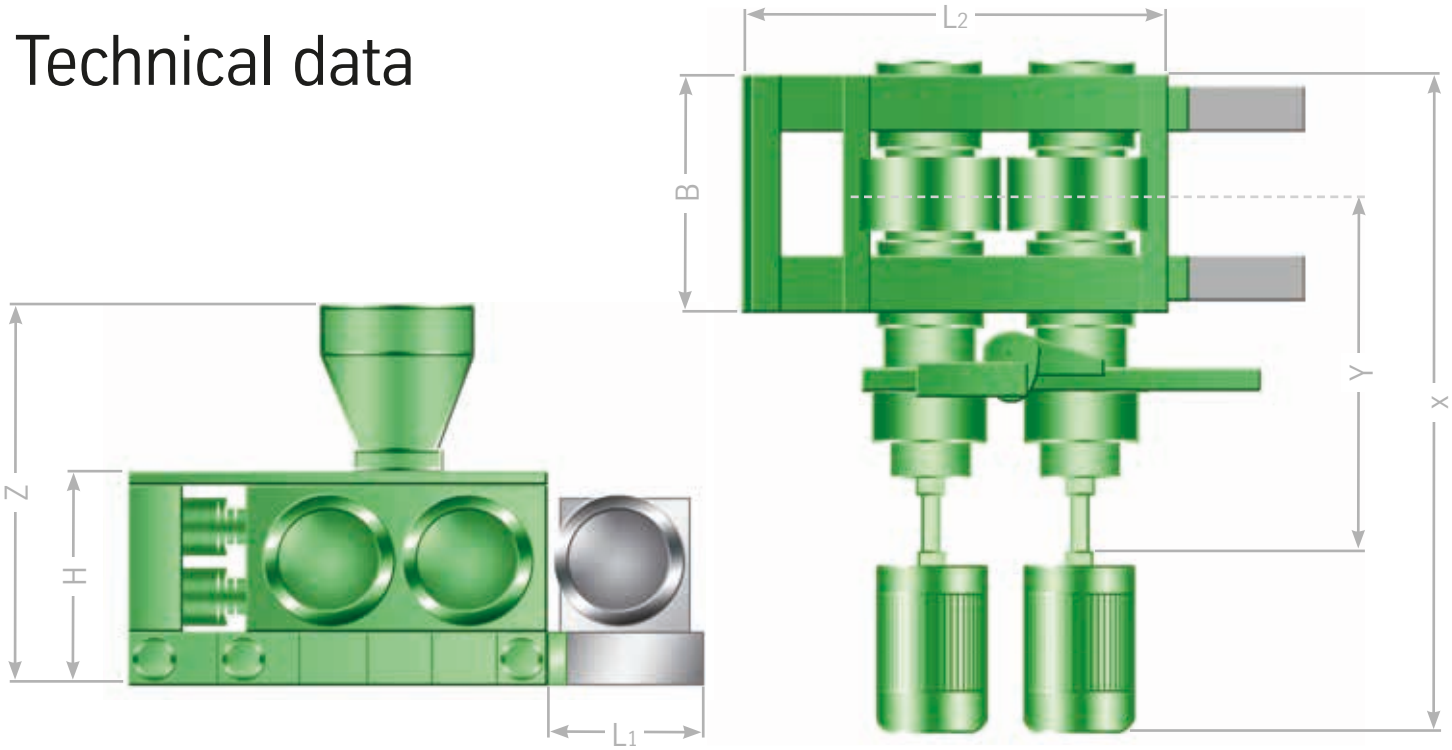
The ThyssenKrupp Industrial Solutions Service also focuses on preventive maintenance and comprehensive training of the plant operators. Due to the numerous POLYCOM® applications installed, the customer profits also in the service sector from complex experience, customer-specific service concepts and thus reliable plant operation for long periods.

Optimally trained personnel take care that optimum wear protection is restored.

Within the framework of service contracts service experts plan e.g. the exact life cycles of the installed roll bodies thus ensuring as a preventive measure free capacities in the ThyssenKrupp Industrial Solutions workshops so that the wear parts can be immediately refurbished.

The service centres located close to customers in all important mining regions all around the world and equipped with top-end workshop machines perform the maintenance and manufacturing of machines and components: close to the plant site, quickly and expertly.

# Technical data




| Size | | 0 | 1 | 2 | 4 | | | | 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | | 9/7 | 11/8 | 14/8 | 14/10 | 15/11 | 17/10 | 17/12 | 17/12 | 17/14 | 20/10 |
| Roll diameter | mm | 950 | 1100 | 1400 | 1410 | 1520 | 1700 | 1700 | 1700 | 1700 | 2000 |
| Roll width | mm | 650 | 800 | 800 | 950 | 1100 | 1000 | 1200 | 1200 | 1400 | 1000 |
| Grinding force | kN | 2700 | 3400 | 4300 | 7000 | | | | 8600 | | |
| Motor power | kW | 2 x 220 | 2 x 450 | 2 x 500 | 2 x 800 | | | | 2 x 1600 | | |
| L1 | mm | 1150 | 1300 | 1600 | 1720 | 1720 | 1900 | 1900 | 2100 | 2100 | 2100 |
| L2 | mm | 3240 | 3750 | 3735 | 4305 | 4305 | 4490 | 5050 | 5530 | 5530 | 5950 |
| B | mm | 1860 | 2150 | 2164 | 2580 | 3030 | 3030 | 3030 | 3025 | 3500 | 3000 |
| H | mm | 1371 | 1685 | 1895 | 2095 | 2095 | 2220 | 2220 | 2390 | 2390 | 2760 |
| Y | mm | 3910 | 4300 | 4580 | 4960 | 5870 | 5230 | 5010 | 5010 | 6260 | 5160 |
| X | mm | 6000 | 7000 | 7360 | 7860 | 9850 | 6800 | 8250 | 9600 | 10400 | 9270 |

| Size | | 6 | | 7 | | 8 | | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Type | | 19/15 | 20/15 | 20/15 | 20/17 | 22/15 | 24/17 | 26/18 | 30/20 |
| Roll diameter | mm | 1850 | 2000 | 2000 | 2000 | 2200 | 2400 | 2600 | 3000 |
| Roll width | mm | 1500 | | 1500 | 1650 | 1550 | 1650 | 1750 | 2000 |
| Grinding force | kN | 11000 | | 13500 | | 17000 | | 20000 | 25000 |
| Motor power | kW | 2 x 1850 | | 2 x 2500 | | 2 x 2800 | | 2 x 3400 | 2 x 5000 |
| L1 | mm | 2200 | 2200 | 2200 | 2200 | 3000 | 3000 | 3500 | 2000 |
| L2 | mm | 6020 | 6020 | 6550 | 6550 | 7725 | 7725 | 8500 | 9500 |
| B | mm | 3310 | 3460 | 3640 | 3640 | 3820 | 3820 | 4150 | 4600 |
| H | mm | 2635 | 2855 | 2795 | 2795 | 3160 | 3180 | 3510 | 3600 |
| Y | mm | 6800 | 7000 | 6980 | 7100 | 7860 | 7860 | 9000 | 7400 |
| X | mm | 11300 | 12000 | 11300 | 11600 | 11600 | 11600 | 14000 | 14000 |

The stated dimensions are subject to alteration in the course of technical advancements.

Industrial Solutions
Resource Technologies

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