



Hard Rock Mining

Solutions for Underground Construction





Master Builders Solutions from BASF

The Master Builders Solutions brand brings all of BASF's expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of BASF construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve your specific construction challenges. We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide. We leverage global BASF technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

The comprehensive portfolio under the Master Builders Solutions brand encompasses concrete admixtures, cement additives, solutions for underground construction, waterproofing solutions, sealants, concrete repair & protection solutions, performance grouts, performance flooring solutions.

Global Underground Construction Team

BASF, with its global underground construction team, is a world leader in the provision of reliable, customer-oriented solutions focused on your needs in the tunneling and mining industries. We recognise that your success is underpinned by our ability to deliver solutions that meet or exceed your critical needs. By accompanying you from the start of your project and understanding the issues that are important to you, we can contribute to your success. We support you with product training and quality control, and our professional technical services team is on hand around the clock, helping you with specialist technical advice and trouble shooting.





Introduction



In recent years, there has been a vast improvement in the attitude and approach to safety in underground environments. The development of modern admixtures in particular, coupled with procedure mechanization that has taken place in the mining industry in the last 20 years has allowed larger openings, and consequently higher and more efficient output. Furthermore, mines are becoming deeper, which poses a big challenge to the industry in terms of ground control due to increased heat and deformation. To tackle these challenges, more developed and flexible mechanization as well as improved logistics will be necessary, alongside advanced ground support and consolidation technology. This not only encompasses sprayed concrete, but also injection and sprayable membrane technology.

BASF has contributed in all areas to advance ground support technology, with its comprehensive range of chemicals, providing tailor made solutions. A dedicated Research & Development team develops solutions for challenges in underground construction with its expertise in cement chemistry, concrete technology and material science, with the help of state of the art testing and investigation equipment. BASF's worldwide team of specialist representatives provide technical support, training and problem solving on-site.

Mastering underground construction challenges requires the right partner. Continuous innovation and customized solutions ensure that customers using Master Builders Solutions operate successfully, and to the highest safety standards.



Ground Support



Sprayed concrete lining

Sprayed concrete applications must ensure safety and be formulated to last. Master Builders Solutions offers a wide range of admixtures for addition during concrete batching and on site.

- MasterRoc SA alkali-free set accelerators to accelerate the setting and hardening of the sprayed concrete, providing high early strength gain and long-term strength development, as well as reducing dust and rebound levels.
- MasterGlenium water-reducing superplasticizer for reduced accelerator consumption, reduced bleeding, lower levels of segregation and increased compressive and flexural strength performance of sprayed concrete.
- MasterRoc HCA cement hydration control system to maintain the open time of sprayed concrete for up to 72 hours.
- MasterRoc TCC 780 pumping aid for improved thixotropy of the sprayed concrete mix, eliminating the risk of segregation, thus improving pumpability.
- MasterRoc TCC 735 concrete improving admixture for substantial reduction of initial shrinkage, enhanced bonding characteristics and for increased density and compressive strength.
- MasterRoc MS microsilica for improved pumpability and workability and less rebound of sprayed concrete in the fresh state, while reducing permeability and increasing density and long-term strength performance in the hardened state.
- MasterFiber structural plastic and steel fibers for enhanced post crack load absorption capability of sprayed concrete linings.
- MasterRoc LUB 1 pump lubrication aid for lubricating concrete pumps, hoses and pipelines prior to concrete pumping or spraying.



Ground Consolidation and Water Stopping



Ground consolidation

The fast reacting and non-water-sensitive polyurethanes and polyurea silicate systems quickly stabilize poor ground, and are suitable for both strata consolidation, cavity filling applications and sealing bulk heads.

- MasterRoc MP 358 GS / MP 358 SC: to consolidate fractured ground – low sensitivity to water
- MasterRoc MP 364 Flex: dense glue-like resin for fractured rock, gravel and coal – not sensitive to water
- MasterRoc MP 367 Foam: low density foam for cavity filling in rock, gravel and coal – not sensitive to water

Water stopping

Foaming, water-sensitive polyurethanes combat water ingress quickly and effectively. Many of the products for preventing water ingress can be adjusted on site to suit local conditions.

- MasterRoc MP 355 1K: to stop low to mid-volume water ingress
- MasterRoc MP 355: to stop mid to high-volume water ingress

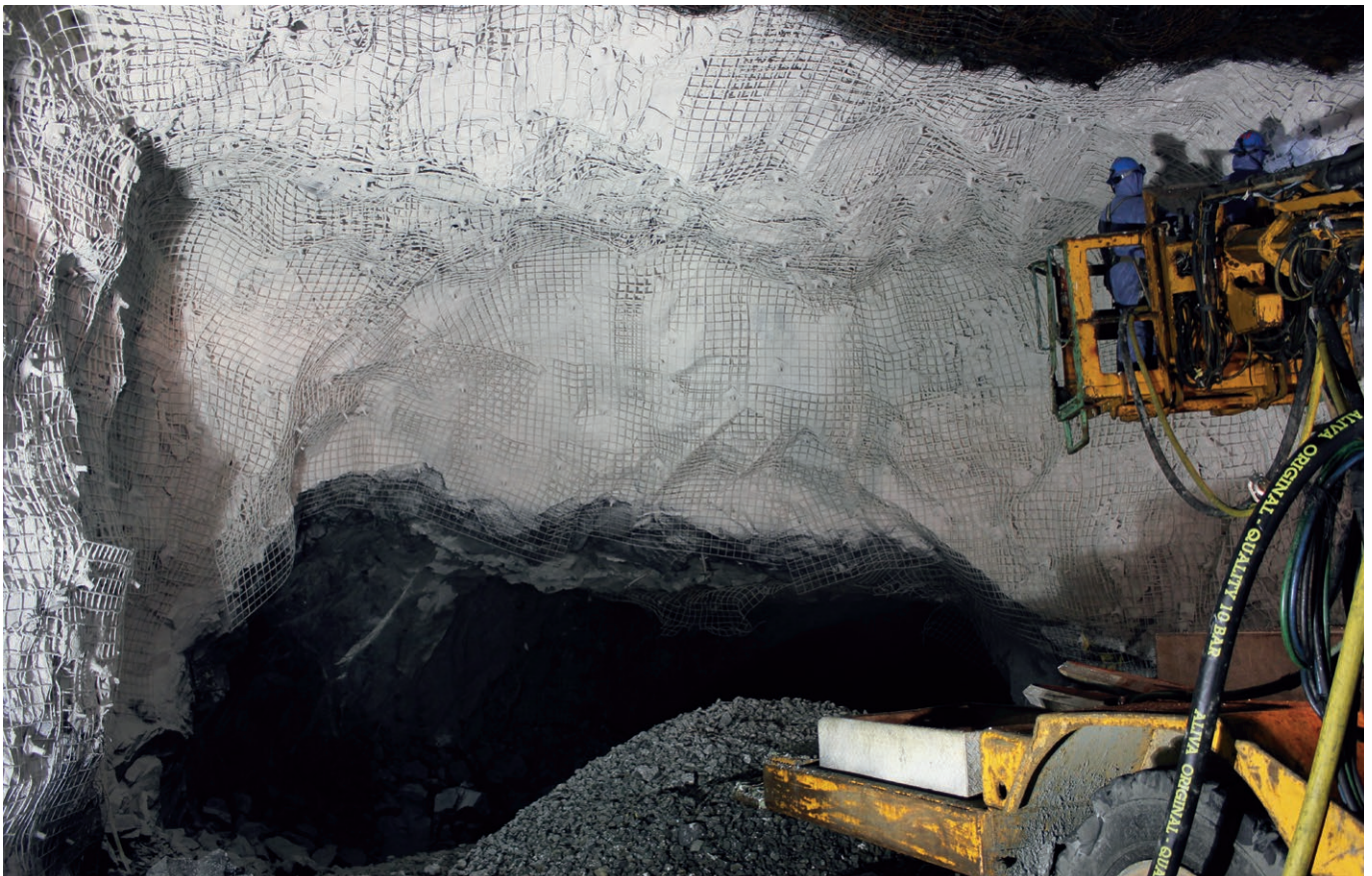
Water ingress prevention with pre-injection

Unexpected water ingress and poor ground conditions can cause significant delays and escalate costs. To counteract these risks, an economical approach is to pre-inject the ground ahead of the advancing face using microcements to avoid water ingress occurring, and to stabilize the ground.

MasterRoc MP microcements are very fine, providing extremely effective penetration into fine cracks in rock and fine grained soils to give efficient water tightness, stability and durability. They are particularly suited to applications in drifts and slopes.



Surface Sealing and Weathering Protection



In hard rock mining, oxidation can affect weak strata, causing rock slabbing and roof and wall degradation. Effective surface support and the protection of rock and strata against weathering are critical to the safety and efficiency of any mining operation.

BASF provides systems for supplementary surface support to strategic areas of a mine where people and infrastructure are present, bringing important safety benefits.

MasterRoc TML (thin mortar liner) sets very quickly, and is ideal for use as an alternative to sprayed concrete in combination with mesh. MasterRoc TSL (thin spray-on liner) membrane is suitable for applications where high elasticity and elongation are required. Both liners have an excellent bond to concrete, rock and coal and can be spray applied with simple to operate equipment.

Fields of application (TML and TSL):

- Stabilization of rock through substrate sealing
- Preliminary slope protection

- Protection against rock weathering and air-slacking
- Corrosion protection of standing steel supports

Further fields of application for MasterRoc TSL:

- Preliminary and temporary in-cycle surface support before sprayed concrete application
- Minimization of the effects of rock strain bursting
- Ventilation improvement by reduced surface friction
- Longwall face support as an alternative to mesh on installations

Added features and benefits of MasterRoc TSL:

- Fast setting polymers provide progressive increase in strength development
- High elasticity to accommodate small rock movements
- Can assist in preventing the passage of methane and radon gas and CO² through strata



Repair and Maintenance



Crack repair for shaft bunkers and other concrete structures

- The MasterRoc MP series of acrylic resins can instantly and permanently seal the finest cracks to prevent water ingress, as well as stabilizing weak soil
- The MasterRoc MP series of polyurethanes offer permanent structural crack sealing of concrete structures
- MasterEmaco repair solutions resist cracking and thus prolong the lifespan of concrete structures

Repair and protection mortar

MasterRoc STS is a high build sprayed concrete mortar ideal for structural repair of metal and concrete structures that require corrosion resistance. It is also suitable to reduce surface roughness prior to the application of sprayable membranes. Fields of application include:

- Pipes and drains
- Reservoirs and tanks
- Treatment facilities
- Openings, drifts and caverns
- Slope stabilization

Anchoring and grouting systems

BASF offers a complete range of cable bolt grouts to suit most applications such as MasterRoc FLC 100, a shrinkage compensating and plasticizing admixture designed specifically for rock bolts and anchors. Due to its shrinkage compensating properties, it secures the bonding between anchor and rock, and ensures the steel of the anchor or rockbolt is protected against chemical attack. It is ideal for overhead applications because of its thixotropic nature, preventing the grout from running out of the drill hole. It can also be used for duct and cable grouting.

The MasterFlow range of cementitious, polymer and epoxy based grouts offer precision, dimensional stability, durability and toughness for the following applications:

- Structural stabilization
- Load transfer
- Equipment
- Rails



Infrastructure Above Ground



Admixtures for ready-mix concrete

Master Builders Solutions admixtures aid in the production of high-strength, durable concrete – a prerequisite for complex structures. They render unnecessary the mechanical compacting by vibration allowing the concrete to flow, thus increasing performance and making it easier to use. They aid in the curing process of the concrete, preventing the concrete's components from segregating. After curing they leave the concrete with a smooth and clean surface – and ensure an extremely long service life for the structure. The increased energy efficiency, higher concrete durability and better construction process contributes to reducing CO² emissions and save time and costs.

- MasterGlenium superplasticizer to provide high water reduction and slump retention, accelerated strength development and extended workability without delayed setting characteristics.
- MasterMatrix advanced rheology control solutions for self-compacting concrete.
- MasterPozzolith to plasticize, accelerate or retard concrete, improving its performance and making it more uniform and predictable in behavior.
- MasterPolyheed water reducing admixture to ensure superior workability and finishing. It improves concrete performance with a wide range of cements, fly ashes, granulated slags, and aggregates, including coarse and manufactured sands.
- MasterRheobuild to impart rheoplastic qualities to concrete and to improve the pumpability of fresh concrete.

Performance flooring solutions

The MasterTop cementitious flooring system is applied together with the concrete installation to ensure long lasting durability where floors are subject to high traffic loads or an abrasive environment, such as processing plants and workshops.



Backfill



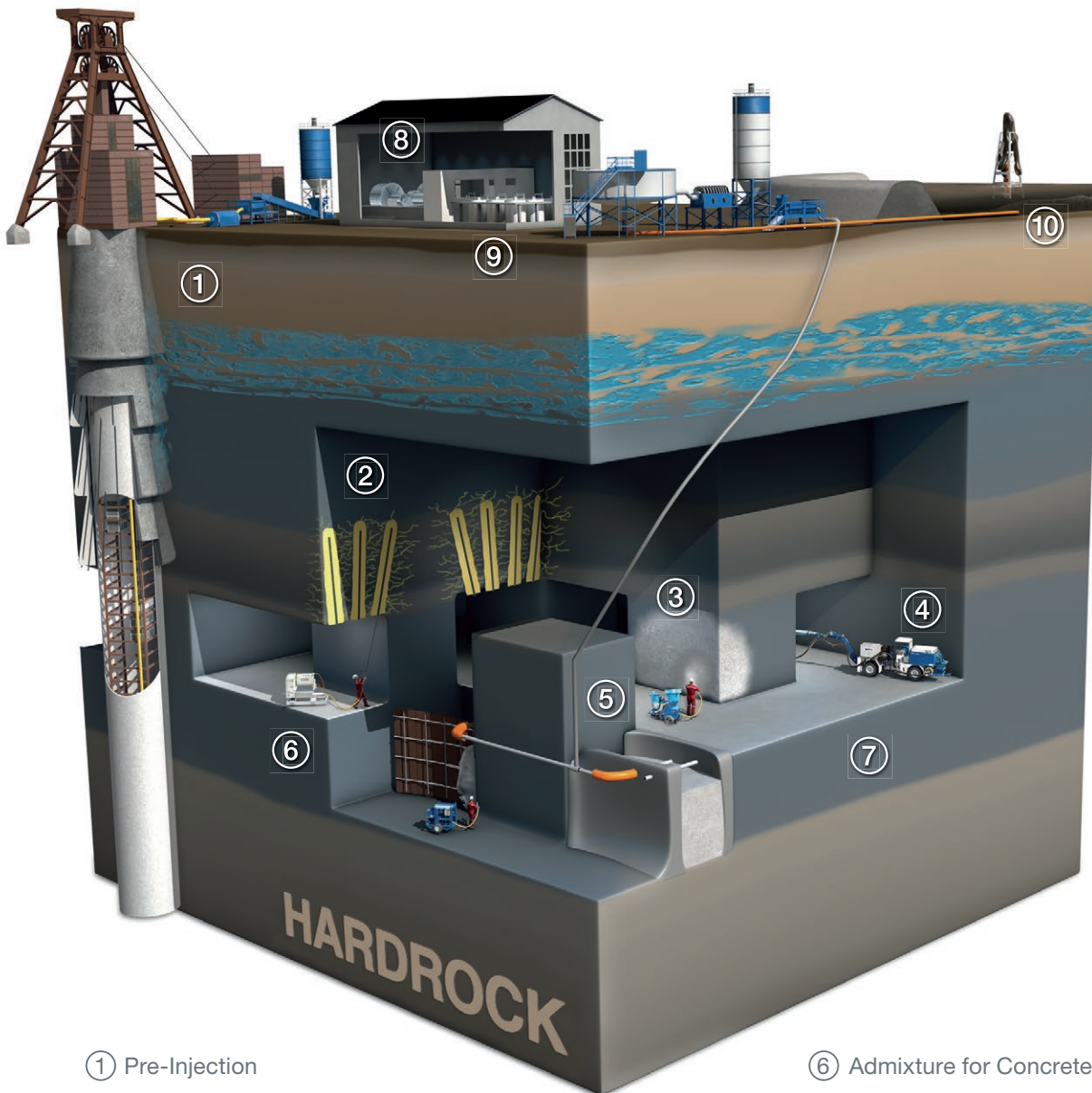
Backfill, the process of back filling material into the underground voids created by mining, is essential in many underground operations for the holistic extraction process. Backfill material types and processes are numerous but generally utilize a blend of binders, process water and aggregates ranging from rock, crushed aggregates, gravel and quarried sands to tailings left over from mineral processing to provide the required restraint to enable massive strategic support for the underground extraction sequence of the ore. Mine backfill is becoming increasingly important because of the trends in mining to mine deeper, optimize ore recovery, optimize water recovery, improve the mine cycle and optimize production, decrease environmental impact and reduce overall costs.

The criteria and requirements for backfilling can vary substantially, depending on the site specific requirements. BASF offers an extensive range of customized solutions for all types of mine and underground backfill operations, all of which have been developed with a focus on:

- Optimizing production efficiency and maintenance costs
- Providing a cost-effective, efficient and sustainable backfill solution as a part of the total mining operation
- Improving reliability of fill delivery (ensuring reliable and adequate delivery volumes)
- Maximizing the quality, consistency, uniformity and performances of the fill
- Minimizing blockage risk, thus improving safety
- Minimizing the risk of fill failure or liquefaction
- Ensuring adequate early strength and sustaining longterm strength
- Achieving dimensional stability after placement
- Minimizing segregation
- Reducing build-up in the pipe lines



Technology Overview



① Pre-Injection

② Injection / Rock Bolting

③ Thin Spray-on Liner (TSL)

④ Sprayed Concrete

⑤ Mine Backfill

⑥ Admixture for Concrete

⑦ Roadway Concrete

⑧ Grinders

⑨ Flotation

⑩ Tailing Pond



Training and Education

BASF brings extensive know-how gained through worldwide experience in solving challenging situations in hard rock mining.

In addition, support is offered frequently for clients, contractors and consultants by offering technical training courses and specialized seminars.

Whenever required, and especially in the case of large projects, tailored on-site training can be organized.

Technical Services

BASF supplies more than just specialty products for underground construction, assisting in the selection of the most suitable combination of products for each project specific geology, as well as providing start-up supervision and site support.

More brochures on our underground construction solutions are available at www.ugc.basf.com

Documentation available on request:

- Reference list
- Project reports
- Technical data sheets
- Design guidelines
- Method statements



Master Builders Solutions from BASF for the Construction Industry

MasterAir®

Complete solutions for air entrained concrete

MasterBrace®

Solutions for concrete strengthening

MasterCast®

Solutions for the manufactured concrete product industry

MasterCem®

Solutions for cement manufacture

MasterEase®

Low viscosity for high performance concrete

MasterEmaco®

Solutions for concrete repair

MasterFinish®

Solutions for formwork treatment and surface improvement

MasterFlow®

Solutions for precision grouting

MasterFiber®

Comprehensive solutions for fiber reinforced concrete

MasterGlenium®

Solutions for high performance concrete

MasterInject®

Solutions for concrete injection

MasterKure®

Solutions for concrete curing

MasterLife®

Solutions for enhanced durability

MasterMatrix®

Advanced rheology control for concrete

MasterPel®

Solutions for water tight concrete

MasterPolyheed®

Solutions for mid-range concrete

MasterPozzolith®

Solutions for water-reduced concrete

MasterProtect®

Solutions for concrete protection

MasterRheobuild®

Solutions for high strength concrete

MasterRoc®

Solutions for underground construction

MasterSeal®

Solutions for waterproofing and sealing

MasterSet®

Solutions for set control

MasterSure®

Solutions for extraordinary workability retention

MasterTop®

Solutions for industrial and commercial floors

Master X-Seed®

Advanced accelerator solutions for concrete

Ucrete®

Flooring solutions for harsh environments

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