Injection 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.

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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 recognize 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.
Avoid the Unexpected with Pre-Injection
Unexpected water ingress and poor ground conditions during underground construction usually escalate costs, can have a negative influence on the environment, and inevitably cause significant delays. To counteract these risks, an economical approach is to pre-inject the ground ahead of the advancing face to avoid water ingress occurring, and to stabilize the ground. Microcements and colloidal silica, the latter also known as mineral grout, allow a cost-effective approach and improve working safety with minimal environmental consequences.

Ground Consolidation
Fast-reacting and non-water-sensitive polyurea silicate systems quickly stabilize poor ground. The high-foaming version is excellent for void filling. The less water-sensitive polyurethanes are also suitable to strengthen the ground.

Water Stopping
Foaming, water-sensitive polyurethanes are ideally suited to combat water ingress quickly and effectively. For particularly difficult cases the solution is a combination of drainage and the injection of a fast-reacting foaming resin.

Crack Sealing and Concrete Rehabilitation
The range of acrylic resins are particularly suitable for rehabilitation injection for cast concrete, segment linings and brick & masonry lined tunnels.
Injection from Master Builders Solutions

Stable microcement penetrating fine fissures

Fast Setting, Fast Cycle
MasterRoc MP microcements (formerly RHEOCEM®) are a range of superfine portland cements for pre-injection application. Due to their fineness they provide extremely effective penetration into fine cracks in rock and fine grained soils to give efficient water tightness, stability and durability. They represent a significant technological advantage in cementitious injection. Their unique and innovative feature is rapid and controlled setting, allowing uninterrupted blasting rounds or continued injection sequences, thereby enhancing productivity considerably. Where it would take 6 hours between blasting rounds with normal cement, the waiting time is only 2 hours with BASF’s microcements.

Stable (left) vs. unstable (right) grout
Microcement - Stable Penetrating Grout

A stable grout is crucial for efficient penetration into the rock, and cannot be achieved with ordinary cement. A stable grout can travel far without losing its effectiveness, reducing time required for a given result as less drilling and less pumping are necessary. Microcements penetrate small cracks and inter-granular spaces very well, and allow high pumping pressure where needed as the grout remains stable. A further benefit is that standard cement injection equipment can be used.

Limit Grout Travel Distance with

Accelerated Setting of Microcement

The setting of microcement grout suspensions can be accelerated with a controlled dosage of a specially designed alkali-free accelerator. Using this unique method, the open time of the grout suspension can be controlled from 1-2 minutes up to approximately 20 minutes, remaining pumpable before it sets and becomes solid.

This is particularly suitable for situations where controlled injection is needed to limit grout spread in very permeable rock masses and soils, as well as for cold groundwater conditions where very fast setting is necessary.

MasterRoc MP microcements are available on special request as slower setting sulphate resisting versions and in different grades relating to the maximum particle size as given by the D95 values illustrated in the image above.
Polyurethane and Polyurea Silicates

Water Stopping, Water Sealing, Consolidation and Cavity Filling

The MasterRoc MP 350 series of polyurethanes and the fire-resistant (according to DIN4102-B2) MasterRoc MP 360 series of polyurea silicates are designed for water stopping and sealing, strata consolidation and cavity filling applications, meeting the modern-day demands of the tunneling and mining industry. The range varies from a convenient 1-component PU for small water sealing jobs to specialist robust 2-component systems to effectively stop massive water ingress problems.

Many of the products for preventing water ingress can be adjusted on site to give varying performance properties to suit the conditions using different accelerators. All MasterRoc MP polyurethane and polyurea silicate products are solvent free, and all foaming products build closed-cell foams, acting as a water barrier. They have been tested and certified by external institutes in terms of technical properties and health and safety aspects.
**Water Stopping**

**MasterRoc MP 355 1K**
- To stop low- to mid-volume water ingress
- Reaction time: 10 to 120 seconds at 20°C (accelerator provided to adjust reaction time)
- Foam factor: 20 to 30
- MasterRoc MP 355 1K DW is an almost identical product with a potable water approval
- 1-component pump

**MasterRoc MP 355**
- To stop mid- to high-volume water ingress
- Reaction time: 20 to 70 seconds depending on accelerator type
- Foam factor: 8 to 20 depending on accelerator type
- MasterRoc MP 355 Thix is a similar product for very high-volume water ingress
- 2-component pump

**Water Sealing**

**MasterRoc MP 350**
- For permanent structural crack sealing of concrete and masonry structures
- Reaction time: 30 to 100 seconds
- Foam factor: up to 8
- 1-component pump

**Ground Consolidation**

**MasterRoc MP 358 GS / MP 358 SC**
- To consolidate fractured ground, low sensitivity to water
- Reaction time: 30 to 70 seconds
- Foam factor: GS – up to 1.5, SC – up to 3
- 2-component pump

**MasterRoc MP 364 Flex**
- Dense glue-like resin for fractured rock, gravel and coal, not sensitive to water
- Reaction time: 90 to 120 seconds
- Foam factor: 1
- 2-component pump

**MasterRoc MP 367 Foam**
- Brittle foam for cavity filling in rock, gravel and coal, not sensitive to water
- Reaction time: 10 to 60 seconds
- Foam factor: 2 to 30
- 2-component pump
**Acrylic Resins**

Water can flow in every direction, before and during injection.

Possibly leaking joints

**Crack injection in tunnel linings**

Goal of injection: to section and create barriers, subsequently removing water.

Strong Durable Gels for Crack Sealing and Concrete Rehabilitation

The MasterRoc MP acrylic series is a range of high-performance acrylic resins that permanently seal the finest cracks in concrete instantly and even accommodate limited movement due to their flexibility and swelling capability. They are also ideal products for curtain injection behind leaking tunnel linings and diaphragm walls. Furthermore, they can stabilize weak soil and sand immediately and seal off water. They are widely used in major infrastructure projects such as power stations’ generator housings for the permanent waterproofing of concrete defects.

Certification

The European CE certificate specifies requirements and conformity criteria for the identification, performance (including durability aspects) and safety of injection products for the repair and protection of concrete structures.

Two of our latest acrylics, MasterRoc MP 303 CE and MP 307 CE have CE certification for the "swelling fitted filling of cracks, voids and interstices in concrete" according to EN 1504-5.
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.

**Crack Sealing and Rehabilitation**

**MasterRoc MP 303 CE**
- Flexible with good adhesion to wet rock and concrete and can swell up to 200%
- Reaction time: 10 seconds to 3 minutes
- Viscosity: 5 mPa·s
- 2-component pump

**MasterRoc MP 307 CE**
- Rubber-like and very flexible with good adhesion to wet rock and concrete, balances ground movement, for “living cracks”
- Reaction time: 4 to 17 minutes
- Viscosity: 7 mPa·s
- 1- or 2-component pump

**Ground Consolidation**

**MasterRoc MP 309**
- Extremely strong with good adhesion to wet rock and concrete, for consolidation in silty and sandy strata
- Reaction time: 45 seconds to 8.5 minutes
- Viscosity: 13 mPa·s
- 2-component pump
Colloidal Silica

The Mineral Grout

MasterRoc MP 320 and MP 325 are colloidal silica gels, referred to as “mineral grouts”. These are not chemical grouts and consist only of natural ingredients (quartz sand, water and salt). They are made of a stable liquid dispersion of discrete, nanometric spherical particles composed of 100% amorphous silicon dioxide. The colloidal silica products are used in jointed rock and fine grained soils mostly as a supplement to microcement injections to achieve the final required result and where durable long-term solutions for water sealing and ground stabilization are required.

Having a viscosity similar to water, colloidal silica penetrates soils and fine rock fissures very easily, ensuring unrivalled penetration and permanent stabilization of fine, silty sands. Unlike sodium-silicate-based products (waterglass), colloidal silica is durable and does not affect the pH value of the ground water, and continually gains strength over time. The gel time can be adjusted to between 10 minutes and 2 hours, allowing for adaptation to the needs of each project. A further benefit is that standard cement injection equipment can be used.
Training and Education
BASF provides technical injection training courses on a frequent basis centrally located in the Hagerbach underground facility in Switzerland. The courses are organized both as demonstration workshops in realistic underground settings and as practical injection operators’ training.

The demonstration workshops are practical “show-and-tell” sessions and aim to visualize and explain the possible types of application and the technical performance of our injection systems.

The practical injection operators’ training is offered exclusively to injection customers who are working with BASF injection systems. During this training the participants are given the chance to work in small groups, taking part in hands-on exercises under the supervision of experienced instructors. The main objective is to gain practical skills for the correct application and execution of injection works.

In addition, tailored training is organized for individual projects worldwide when required by customers.

Technical Services
BASF provides more than simply a range of products. Assisting customers in selecting the right injection system and setting out the injection method, as well as providing initial supervision and site training of the customer’s personnel, is an essential part of our concept. BASF works together with suppliers of equipment and injection accessories to provide the best, most cost-effective and complete technology solution.

More brochures on our underground construction solutions are available at www.master-builders-solutions.basf.us

Documentation available on request:
- Reference list
- Project reports
- Technical data sheets
- Design guidelines
- Method statements
LIMITED WARRANTY NOTICE
We warrant our products to be of good quality and will replace or, at our discretion, refund the purchase price of any products proved defective. Satisfactory results depend not only upon quality products, but also upon many factors beyond our control. Therefore, except for such replacement or refund, BASF MAKES NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, RESPECTING ITS PRODUCTS, and BASF shall have no other liability with respect thereto. Any claims regarding product defect must be received in writing within one (1) year from the date of shipment. User shall determine the suitability of the products for the intended use and assume all risks and liability in connection therewith. Any authorized change in the printed recommendations concerning the use of our products must bear the signature of the BASF Technical Manager.

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Master Builders Solutions products from BASF for the Construction Industry:

**MasterAir®**
Solutions for air-entrained concrete

**MasterBrace®**
Solutions for concrete strengthening

**MasterCast®**
Solutions for manufactured concrete products

**MasterCem®**
Solutions for cement manufacture

**MasterEmaco®**
Solutions for concrete repair

**MasterFiber®**
Comprehensive solutions for fiber reinforced concrete

**MasterFinish®**
Solutions for formwork treatment

**MasterFlow®**
Solutions for precision grouting

**MasterGlenium®**
Solutions for high-performance flowing concrete

**MasterInject®**
Solutions for concrete injection

**MasterKure®**
Solutions for concrete curing

**MasterLife®**
Solutions for enhanced durability

**MasterMatrix®**
Advanced rheology control solutions for self-consolidating concrete

**MasterPel®**
Solutions for watertight concrete

**MasterPolyheed®**
Solutions for moderate slump concrete with superior finishability

**MasterPozzolith®**
Solutions for conventional slump concrete

**MasterProtect®**
Solutions for concrete protection

**MasterRheobuild®**
Solutions for high slump concrete

**MasterRoc®**
Solutions for underground construction

**MasterSeal®**
Solutions for waterproofing and sealing

**MasterSet®**
Solutions for set control

**MasterSure®**
Solutions for workability control

**MasterTop®**
Solutions for industrial and commercial floors

**Ucrete®**
Flooring solutions for harsh environments

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