

# LARGE-SCALE TESTS TO INVESTIGATE MGO CONCRETE WITH A LONG-TERM STABLE 3-1-8 PHASE IN THE SONDRERSHAUSEN AND TEUTSCHENTHAL MINES

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The installation of sealing elements in salt rock requires a mechanical support system, which is chemical compatible with the host rock. In future HAW-repositories abutments and sealing elements within the shafts and drifts could be made of magnesia building material with the long term stable 3-1-8 binder phase, if solution containing magnesium can attack the seal.

In 2014 and 2018 two large-scale experiments were performed in the Sondershausen and Teutschenthal salt mines in Germany. Vertical boreholes with the depth of 2.0 and 3.5 meters were filled with the magnesia-based concrete. Several sensors measured the development of temperature, comprehensive stress and expansion within the test construction for approximately one year. During the binding reaction the temperature increased by 55 K in the center.



Figure 1: Second large-scale experiment during concreting

Long-term stable MgO concrete with 3-1-8 phase has been used for the first time in these tests. The measured parameters (temperature, stress, strain) of the two large-scale tests are the foundation for modelling the behaviour of the MgO-concrete.

After one year a comprehensive stress of 6.5 MPa was measured at the contour (April 2020). The maximum axial expansion reached 7.9 mm/m and stays at this level. The maximum radial expansion reached 0.7 mm/m 20 days after concreting and decreased subsequently. This material behavior corresponds to the high comprehensive stress level.

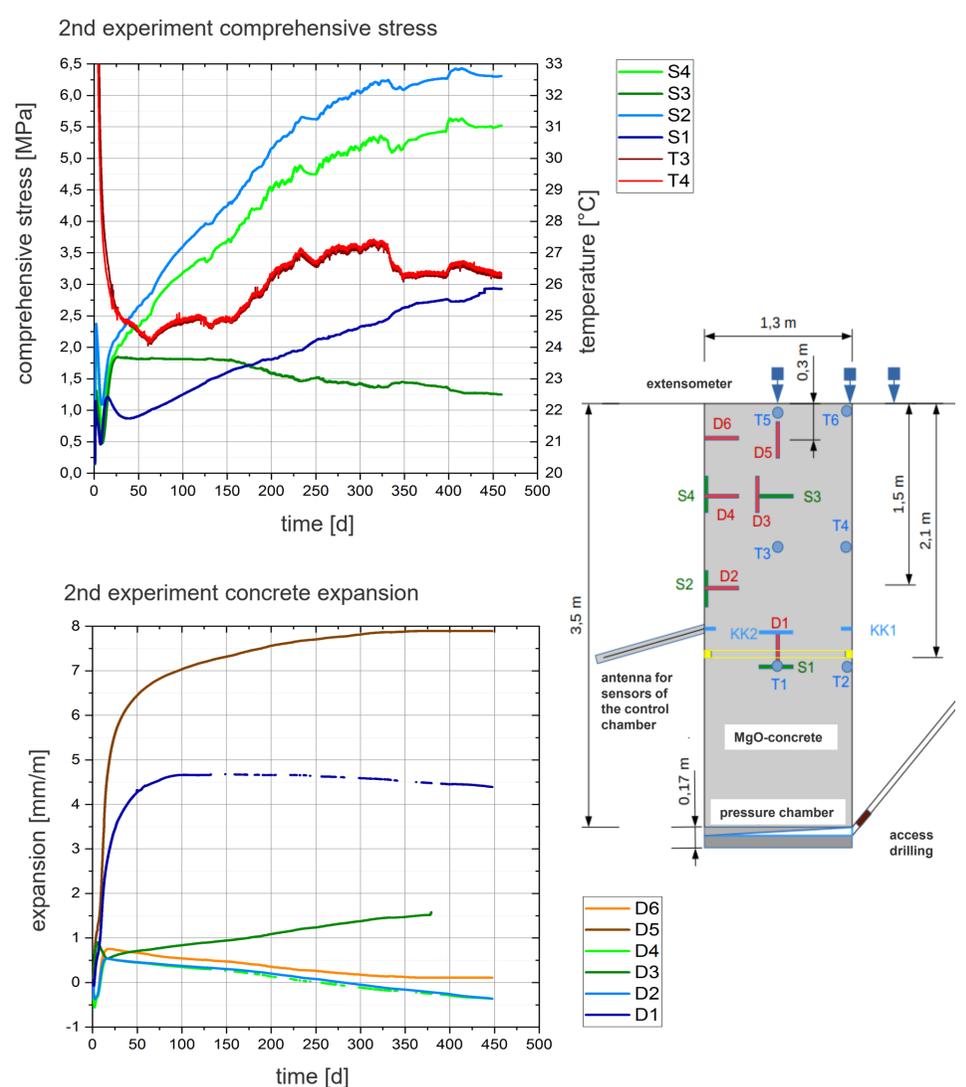


Figure 2: stress and strain development in the second experiment

The second experiment is equipped with a pressure chamber at the bottom. A first determination of the integral gas permeability revealed a value of approx.  $3E-18 \text{ m}^2$  to  $3E-17 \text{ m}^2$ . In the near term a multistage pressurization of the construction is planned, using a saturated NaCl solution to evaluate the sealing ability.

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