



Production and grouting with gypsum-forming solutions at Mosaic Potash Esterhazy Ltd. (Canada)

References of the successful application of this technology exist for sealing of brine leakages in potash mines operated by K+S Kali GmbH (Germany) and Mosaic Potash Esterhazy (Canada) as well as for the consolidation of loose sands ("CRYSTECHSALINE"-project).

BaSO₄ forming solutions were successfully used for immobilization of contaminants in the former uranium mine Koenigstein of Wismut GmbH (Germany).

We are offering the application of the technology for solving geotechnical tasks as well as for immobilization of contaminants. This will include the adjustment of the composition to the defined conditions as well as the set up and if needed operating the plant for preparation and grouting of the solutions.

All investigations are realized user-specific in close cooperation with the clients. Short realization times and confidentiality are main aspects of our work.

All investigations follow good laboratory practice guidelines and base on the state of the art.

Simultaneously we offer the following service:

- Column tests for characterization of dissolution and leaching processes
- Investigations concerning the formation of acidic weathering solutions (acid rock drainage)
- Determination of the permeability of sedimentary and hard rock
- Determination of grain size distributions (sieve analysis, laser diffraction)
- Determination of uniaxial compressive strength and tensile strength
- Investigations concerning water and waste water treatment
- Characterization of thermal degradation of organic and inorganic materials up to 1500°C with DTA/TGA

Further services are summarized on our homepage at www.ibz-freiberg.de

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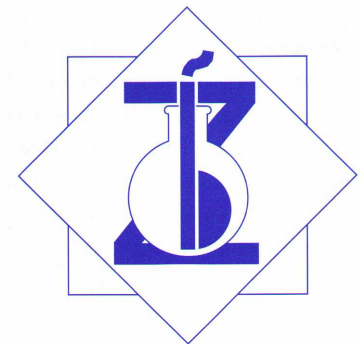
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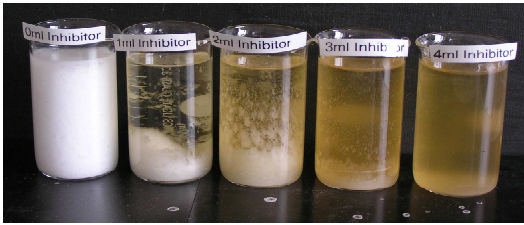
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Provoked Mineral Synthesis

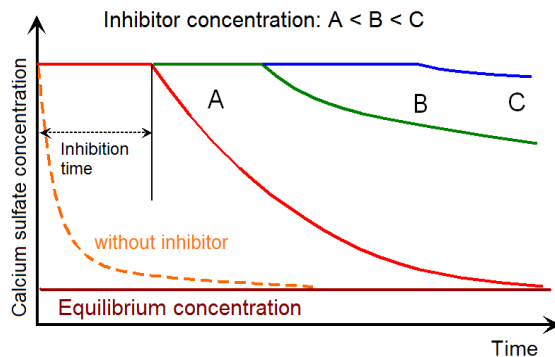
Immobilization of contaminants and sealing of rock by using time dependent crystallization





Precipitation of gypsum depending on concentration of inhibitor

The „Provoked Mineral Synthesis“ is a new technology which forms slightly soluble minerals from supersaturated solutions allowing the fixation of contaminants and the reduction of the permeability of soils or rock formations. Solutions containing high amounts of calcium sulfate, barium sulfate, calcium carbonate or calcium hydroxide can be prepared by using special inhibitors, which prevent spontaneous crystallization during the solution preparation. Inhibitors do not change the solubility, they stabilize temporarily concentrations high above the normal solubility of the minerals.



Crystallisation steps in the presence of inhibitors

Inhibitors enable, for example, the mixing of BaCl_2 and Na_2SO_4 solutions as well as lime ($\text{Ca}(\text{OH})_2$) slurries and diluted sulfuric acid without spontaneous BaSO_4 and gypsum formation, respectively. Clear solutions are obtained with time dependent stability. The rate of precipitation can be directed by the degree of supersaturation, pH, temperature and type and concentration of the inhibitor. When supersaturated solutions are used as grout, time dependent crystallization occurs within the penetrated soil or rock structures. The flow paths are closed step by step starting from the inner part. Reduction of permeability starts and will be finished with sealing of the pore space or the crack. Contaminants are incorporated into the growing layers of slightly soluble minerals.

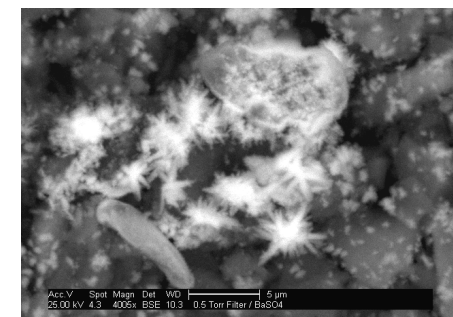


Growing crust resulting from supersaturated CaSO_4 - solution



Plant for preparation of BaSO_4 -forming solution in the former uranium mine Koenigstein (Wismut GmbH)

Such processes can be used for preparation of solutions from which directed gypsum, anhydrite, BaSO_4 , CaCO_3 or $\text{Ca}(\text{OH})_2$ formation takes place. All have in common that the setup of supersaturation, pH value and redox potential opens many possibilities to change contaminants into stable, non-dissolvable compounds. Organic degradation processes can be initiated simultaneously. One main fact is the formation of only naturally occurring minerals which do not harm the treated formations.



BaSO_4 -crystals formed in porous sandstone