Training Courses

Based on his experiences in teaching at university level for many years, the lecturer Dr. Gerald Ziegenbalg offers several courses concerning the Graphical Representation of Phase Equilibriums and Chemical Engineering.

The knowledge of solid-liquid equilibriums is the basis for the description of crystallization as well as precipitation processes. Phase relationships in simple systems, however, can already be so complex that understanding of them becomes difficult. One possibility to overcome this obstacle is the usage of phase diagrams. The visualization of equilibriums allows one to distinguish between stable and metastable conditions as well as the deduction of crystallization or dissolution paths. The same is true for phase changes during evaporation or cooling.

The benefits of using phase diagrams for the quantitative description of crystallization or dissolution processes are often neglected. The amounts of minerals formed can be calculated exactly, both for isothermal and polythermal processes. In many cases, mixing of different salt brines results in the crystallization of salts. Phase diagrams allow to calculate the crystallization paths and to determine the amount and nature of the formed salts.

In detail we offer the following training courses:

- Introduction into Chemical Engineering
- Graphical representation and quantitative analysis of salt - solution - equilibriums (An introduction into the fundamentals of phase diagrams)
- The solid - liquid equilibriums of the quinary system of oceanic salts (An introduction to the fundamentals of the system, its graphical representation and the quantitative description of the equilibriums)
- The use of phase diagrams to describe crystallization and dissolution processes during Sylvinite and Carnallite processing (An introduction to the fundamentals of the system NaCl-KCl-$MgCl_2$-H_2O)

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Contract Research

Technologies for Sealing

Nano Materials

Training Courses

IBZ-Freiberg

Chemical and Geochemical Consultancy Dr. Ziegenbalg

IBZ-Freiberg (Chemical and Geochemical Consultancy Dr. Gerald Ziegenbalg) was founded in 2003 and provides extensive chemical and environmental consulting services. Based on comprehensive experience in applied research and development as well as technology transfer we offer:

- Contract research concerning Chemical Engineering as well as basic and applied research.
- Development and application of technologies for sealing fractured and porous rock by directed crystallization processes from supersaturated solutions.
- Development and application of technologies for in-situ immobilization of contaminants.
- Production of sophisticated nano materials for conservation and restoration of natural and artificial stone, plaster and frescos.
- Training courses concerning Chemical Engineering and Graphical Representation of Phase equilibriums.

All services are carried out in well equipped laboratories. Own research and development activities guarantee the realization of all consulting services at high scientific level.

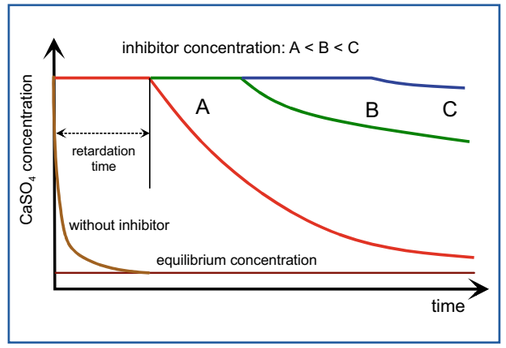
Contract Research

Main subjects of contract research are:
- Crystallization, Precipitation, Phase Equilibriums.
- Leaching processes.
- Water and waste water treatment.
- Separation technologies such as ion exchange, extraction, flotation.
- Synthesis of Inorganics.
- Development of construction materials.
- Development of fillers.

The investigations are carried out 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.

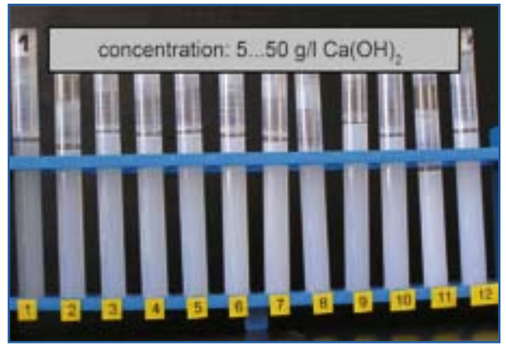
Technologies for Sealing and Immobilization

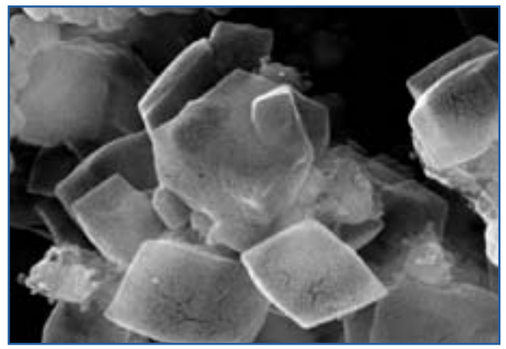
We offer a newly developed process for sealing porous or fractured rock formations and to bind contaminants. The technology bases on directed crystallization of naturally occurring, slightly soluble minerals. Solutions are prepared and used as grouts which are highly supersaturated in respect to slightly soluble sulfates or carbonates. Their preparation bases on using special precipitation inhibitors. These allow mixing of components which are normally incompatible. For example, mixing of calcium chloride and magnesium sulfate solutions results almost always in fast gypsum crystallization. In the presence of suitable precipitation inhibitors, however, temporarily stable, clear solutions are obtained. It is possible to prepare, for example, solutions containing up to 100 g/l dissolved $CaSO_4$ or up to 1.0 g/l $BaSO_4$. These solutions can be used as grout. A self sealing process, resulting in the formation of gypsum or $BaSO_4$, is induced in the penetrated flow paths. The stability of the grouts and thus the place of crystallisation can be adjusted by the inhibitor and its concentration, pH and the overall grout composition.



The crystallizates are able to form protective layers on the surface of penetrated pores or fractures and immobilization of soluble components is reached. In the case of mixing of the grout with pore water present in the treated formation, precipitation of heavy metals occurs resulting in a fixation of these compounds in stable minerals. There are many possibilities to adjust the solution composition to the tasks to solve.

This technology offers a wide range of applications, both to reduce the permeability of rock formations or tailings and to immobilize contaminants. Another application is sealing of water inflows into mines.





Nano Materials for Stone Conservation and Restoration

IBZ-Freiberg offers different types of calcium hydroxide nano products. These are colloidal materials dispersed in different organic solvents forming a stable sol. The particles have sizes between 50 and 200 nm, depending on the preparation process. Penetration of stones with colloidal calcium hydroxide sols results in the formation of solid $Ca(OH)_2$ after evaporation of the solvent. That can convert into $CaCO_3$ (limestone) in a way similar to traditional lime mortars by reaction with atmospheric carbon dioxide. The favorable application of colloidal calcium hydroxides to consolidate stone monuments has been proven in co-operation with various Academies of Fine Arts. Other potential applications are the formation of ultra thin $Ca(OH)_2$ /$CaCO_3$ layers, mass deacidification of paper or other materials as well as the use as priming color. It is an easy to use product which can be applied by soaking, spraying or injection. Colloidal calcium hydroxide is available in concentrations between 5 and 75 g/l.