



IBZ - Salzchemie
GmbH & Co. KG

TIME TABLE

1st day

- 10:00 - 12:00 welcome, 1st lecture
- 12:00 - 13:00 lunch
- 13:00 - 14:30 2nd lecture
- 15:00 - 17:00 1st exercise

2nd day

- 08:00 - 09:30 3rd lecture
- 10:00 - 11:30 4th lecture
- 11:30 - 12:30 lunch
- 12:30 - 14:00 2nd exercise
- 14:30 - 16:00 5th lecture
- 18:00 dinner

3rd day

- 08:00 - 09:30 3rd exercise
- 10:00 - 11:30 6th lecture
- 11:30 - 12:30 lunch
- 12:30 - 14:00 4th exercise
- 14:30 - 16:00 Final discussion

NOTES

Additional information for registration, request for hotel reservation, etc.

REGISTRATION VIA POST, FAX, MAIL



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TRAINING COURSE

Graphical presentation and
quantitative analysis of
salt - solution - equilibriums

An introduction



IBZ - Salzchemie GmbH & Co. KG

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The knowledge of salt-solution equilibria is the basis for the description of crystallization as well as precipitation processes. However, phase relationships in simple systems can be complex that understanding them becomes difficult. One possibility to overcome this obstacle is the usage of phase diagrams. The visualization of equilibria allows 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.

Phase diagrams' beneficial quantitative descriptions of crystallization or dissolution processes are often neglected. The amounts of formed minerals 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 calculating the crystallization paths and determining the amount (mass) and nature of the formed salts.

Based on his teaching experiences at the university for many years, the lecturer Prof. Dr. Ziegenbalg presents an overview of the graphical representation of different types of equilibria. Starting with simple binary systems. A stepwise introduction into the graphical presentation of complex systems is given. The course discusses similarities and differences between solubility and melting diagrams as well as the behavior of salts during thermal treatment. Special lectures deal with phase diagrams for the deduction of conditions favourable for Sylvinit or Carnallite processing. An example is the production of potassium sulphate in salt industry. Learning by doing is the most efficient way, whereby the course is divided into six lectures and four special seminars in which construction and the use of phase diagrams is trained.

ACCOMODATION

We have pre-booked rooms, please inform us as soon as possible when you are interested. Seminar dates and course fees (including course materials, lunch and evening event) are given in the attached information. The course can also be given as In-House Seminar. Please contact us for details.

TARGET GROUP & KNOWLEDGE

The course is aimed at scientists, engineers and technicians dealing with crystallization and precipitation processes. Basic knowledge in physical chemistry and chemical engineering are required.



Minimum participants **5**, maximum participants **15**

PROGRAM

1 The fundamentals of salt-solution equilibria

- 1.1 Thermodynamics
- 1.2 Criteria of equilibrium
- 1.3 The phase rule
- 1.4 Concentration units
- 1.5 Factors influencing the solubility

2 Binary systems

- 2.1 Solubility diagrams
- 2.2 Driving forces of crystallization
- 2.3 Fundamentals of crystallization kinetics
- 2.4 The system NaCl - H₂O
- 2.5 The system MgCl₂ - H₂O
- 2.6 Stable / metastable equilibria

3 Ternary systems

- 3.1 Isothermal presentation
 - 3.1.1 Rectangular coordinate systems
 - 3.1.2 Gibbs triangle
- 3.2 Polythermal presentation
 - 3.3 The system NaCl - KCl - H₂O
 - 3.3.1 Isothermal / polythermal presentation
 - 3.3.2 Crystallization paths during isothermal evaporation
 - 3.3.3 Processing of Sylvinit
 - 3.4 The system NaCl - CaCl₂ - H₂O
 - 3.4.1 Salting out processes
 - 3.4.2 Quantification
- 3.5 The system KCl - MgCl₂ - H₂O
- 3.6 Congruent / incongruent melting / solubility
- 3.7 Carnallite processing

4 Quaternary systems

- 4.1 Isothermal presentation
- 4.2 Polythermal presentation
- 4.3 Systems with similar ions
 - 4.3.1 The system NaCl - MgCl₂ - CaCl₂ - H₂O
 - 4.3.2 The system NaCl - Na₂SO₄ - NaNO₃ - H₂O
- 4.4 Reciprocal salt systems
- 4.5 Isothermal / polythermal presentation
- 4.6 The system Na⁺, K⁺ / Cl⁻, NO₃⁻ / H₂O
 - 4.6.1 Isothermal, quantitative presentation
 - 4.6.2 Polythermal presentation
- 4.7 The system K⁺, Mg²⁺ / Cl⁻, SO₄²⁻ // H₂O
 - 4.7.1 Isothermal / polythermal presentation
 - 4.7.2 Production of K₂SO₄

5 Outlook

REGISTRATION

Training course

Graphical presentation and quantitative analysis of salt - solution - equilibria

Registration deadline is 7 days before the course starts. Applications will be considered according to the order of receipt.

Wanted Date of Course

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Event participant/s

Mr. Mrs.

Title / Profession
.....

Surname
.....

First name
.....

Company
.....

Address
.....
.....

Phone / Fax
.....

Mail
.....

You can get information about dates of seminars and course fees from the flyer included. If the application will be canceled one week before the seminar starts, you will get money back minus 10% of the course fee for administrative reason. If you cancel later than one week before the course starts there will be no refund.

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Date, Sign, Company stamp