

Deutsche Gesellschaft
für Materialkunde e.V.
Senckenberganlage 10
60325 Frankfurt
Germany

Scope / Speakers

The development and optimisation of new materials for applications under enhanced and complex service conditions require new instruments for the treatment of transformations. They have to be based on fundamental principles in order to provide predictability. Empirical approaches cannot meet these requirements.

The computer simulation of phase transformation, based upon multi-component thermodynamics, offers an excellent tool for treating the kinetics of microstructure formation. This includes the morphological evolution during transitions, the prediction of precipitation sequences of stable and metastable phases and microstructural long term stability. Reliable thermodynamic data are available for a multitude of materials. Since data on true thermodynamic driving forces are available, the kinetic data are reduced to the mobilities of the elements in the various structures. They are also available for many substances and phases.

At present there exist three different approaches focusing on different aspects: (a) the sharp interface concept with local equilibrium at the moving boundary (DICTRA), (b) the phase field method with a diffuse interface allowing for a treatment of morphological evolutions like dendritic solidification (MICRESS), (c) the meanfield treatment of multicomponent, multi-phase precipitation using the concept of maximum entropy production (Onsager's extremum principle), including finite interface mobilities and large deviations from local equilibrium (MatCalc).

It is the aim of this seminar

- to present these approaches in detail,
- to show their excellent predictive capability,
- to demonstrate how to work with the software.

This will be done interactively by particular case studies which include steels, Ni-base alloys, Al-alloys.

The seminar addresses materials engineers and scientists in research and development departments in industry and at Universities.

Chairman of the seminar is **Prof. Dr. G. Inden**, retired from Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf.

Further speakers:

Dr. M. Apel
Dr. Bernd Böttger
RWTH-Aachen, Access e.V., Germany

Dr. Å. Jansson
Thermo-Calc Software AB, Stockholm, Sweden

Prof. Dr. E. Kozeschnik
Institute of Materials Science and Technology, Vienna University of Technology, Austria



Seehotel Maria-Laach

General Information

The seminar takes place in the Seehotel Maria Laach situated 15 km west of Koblenz. It is overlooking the wide round of the largest Eifel maar, a volcano that has become extinct about 10000 years ago and that now forms a lovely lake surrounded by low mountains and isolated forests. Next to the Seehotel is the 900 year old monastery Maria Laach, a holy place for contemplation and meditation.

The Seehotel offers state-of-the-art teaching and learning facilities for conferences and seminars in the immediate vicinity of a healing bath with strengthening effect on everybody. Detailed information is available on the Seehotel website: www.seehotel-maria-laach.de

For further information please contact:

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Participation fee

including full accommodation:
1.650,- EURO

Fee for Members of the DGM:

Personal members or 1 non-member from a member institute/
member company: 1.550,- EURO

The fee includes:

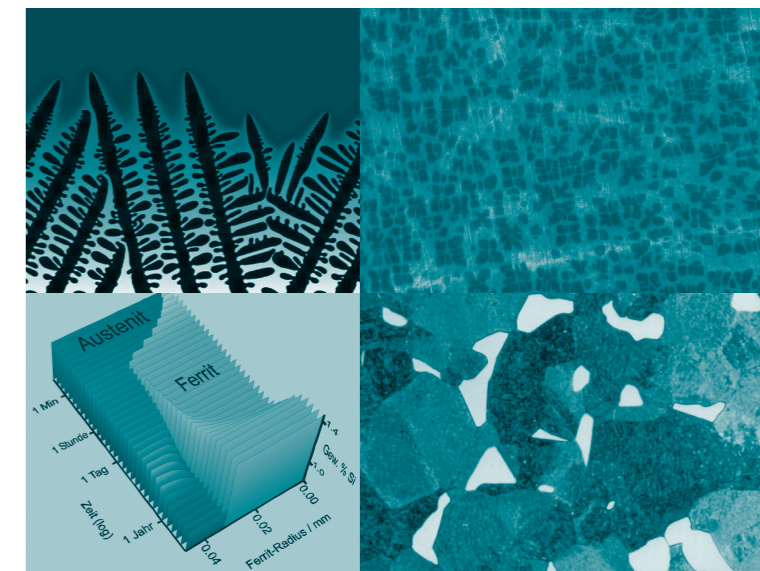
- Attendance of the seminar sessions
- Comprehensive handouts
- Refreshments during the sessions
- Lunch and dinner
- Accommodation (2 nights)

Together with the registration, accommodation and breakfast in the Seehotel will be firmly arranged. This allows to extend communication and networking during the evenings.

Cancellation policy:

Any cancellation is subject to a cancellation fee of 50% of the fees involved. After 15 June the entire fee is due. Substitution is possible at any time.

Simulation of Phase Transformation



4-6 July 2011

Maria-Laach

Deutsche Gesellschaft
für Materialkunde e.V.

Max-Planck-Institut für
Eisenforschung, Düsseldorf

www.dgm.de

Monday

Morning: Arrival

- 13:30 G. Inden
Welcome
- 13:40 G. Inden
Introduction to new approaches
Failure of empirical approaches
Unexpected reactions: effect of alloying elements, role of trace elements, competition between stable and metastable phases
- Conceptual options**
- 14:30 G. Inden
Concept of a sharp phase boundary (DICTRA)
Local equilibrium at moving interfaces (LE), local equilibrium no partitioning (LENP), para-equilibrium (PE), fast and slow reactions
- 15:30 Coffee break
- 16:00 M. Apel
Concept of diffuse interface (MICRESS)
Phase transformation as a free boundary problem; dendritic, eutectic and peritectic solidification, solid state transformations, grain growth and ripening, nucleation
- 17:00 E. Kozeschnik
Concept of maximum rate of Gibbs Energy dissipation (MatCalc)
Precipitation kinetics of spherical particles in multi-component multi-particle and multi-phase systems. Evolution equations in the case of finite mobility of phase boundaries. Estimation of interfacial energies.
- 18:00 Å. Jansson
Diffusion in multicomponent systems, kinetic database
Concept of mobility, up-hill diffusion, data assessment
- 19:00 End of day one
- 19:15 Dinner, informal get together, individual discussions

Tuesday

Software Aspects

- 8:30 Å. Jansson
Introduction into the software DICTRA
Introduction into the command structure, definition of problems, facilities for graphical representations
- 9:30 E. Kozeschnik
Introduction into the software MatCalc
Presentation of software operations via the MatCalc GUI. Ther-modynamic equilibrium analysis for typical problems of precipitation reactions
- 10:30 Coffee break
- 11:00 M.Apel
Introduction into the software MICRESS
Setting up a simulation, required material and process parameters, numerical aspects, data analysis and visualisation
- 12:00 Lunch
- Practical demonstrations**
- 13:30 G. Inden
Practical demonstration of DICTRA simulations
Precipitation in various geometries, simultaneous reactions (multi-cell treatment), various cell boundary conditions (e.g. carburisation)
- 15:00 E. Kozeschnik
Practical demonstration of MatCalc simulations
Treatment of typical problems of precipitation using GUI and command files, discussion of nucleation parameters and thermodynamic inputs
- 16:30 Coffee break
- 17:00 B. Böttger
Practical demonstration of MICRESS simulations
Microstructure variation as function of alloy composition and processing parameters, evaluation of results
- 18:30 Discussion and Dinner, informal get together

Wednesday

Applications: Developments based on Simulations

- 8:30 G. Inden
Computer-aided materials design
Super heat resistant ferritic steels
Complex heat treatments
Combined formation and dissolution of particles
- 9:30 E. Kozeschnik
Precipitation reactions in complex steels
Concurrent precipitation of complex carbides and intermetallic phases in a novel tool steel
- 10:30 Coffee break
- 10:50 B. Böttger
Simulation of microstructure formation during casting, welding and technical heat treatments
Examples of application to various materials as steels, aluminium, magnesium and nickel based alloys
- 11:50 G. Inden
Closing discussion
Future challenges, outlook on further applications
- 12:30 End of the seminar

Registration

Simulation of Phase Transformation

4 - 6 July 2011
European Advanced Training Course
Maria-Laach

DGM-Membership Number

DGM-member
 Non-member

Title, First Name(s), Name

Phone

Institute / Company

Fax

E-Mail

Date, Signature