Scope / Speakers

The properties of materials strongly depend on their microstructure. The microstructure is the result of phase transformations occurring during appropriate heat treatments. Since these treatments are limited in time, stable as well as metastable phases may participate in these reactions. It is thus very important to know about these stable and metastable phase equilibria in the field of materials development and optimization.

In practice, materials are multi-component systems. Their phase equilibria can only be obtained using numerical techniques. This gave rise to the computational thermodynamics which is based on a description of the thermodynamic functions by appropriate modelling. The parameters of these functions are obtained from experimental data by optimization methods. At present thermodynamic databases are available for various classes of materials representing a valuable tool for materials development and for the solution of complex technological problems.

The calculation of stable and metastable phase equilibria as a function of temperature and composition provides the basis for determining the effect of alloying elements on the precipitation behaviour. Similarly, chemical reactions can be calculated under various boundary conditions yielding the input for process simulation. The calculation of equilibria under time dependent conditions leads to reaction paths.

It is the aim of this training course to present the actual status of various software packages for thermodynamic calculations and to give a comprehensive and compre-hensible overview of the applications. A wide field of materials will be covered, ranging from steels, electronic materials, noble metals, solders and amalgams. Specific examples of industrial applications will be presented. In addition, broad room will be given to live and interactive demonstrations in order to give a good insight into the handling of the different types of software.

The training course addresses to materials research and development departments in industry and at universities.

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

Further speakers are:

Prof. Dr. Hans-Jürgen Christ
Institute of Materials Technology, University of Siegen

Dr. Uwe Diekmann
Metatech GmbH, Kamen

Dr. Claudia Ernst
Deutsche Edelstahlwerke, Witten

Dr. Rolf Großterlinden
ThyssenKrupp Stahl AG, Duisburg

Prof. Dr. Klaus Hack
GTT-Technologies, Herzogenrath

Dr. A. Jansson
Thermo-Calc Software AB, Stockholm (Schweden)

Prof. Dr. Markus Rettenmayr
Friedrich Schiller University Jena

Prof. Dr. Rainer Schmid-Fetzer
Technical University of Clausthal, Institute of Metallurgy

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 volcanoe 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 monastry 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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http://www.dgm.de

Participation fee
including full accomodation: 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
• Accomodation

Together with the registration, accomodation 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 May the entire fee is due. Substitution is possible at any time.

DGM Training Courses and Conferences in 2010

02.03.-05.03.	**Einführung in die Metallkunde für Ingenieure und Techniker**
17.03.-18.03.	**Titan und Titanlegierungen**
21.03.-26.03.	**Systematische Beurteilung technischer Schadensfälle**
22.03.-24.03.	**Entstehung, Ermittlung und Bewertung von Eigenspannungen**
25.05.-28.05.	**Euro Superalloys**
26.05.-27.05.	**Pulvermetallurgie**
21.06.-23.06.	**Computer-Aided Thermodynamics**
06.07.-06.07.	**Fördermittel effizient nutzen**
26.07.-30.07.	**Junior Euromat 2010**
24.08.-26.08.	**MSE 10 - Materials Science and Engineering**
27.10.-29.10.	**Cellular Materials - CELLMAT 2010**
15.11.-17.11.	**Stranggießen**
02.12.-03.12.	**Werkstoffprüfung**

DGM

European Advanced Training Course

Computer-Aided Thermodynamics
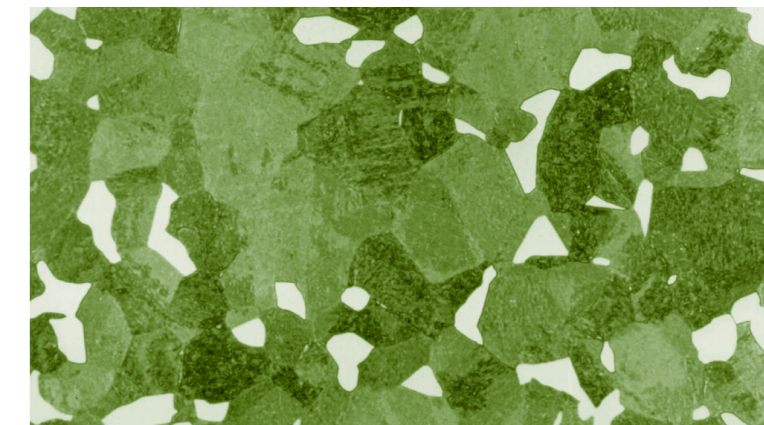
21-23 June 2010

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
Computational Thermodynamics
- Reminder of thermodynamic principles
- Data assessment / Databases / Pure Elements / Alloy systems
- Equilibria

Presentation of different thermodynamic software

14:30 A. Jansson
Software: Thermo-Calc
- Calculation of equilibria in multi-component systems
- Solidification reaction according to Scheil
- Graphical facilities for representation

15:45 Coffee break

16:15 K. Hack, M. Rettenmayr
Software: FactSage, ChemApp, ChemSheet, SimuSage, SolKin
- Thermodynamic properties, stoichiometric reactions, complex equilibria and phase diagrams
- The concept of local equilibrium in process simulation

17:30 R. Schmid-Fetzer
Software: Pandat

19:00 Dinner, informal get together

Tuesday

Examples of industrial application of computational tools

8:30 C. Ernst
Application of Thermo-Calc in tool steel development
- Stable and metastable equilibria
- Solidification according to Scheil
- Optimisation of chemical composition
- Optimisation of heat treatment temperatures and hot deformation processes
- Comparison between calculation and reality (microstructures)

9:30 M. Rettenmayr
Computer-aided alloy and process development in the industrial practice
- Development of new amalgams for gas discharge lamps
- Precipitation hardening in noble metal alloy systems
- Exothermic reactions during melting of alloy components
- Phase stability in soft solders
- Estimation of solidification intervals

10:00 M. Rettenmayr
Scheil or Lever Rule? - Modeling Solidification Kinetics
- Limits of idealized models
- Physical processes influencing concentration and phase distributions
- Examples: microstructural parameters in binary and ternary Al-alloys

10:30 Coffee break

10:45 R. Großterlinden
User-defined application of thermodynamic software
The concept of Steel Map and its realisation
Applications:
- Effect of pre-heating temperature on the effect of micro-alloying elements in steels with respect to grain growth and toughness
- Effect of traces of Ti on the solubility of Nb(C,N)

Tuesday

- Bake Hardening potential of steels
- Interplay between $Ti_4S_2C_2$ and TiS in IF-steels
- The role of thermodynamic conditions in the modelling of microstructure formation
- Effect of C-content on the yield point of steels at higher temperatures
- Thermodynamic calculations: Cp, H and transformation enthalpy of super-heated or super-cooled states

11:45 U. Diekmann
Practical use of JMatPro for the modelling of steel properties
- Phase transitions
- Physical and thermo-physical properties
- Mechanical properties

12:30 Lunch

Practical demonstrations

13:30 K. Hack
FactSage, ChemApp, ChemSheet, SimuSage

14:45 G. Inden, A. Jansson
Thermo-Calc

16:00 Coffee break

16:15 A. Jansson
Precipitation Simulation in Multicomponent Alloy Systems DICTRA news

17:00 R. Schmid-Fetzer
Pandat

18:15 U. Diekmann
JMatPro

19:15 Dinner, informal get together

Wednesday

Further examples of software applications

8:30 H.-J. Christ
Internal high temperature corrosion processes Combination of diffusion and local equilibrium calculations
- Carburisation of Ni-Cr alloys
- Carburisation of austenitic steels
- Internal nitridation of Ni model alloys
- Internal nitridation of Ni-based superalloys

10:00 Coffee break

10:20 R. Schmid-Fetzer, G. Inden, K. Hack
Calculations on demand - Real world problems raised by participants
- Participants are encouraged to present problems of their field of interest.
- It will be tried to solve these problems in live demonstrations using all of the available software and databases

11:20 G. Inden
From equilibrium to the simulation of phase transformations (DICTRA)
- Austenite/ferrite transformation
- Carbide precipitation
- Slow and fast reactions
- Competition between stable and metastable phases

12:15 Final discussion

12:30 End of the seminar

DGM-member ☐
Non-member ☐

DGM-Membership Number

Titel, First Name(s), Name

Institute / Company

Phone

Fax

E-Mail

Date, Signature