European Advanced Training Course

Nano-scale Materials

Characterization-Techniques and Applications

29 - 31 August 2017, Dresden, Germany

Dresden Fraunhofer Cluster Nanoanalysis (DFCNA)

For further information please contact:

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Scope

Nanoscale materials are playing an increasing role in materials science and engineering, they are enabler for high-tech products. The improved understanding of structure-property relationships of new materials are essential for their applications in many branches. Basic research is needed to investigate structure and properties of advanced materials on scales from product dimensions down to the atomic level. Multi-scale materials characterization and multi-scale modelling are needed for further materials research and development.
High-resolution analytical techniques are essential for both development and introduction of new nanotechnologies and thin-film technologies as well as for the integration of advanced materials into high-tech products. Nanoanalysis is more and more needed for process and materials characterization during manufacturing of nanostructured systems and devices as well as for the understanding of the nano-scale microstructure in materials. Therefore, research and development in the field of physical analysis increasingly focused on the study of thin films and nanostructures. Application-specific developments show often that the combination of several analysis techniques is needed to ensure both process control in nanotechnology as well as performance and reliability of new products.

Numerous new developments in the field of nanoanalysis allow the imaging as well as the structural and chemical characterization of structures in the range < 100 nm, down to atomic dimensions. The suitability of a technique for research and development or for process control in manufacturing is determined by the capabilities and limits of the technique itself, particularly if the technique is destructive or non-destructive, but also from the time needed for data acquisition and data analysis ("time-to-data").

The course will provide knowledge in the field of nanoanalysis. Starting with a short introduction, new techniques for the characterization of thin films, nanostructures and nanoparticles will be explained. New results from fundamental research will be presented, and applicationspecific solutions will be demonstrated as well. Challenges to nanoanalysis techniques in the industry will be an additional topic. Special examples for applied studies in micro-, nano- and optoelectronics as well as in the fields of renewable energies and lightweight construction will be demonstrated. Nanoanalytical studies at metallic, inorganic-nonmetallic and organic materials will be reviewed. We are offering a practical half-day lab training in small groups in one of the following fields of research that should be chosen by the participant:

- scanning electron microscopy / Focused ion beam
- particle analysis
- scanning probe microscopy.

All lecturers are experienced experts in the field of physical and chemical analysis.

Scope (cont.) / Speakers / General Information

The course is intended for individuals who wish to expand their knowledge in the field of nanscale materials and nanoanalysis. The subjects covered in this course extend from fundamentals of materials science and analysis to the current nanotechnologies and challenges in industry. Scientists, engineers and technicians working in industry, research and education, who are interested to extend their knowledge in nanoanalysis, will benefit from this course.

Chairman of the seminar is **Prof. Dr. Ehrenfried Zschech**, Dresden Fraunhofer Cluster Nanoanalysis, Germany.

Further speakers are:
Dr. Markus Loeffler, Dr. Uwe Mühle, Technical University Dresden, Germany, **Dr. André Clausner**, **Dr. Juergen Gluch, Dr. Malgorzata Kopycinska-Müller, Dr. Annegret Potthoff,** Fraunhofer IKTS Dresden, Germany, **Dipl.-Phys. Joerg Heber**, **Dr. Jan-Uwe Schmidt,** Fraunhofer IPMS Dresden, Germany, **Dr. Pradeep Konda Gokuldoss,** Max-Planck-Institut für Eisenforschung, Duesseldorf, Germany, **Dr. Eckhard Langer**, GLOBALFOUNDRIES Dresden, Germany, **Sylvia Mucke,** Plastic Logic GmbH, Dresden, Germany

The seminar takes place at the Fraunhofer IKTS, Maria-Reiche-Str. 2 and Winterbergstr. 28 as well as TU Dresden.

Participation fee for DGM-Members: 1.190 EUR inkl. MwSt.
personal members

DGM-Members, Young Professionals (<30 years old)*: 595 EUR inkl. MwSt.
personal members

Participation fee: 1.290 EUR inkl. MwSt.
Employees of a DGM member company / institute or FEMS member receive a 5% discount on the participation fee

Young professionals participants (<30 years old)*: 775 EUR inkl. MwSt.

** Young professionals' places will only be assigned if the conference is not to its full capacity. At least three weeks before the conference, participants registered as young professionals will be informed whether participation is possible. In case of high demand, priority will be given to DGM Members, Young Professionals.*

The fee includes:
Attendance of the seminar sessions, comprehensive handouts, refreshments during the coffee breaks, lunch and dinner* *(* incl.19% VAT.)*

Cancellation policy:
The following conditions of participation are bindingly acknowledged with the registration. Cancellations must be made in writing. In case of cancellation up to 30 days before the start of the event, the processing fee is fixed at a flat rate of 100 EUR. Thereafter, the cancellation fee is 50% of the participation fee. The cancellation must be made 10 days before the start of the event, otherwise the full participation fee has to be paid. It is possible to appoint a substitute participant after consultation. If the conference has to be canceled for unforeseeable reasons, an immediate notification will be given. In this case, the only obligation is to reimburse the already paid participation fee. In any case, the liability of Deutsche Gesellschaft für Materialkunde e.V. is exclusively limited to the participation fee.

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New Practical lab training in small groups

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Tuesday

29 August 2017

13:00 E. Zschech
Welcome and introduction

13:15 E. Zschech
Survey of analysis techniques for multiscale materials characterization

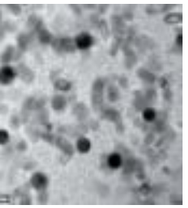
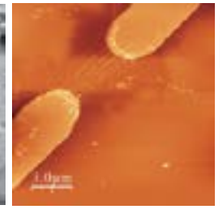
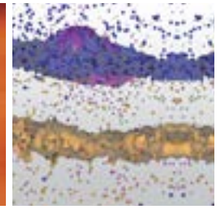
13:45 E. Langer and S. Mucke
Imaging and element analysis of materials: Scanning electron microscopy and focused ion beam technique
- Introduction to SEM and FIB
- Application in industry: Si-based and organic micro-electronics
- Challenges and limits of the techniques

15:30 Coffee Break

16:00 U. Muehle and M. Loeffler
Atomic resolution studies of materials and interfaces: Transmission electron microscopy
- Imaging: Setup and contrast mechanisms
- Structure and strain analysis: Diffraction techniques
- Elemental analysis: EDX and EELS/EFTEM
- Electron tomography
- In-situ studies

17:30 P. Konda Gokuldoss
3D atomic structures in nanoscale materials: Atom probe tomography
- Experimental and analysis techniques
- Sample preparation with focused ion beam
- Application in materials science and nanoelectronics

18:30 **Lab tour**

Wednesday

30 August 2017

9:00 J.-U. Schmidt and J. Heber
Thin film analysis: Optical analysis and metrology, X-ray reflectometry
- Ellipsometry
- Interferometry
- Application to photonic microsystems

10:00 M. Kopycinska-Müller
Contact scanning probe methods to determine mechanical properties of materials on nanoscale
- Principle of scanning probe microscopy
- Modelling the nanoscale contact
- Introducing the AFM tip – confrontation of assumptions and reality
- Accessing the information on the contact stiffness – contact resonance methods
- Applications in the field of thin-film characterization

11:00 Coffee Break

11:30 A. Potthoff
Characterization of nanoparticles: Chemical and physical analysis techniques
- Dispersion of nanomaterials
- Particle size analysis in suspensions
- Characterization of particle surfaces

12:30 Lunch

14:30 **Practical lab training in small groups**
1 - E. Langer and M. Löffler
Scanning Electron Microscopy/Focused Ion Beam

2 - A. Potthoff
Particle Analysis

3 - M. Kopycinska-Müller
Scanning Probe Microscopy

19:00 Dinner

Thursday

31 August 2017

9:00 A. Clausner
Mechanical properties of nano-scale materials and thin films: Nanoindentation and related techniques
- Hardness, Young's modulus and yield stress of nano-structures
- Nano-scale behavior of metals, ceramics, and glasses
- Properties and structure of nano-porous materials

10:00 J. Gluch and M. Loeffler
3D imaging of materials: Micro- and nano X-ray tomography
- X-ray tomography: from micro to nano
- Resolution and field of view
- Lab-based systems vs. synchrotron research
- Applications in materials science, electronics and biology

11:30 E. Zschech
Final remarks

12:30 **Lab tour**

13:30 End of the seminar

Registration

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Please scan and send via email to:
fortbildung@dgm.de
Or send via fax to:
+49 (0)69 75306 733
Registration online:
Link

☐ DGM-member
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DGM-Membership Number

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