NanoScale 2006

Seminar on Quantitative Microscopy and Nanoscale Calibration Standards and Methods

Swiss Federal Office of Metrology and Accreditation,
METAS, Lindenweg 50
Wabern, Switzerland,

24 & 25 April 2006

Programme

Monday, April 24

8:00 Registration

Session A Instrumentation and Methods

9:00	**Welcome address** R. Thalmann, G. Wilkening
9:15	**Investigation and calculations into decreasing the uncertainty of a NPM machine** I. Schmidt, T. Hausotte, U. Gerhardt, E. Manske, G. Jäger (TU, Ilmenau, DE)
9:40	**Nanoscale surface measurements at side walls of nano micro structures** G. Dai, H. Wolff, M. Xu, F. Pohlenz, H.-U. Danzebrink (PTB, Braunschweig, DE)
10:05	**The Nanostation 300 - Development of an SPM for large objects** K. Dirscherl, S.Czerkas, H.Bosse, H.-A. Fuß (PTB, Braunschweig, DE)
10:30	***Coffee break***
11:00	**Conventional coordinate measurement and nanometrology: Evaluation and reduction of parasitic effects** M.Gruhlke (Helmut Schmidt University, Hamburg, DE)
11:25	**Scanning performance of an ultra precision Micro-CMM using a low force 3 D touch probe** A. Küng, F. Meli, R. Thalmann (METAS, Bern, CH)
11:50	**An atomic force microscope for the study of tip-sample interaction** A.Yacoot (NPL, Teddington, UK) , L. Koenders, H. Wolff (PTB, Braunschweig, DE)

12:15 *Lunch break and Poster session*

Session B Application

14:00 **Preliminary study on nano particle sizes under the APEC Technology Cooperative Framework**

W. Fu, G.S. Peng, (CMS, ITRI, Taiwan)

14:25 **Profile characterization with combined AFM and spectroscopic scatterometry**

L. L. Kildemark[1], A. Kühle[1], I. Daví[1], F. Borsetto[1], J. C. Petersen[1], J. Garnæs[1], P.-E. Hansen[2], N. Agersnap[2], J. Holm[3], L. H. Christensen[4], L. H. Thamdrup[5] Andrej Mironov[5] and A. Kristensen[5]

([1]Danish Fundamental Metrology, Kgs. Lyngby, DK, [2]LuKa Optoscope, Rørmose Parkvej 50, Farum, DK, [3]Ibsen Photonics, Farum, DK, [4]Centre for Microtechnology and Surface Analyses, Teknologisk Institut, Taastrup, DK, [5]MIC - Department of Micro and Nanotechnology, Technical University of Denmark (DTU), Lyngby DK)

14:50 **Precise 3D-characterization of micro and nanostructured materials by means of confocal microscopy**

M.Weber, (NanoFocus AG, Oberhausen, DE)

15:15 **AFM investigation on possible surface damages caused by mechanical probing with small ruby spheres**

F. Meli, (METAS, Bern-Wabern, CH)

15:40 *Coffee break*

16:10 **Deformation measurements at the nanoscale**

J. Keller[1,2)], A. Gollhardt[1)], D. Vogel[1)], B. Michel[1)]
([1)]Fraunhofer Institute for Reliability and Microintegration (IZM), Berlin, DE, [2)]AMIC, Angewandte Micro-Messtechnik GmbH, Berlin, DE)

16:35 **Atomic force microscopy studies of cross-sections of columnar thin films**

P. Klapetek[1], I. Ohlidal[2] ([1]Czech Metrology Institute, Brno, CR, [2] Faculty of Masaryk University, Brno, CR)

17:00 **New applications of the nanopositioning and nanomeasuring machine by using advanced tactile and non-tactile probes**

E. Manske, R. Mastylo, T. Machleidt, K.-F. Franke, G. Jäger (TU Ilmenau, DE)

17:25 *End of first day; departure for Conference Dinner*

18:30 *Apéro at Gurten*

19:30 *Conference Dinner at Gurten*

Tuesday, April 25

	Session C **Calibration & Correction Methods**
8:30	***Technical announcements***
8:35	**Two-dimensional encoder with picometer resolution using lattice spacing on regular crystalline surface as standard**
	M. Aketagawa, H. Honda, M. Ishige, C. Patamaporn (Department of Mechanical Engineering, Nagaoka University of Technology, JP)
9:10	**Calibration strategies for scanning probe metrology**
	K.R. Koops., M.G.A. van Veghei, G.J.W.L. Kotte (NMI, Delft, NL)
9:35	**A landmark based 3D calibration strategy for SPM**
	M. Ritter, A. Kranzmann, (BAM, Berlin), T. Dziomba, L. Koenders (PTB, Braunschweig, DE)
10:00	***Coffee break and Poster presentation***
11:00	**Calibration of a commercial AFM: interferometric traceability for co-ordinate system**
	V. Korpelainen, A. Lassila (MIKES, Espoo, FI)
11:25	**Detecting and addressing the surface following errors in the calibration of step heights by atomic force microscopy**
	J. Haycocks (NPL, Teddigton, UK)
11:50	**Calibration issues in line scale based 3-D nano and micro CMMs**
	R. Bergmans, G. Kotte, (NMI, Delft, NL)
12:15	***Lunch break***
13:15	**Higher order tip effects in traceable AFM-based linewidth measurements**
	NG Orji, RG Dixon (NIST, Gaithersburg, USA)
13:40	**CD Characterization of Nanostructures in SEM Metrology**
	C.G. Frase, E. Buhr, K. Dirscherl (PTB Braunschweig, DE)
14:05	***Final remarks + closure of the seminar***
14:15	***Coffee***
14:30 – 16:00	***Guided lab tours***

Poster presentation

Instrumentation & Methods

P1 Metrological characterization of piezoelectric quartz tuning forks used as SNOM probes

M. Bressanutti, A. Boscolo, (Trieste University, Trieste, I), S. Prato, (A.P.E. Reasearch srl, Trieste, I)

P2 Development of instrumentation for SNOM applications

F. Alasia[1], M. Bressanutti[2´3], G. Picotto[1], M. Pisani[1], S. Prato[3], B. Troian[3], A. Sosso[1] ([1]Instituto di Metrologia, Torino, I, [2] Trieste Universtity, Trieste, I, [3] A.P.E. Research srl, Trieste, I.)

P3 Consequences for the assessment of functional requirements with tactile instruments in nanometrology

S. Gröger[1], M. Dietzsch[1], T. Dziomba[2], H. Winkler[2] ([1] TU Chemnitz, DE, PTB Braunschweig, DE)

P4 Artefacts in scanning near-field optical microscopy

P. Klapetek (Czech Metrology Inst., Brno, CR), I.,Ohlídal, (Faculty of Sciense, Masaryk University, Brno, CR)

P5 Gwyddion-open source SPM analysis software

P. Klapetek (Czech Metrology Inst., Brno, CR), D. Necas (Faculty of Sciense, Masaryk University, Brno, CR)

P6 Morphological filtering with Neural Networks

R. Krüger-Sehm, P. Bakucz (PTB Braunschweig, DE)

P7 Interference device for measurements in nanorange

V.S. Kupko, I.V. Lukin, V.A., Risto, A. F. Kostin, S.B. Kovshov (NSC, Kharkiv, Ukraine)

P8 Refractive index of air compensation by acoustic method for plane mirror interferometer

A. Lassila, v. Korpelainen (Mikes, Espoo, FI), L. Mihaljov (Acwaco Ltd., FI)

P9 A MEMS micro-tensile tester for characterising the mechanical properties of free-standing films

Z. Li, K. Herrmann, F. Pohlenz (PTB Braunschweig, DE)

P10 Statistical processing of high complexity fringe patterns by using discrete Fourier analysis

V. Nascow, Fl. Garoi, D. Apostol (National Inst. For Laser, Plasma and Radiation Physics, Bucharest, RO)

P11 Facility and methods for the measurement of micro and nano forces in the range below 10^{-5} N with a resolution of 10^{-12} N (Development concept)

V. Nesterov (PTB-Braunschweig, DE)

P12 Determination of modulation transfer function by imaging of square wave gratings with different periods in the nanometre range

M. Senoner, Th. Wirth, W. Unger (BAM, Berlin, DE)

P13 Linear measurements in nanometer range in Russia

P.A. Todua (Center for Surface and Vacuum Research, Moscow, RU), Yu.A. Novikov, A.V. Rakov, (Russian Academy of Sciences, Moskow, RU), Yu.V. Ozerin (Micron Corp., Moscow, RU)

P14 Scanning fluorescence microscopy with a lens colour filter

F. Quercioli, B. Tiribilli, M. Vassalli (CNR, Instituto dei Sistemi Complessi, Firenze, I), G. Molesini , M. Vannoni (CNR, Istituto Nazionale di Ottica Applicata, Firenze, I) , U. Wendt (Otto v. Guericke Univers. Magdeburg, DE) M. Smid (Carleton Univers. Ottawa, Canada) K. Stiebe-Lange (Otto v. Guericke Univers. Magdeburg, DE)

Calibration & correction methods

P15 Calibration of optical encoder by combining graphite crystalline lattice an laser interferometry

M. Aketagawa, Y. Ikeda, N. Tanyarat, M. Ishige (Nagaoka University of Technology, JP)

P16 Investigation of a probing force standard for stylus instruments

G. Dai, U. Brand, L. Doering, H.-U. Danzebrink (PTB Braunschweig, DE)

P17 Calibrate micro and nanoscale lateral standards using metrological SFM

G. Dai, F. Pohlenz, T. Dziomba, M. Xu, L. Koenders, H.-U. Danzebrink (PTB Braunschweig, DE), Z. Chen, J. Zhou (Inst. of MinR. Koops (NMi VSL, Delft, NL)

P18 Quantitative line width measurement down to 100 nm by means of optical dark field microscopy and rigorous model-based evaluation

G. Ehret, B. Bodermann, W. Mirandé(PTB Braunschweig, DE)

P19 A nanoscale linewidth standard for high resolution optical microscopy

U. Huebner[1], W. Morgenroth[1], R. Boucher[1], H.-G. Meyer[1], W. Mirandé[2], E. Buhr[2], G. Dai[2], T. Dziomba[2], R. Hild[3], N. Schwarz[4] ,T. Fries[4] ([1]Institute for Physical High Technology, Jena, DE, [2]PTB Baunschweig, DE, [3]HTWK, Naurwissenschaften, Leipzig, DE, [4]FRT GmbH, Bergisch-Gladbach, DE)

P20 A method for the in situ determination of Abbe errors and their correction

R. Köning, J. Flügge, H. Bosse, (PTB Braunscheig, DE)

P21 Control of AFM tip wear

F. Marinello, E. Savio, (University of Padova, Padova, IT)

P22 Use of cylindrical artefact for AFM vertical calibration

F. Marinello, E. Savio, (University of Padova, Padova, IT)

P23 Ge (Si) self-assembled islands as possible topography standards on the nanometre scale

M.V. Shaleev, A.V. Novikov (Institute for Physics of Microstructures, RussianAcademy of Sciences, Nizhny Novgorod, RU), T. Dziomba, R. Krüger-Sehm (PTB Braunschweig, DE)

P24 Test object for SEM calibration in nanometer range

P.A. Todua (Center for Surface and Vacuum Research, Moscow, RU), Yu.A. Novikov, A.V. Rakov, (Russian Academy of Sciences, Moskow, RU), Yu.V. Ozerin (Micron Corp., Moscow, RU)

P25 Self calibration technique to check SPM for artefacts and calibration errors

M. Xu, L. Koenders, T. Dziomba, (PTB Braunschweig, DE)

P26 The role of tip geometry and tip-sample interactions in scanning probe microscopy

A.Yacoot (NPL, Teddington, GB), L. Koenders (PTB Braunschweig, DE)

Application

P27 SEM Linewidth Measurements at anisotropically etched silicon structures smaller than 0.1 µm

C.G. Frase, W. Häßler-Grohne, H. Bosse (PTB Braunschweig, DE), Y.A. Novikov, A.V. Rakov (Russian Academy of Sciences, Moscow, RU)

P28 What is the real surface? – Is there a correlation between the mechanical surface and the electro-magnetic surface?

S. Gröger (TU Chemnitz, DE), T. Dziomba, H. Winkler (PTB Braunschweig, DE)

P29 AFM Analysis of MgB_2-Nanostructures
C. Portesi, S.Borini, (CNR-Istituto di Metrologia "G.colennetti" (INRIM), Torino, I) E. Monticone (Istituto Elettrotecnico Nazionale "Galileo Ferraris" (INRIM), Torino, I)

P30 Surface studies of weights with AFM
L. Stenlund, K.Riski, V. Korpelainen (MIKES, Espoo, FI)

Post deadline posters

PD1 CD-AFM vs CD-SEM for LER and LWR measurements
J. Foucher (CEA/LETI, Grenoble, FR)

PD2 A new metrology tool for measuring aspheres
J. Koglin, G.Jakob, M. Meyer, T. Fries (Fries Research & Technology GmbH FRT, Bergisch Gladbach, DE)

PD3 Imaging Laser-Diffractometer for traceable grating pitch calibration
J.R. Pekelsky, P.R., Nistico, B.J. Eves, J.E. Decker (INMS/NRC, Ottawa, CA)

PD4 Increase of maximum detectable slope with optical profilers, through controlled tilting and image processing
F. Marinello[1], P. Bariani[2], A. Pasquini[3], L., De Chiffre[4], M. Bossard[2],G.B. Picotto[3] ([1]University of Padova, DIMEG, IT, [2]Schaefer Italia Srl, IT, [3]Italian National Research Institute of Metrology, INRiM, IT, [4]Technical University of Denmark, IPL, Denmark)

PD5 Nanoscale deformation inspection of micro-components using optical interferometry
S. H. Wang, G. X. Tan and S. L. Tan (National Metrology Centre, Spring, SG)

PD6 Correction of structure width measurements performed with a combined shear-force/Tunneling microscope
A. Sikora, (Electrotechnical Institute, PL)