

POSTERS NANOSCALE 2023

The area for the posters is **97 cm (wide) x 118 cm (high)**, i. e. A0 format fits well.

Part 1	P-11 to P-18	Interferometry
Part 2	P-21 to P-26	Scatterometry and ellipsometry
Part 3	P-30 to P-39	Topographically measuring optical microscopes
Part 4	P-41 to P-45	MetExSPM
Part 5	P-51 to P-55	SPM instrument development
Part 6	P-61 to P-63	SPM methods
Part 7	P-71 to P-79	Transfer standards and their calibration
Part 8	P-81 to P-84	Spectroscopy and analytics
Part 9	P-91 to P-92	Nanowires

The poster boards are marked with the numbers P-11 to P-92. Please place your poster there and keep it on the boards until the end of the conference so that the posters can be visited not only during the two official poster sessions but also in the coffee breaks in between.

Please make sure that you or a co-author is near the poster during the poster sessions.

The page numbers lead you to the abstracts in the printed Book of Abstracts.

Posters Part 1 – INTERFEROMETRY

<p>P-11 p. 115</p>	<p>Correction of periodic non-linearities in homodyne optical interferometry by measurement arm intensity normalisation</p> <p>1) Angus Bridges*, Andrew Yacoot 2) Thomas Kissinger, Ralph P. Tatam 3) Thomas Kissinger</p> <p>1) National Physical Laboratory, Teddington, United Kingdom 2) Centre for Engineering Photonics, Cranfield University, United Kingdom 3) Now: Institute of Process Measurement and Sensor Technology, Technical University of Ilmenau, Germany</p>
<p>P-12 p. 119</p>	<p>Generation and measurement of sub nanoradian angles</p> <p>1) Andrew Yacoot* 2) Simon Alcock, Rabia Ince and Hiten Patel</p> <p>1) National Physical Laboratory, Teddington, United Kingdom 2) Diamond Light Source, Didcot, Oxfordshire, United Kingdom</p>
<p>P-13 p. 123</p>	<p>Characterisation of a novel multi-axis position sensor</p> <p>1) Edward Heaps, Andrew Yacoot 2) Richard Aras, James Dallas 3) László Varga</p> <p>1) National Physical Laboratory, Teddington, United Kingdom 2) Anemos Technology Ltd, London, United Kingdom 3) Anemos Technology Ltd and University of Szeged, Szeged, Hungary</p>
<p>P-14 p. 127</p>	<p>Compensation method of measurement deviation by the lateral positioning axis for topography measurements with heterodyne Interferometry</p> <p>1) Dennis Leitz*, Christian Rembe 2) Sai Gao</p> <p>1) Institute of Electrical Information Technology, TU Clausthal, Germany 2) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany</p>
<p>P-15 p. 133</p>	<p>Periodic nonlinearities of the fiber interferometric sensor in comparison to commercial homodyne interferometer</p> <p>V. Shmagun*, T. Kissinger, T. Fröhlich</p> <p>Technical University of Ilmenau, Ilmenau, Germany</p>

<p>P-16</p> <p>p. 137</p>	<p>Modified common-path differential interferometer with balanced arms and sub-nanometre long-term zero drifts</p> <p>M. Hola*, S. Rerucha*, J. Lazar, O. Cip</p> <p>Institute of Scientific Instruments of the CAS (ISI), Brno, Czechia</p>
<p>P-17</p> <p>p. 139</p>	<p>Characterising and tackling thermally induced zero-drift in displacement measuring interferometry</p> <p>S. Rerucha*, M. Hola, J. Lazar, O. Cip</p> <p>Institute of Scientific Instruments of the CAS (ISI), Brno, Czechia</p>
<p>P-18</p> <p>p. 143</p>	<p>Gauge block interferometer designed for gauge blocks calibration with modified uncertainty budget</p> <p>1) Yasser A. AlTalhh, Abdulhakim N. AlZamil, Nasser M. AlQahtani 2) Khaled M. Ahmed*</p> <p>1) SASO-NMCC (Saudi Arabia) 2) SASO-NMCC (Saudi Arabia) and NIS (Egypt)</p>

Posters Part 2 – SCATTEROMETRY and ELLIPSOMETRY

<p>P-21 p. 151</p>	<p>Multi-beam coherent Fourier scatterometry</p> <p>S. Soman*, S. F. Pereira</p> <p>Technische Universiteit Delft, Mekelweg 5, 2628 CD Delft, The Netherlands</p>
<p>P-22 p. 153</p>	<p>Exploring the Impact of Steep Side Wall Angles on Nanostructure Far Fields using Coherent Fourier Scatterometry: Simulation-Experimental Analysis</p> <p>1) Anubhav Paul*, Jila Rafighdoost, Silvania F. Pereira 2) Xiujie Dou</p> <p>1) Delft University of Technology, Delft, The Netherlands 2) Nanophotonics Research Centre, Shenzhen University, People’s Republic of China</p>
<p>P-23 p. 155</p>	<p>Analysis of fine milled technical surfaces with angular resolved scatterometry</p> <p>1) S. Bösche*, D. Hüser, A. Felgner 2) G. Stelzer, J. Seewig</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau (RPTU), Erwin-Schrödinger-Straße 52, 67663 Kaiserslautern, Germany</p>
<p>P-24 p. 159</p>	<p>Adaptions of a conventional imaging ellipsometer for the full Mueller matrix</p> <p>1) J. Grundmann*, M. Wurm, B. Bodermann* 2) M. Duwe, S. Schneider</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) Park Systems GmbH (Accurion Division), Göttingen, Germany</p>

<p>P-25</p> <p>p. 161</p>	<p>Resonance enhanced optical nanometrology</p> <p>1) T. Käseberg; 2) S. Kroker; 1) B. Bodermann; 3) S. Pereira; 3) O. El Gawhary; 4) 5) P. Petrik; 4) 6) D. Mukherjee; 7) T. Siefke; 8) F. Binkowski; 8) 9) S. Burger; 10) M. Karamehmedovic; 11) A. T. Rømer; 11) P.-E. Hansen</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) Institut für Halbleitertechnik, TU Braunschweig, Germany 3) Delft University of Technology, Delft, The Netherlands 4) Institute of Technical Physics and Materials Science, Budapest, Hungary 5) Department of Electrical Engineering, Debrecen, Hungary 6) Óbuda University, Budapest, Hungary 7) Friedrich-Schiller-Universität, Jena, Germany 8) Zuse Institute Berlin, Berlin, Germany 9) JCMwave GmbH, Berlin, Germany 10) Technical University of Denmark, Kgs. Lyngby, Denmark 11) Danish Fundamental Metrology A/S, Hørsholm, Denmark</p>
<p>P-26</p> <p>p. 165</p>	<p>Enhancement of an on-going photomask CD-comparison by a new approach for model-based optical measurements</p> <p>1) J. Krüger*, D. Bergmann, R. Köning, B. Bodermann 2) & 3) P. Manley, P.-I. Schneider, L. Zschiedrich 4) C. Eder, A. Heinrich</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) JCMwave GmbH, Bolivarallee 22, 14050 Berlin, Germany 3) Zuse Institute Berlin, Takustraße 7 14195 Berlin, Germany 4) Hochschule Aalen, Beethovenstraße 1, 73430 Aalen, Germany</p>

<p>P-36 p. 195</p>	<p>Quantitative 3D determination of dimensional parameters of surfaces by optical profilometer's images</p> <p>Luigi Ribotta*, Andrea Giura, Massimo Zucco</p> <p>Nanometrology Laboratory, Istituto Nazionale di Ricerca Metrologica (INRiM), Strada delle Cacce 91, 10135, Turin, Italy</p>
<p>P-37 p. 197</p>	<p>A case study for quantitative 3D optical characterization of machined technical surface of a cylindrical master roughness</p> <p>Luigi Ribotta*, Andrea Giura, Roberto Bellotti, Massimo Zucco</p> <p>Nanometrology Laboratory, Istituto Nazionale di Ricerca Metrologica (INRiM), Strada delle Cacce 91, 10135, Turin, Italy</p>
<p>P-38 p. 199</p>	<p>Calibration of the diamond spherical tip of Rockwell hardness indenters using a confocal laser scanning microscope</p> <p>1) M. Zackaria*, A. Felgner*, F. Menelao, T. Ahbe, U. Brand 2) R. Tutsch</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) Institut für Produktionsmesstechnik, TU Braunschweig, Germany</p>
<p>P-39 p. 203</p>	<p>Influence of cooling lubricant residues on the confocal roughness measurement of milled surfaces</p> <p>Andre Felgner, Thorsten Dziomba, Sai Gao, Dorothee Hüser and Uwe Brand*</p> <p>Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany</p>

Posters Part 4 – MetExSPM

<p>P-41 p. 211</p>	<p>Implementation of interferometers in a commercial SPM to extend positioning capabilities</p> <p>Bruno Sauvet*, Virpi Korpelainen, Antti Lassila VTT MIKES, Tekniikantie 1, 02150 Espoo, Finland</p>
<p>P-42 p. 215</p>	<p>Implementation of self-sensing and self-actuating SPM to commercial SPM</p> <p>1) Bruno Sauvet, Aarre Kilpeläinen*, Virpi Korpelainen 2) Ivo Rangelow, Hans-Georg Pietscher 3) Teodor Gotzalk, Dominik Badura</p> <p>1) VTT MIKES, Tekniikantie 1, 02150 Espoo, Finland 2) Nano analytik GmbH, Ehrenbergstraße 3, 9869 Ilmenau, Germany 3) Wrocław University of Science and Technology, Wrocław, Poland</p>
<p>P-43 p. 217</p>	<p>A high speed large-range SPM prototype based on a combination of a magnetic levitation stage and piezo scanners</p> <p>1) Jan Thiesler*, Gaoliang Dai 2) Rudolf Krueger, Felix Moehler 3) Hans-Georg Pietscher, Ivo W. Rangelow 4) Petr Klapetek</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) Physik Instrumente (PI) GmbH & Co. KG, Karlsruhe, Germany 3) nano analytik GmbH, Ehrenbergstraße 3, 98693 Ilmenau, Germany 4) Czech Metrology Institute (CMI), Okružní 31, 638 00 Brno, Czechia</p>
<p>P-44 p. 219</p>	<p>Compressed Sensing Method for Scanning Probe Microscopy based on Gaussian Processes</p> <p>R. Šlesinger*, P. Klapetek</p> <p>Czech Metrology Institute, Okružní 31, 63800 Brno, Czech Republic</p>
<p>P-45 p. 221</p>	<p>A new algorithm for function fitting: applications in AFM data analysis</p> <p>1) A. Charvátová Campbell*, P. Klapetek, R. Šlesinger 2) G. Wimmer 3) V. Witkovský</p> <p>1) Czech metrology institute, Okružní 31, 638 00 Brno, Czech Republic 2) Mathematical institute, Slovak Academy of Sciences, Bratislava, Slovakia 3) Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, Slovakia</p>

Posters Part 5 – SPM INSTRUMENT DEVELOPMENT

<p>P-51 p. 225</p>	<p>Applications of open hardware GwyScope controller for adaptive and high-speed SPM measurements</p> <p>1) M. Valtr*, P. Klapetek, V. Hortvík 2) P. Sosinowski, D. Czudek</p> <p>1) Czech Metrology Institute, Okružní 31, 638 00 Brno, Czech Republic 2) Central Office of Measures, Elektoralna 2, 00-139 Warszawa, Poland</p>
<p>P-52 p. 227</p>	<p>Atomic Force Microscopy: the Latest Technology and the Increasing Demand on Calibration for Critical-Dimension Measurements in Semiconductor</p> <p>A.C. Chang, W.-E. Fu*</p> <p>Industrial Technology and Research Institute, Hsinchu, Taiwan</p>
<p>P-53 p. 229</p>	<p>Large Range Nanomeasuring Machine NMM and Laser Sensor for extended range as primary instrument for surface measurements at CEM</p> <p>1) L. Carcedo*, M. M. Ozaita 2) J. de Vicente</p> <p>1) Centro Español de Metrología (CEM), Tres Cantos, Madrid, Spain 2) Laboratorio de Metrología y Metrotecnica (LMM), Universidad Politécnica de Madrid (UPM), C/ J.G.Abascal 2, 28006 Madrid, Spain</p>
<p>P-54 p. 231</p>	<p>An ultra-large sample stage atomic force microscope</p> <p>Liu Jirui, Xiao Shasha, Zhang Rui, Lu Nianhang, Chen Ying, Wu Sen*</p> <p>Tianjin University (TJU), Yaguan Road No.135 , 300354 Jinnan, Tianjin, China</p>
<p>P-55 p. 235</p>	<p>Precise sample tilt reduction system for advanced AFM modes</p> <p>A. Sikora*</p> <p>Faculty of Electronics, Photonics and Microsystems, Wrocław University of Science and Technology, Janiszewskiego 11/17, 50-372 Wrocław, Poland</p>

Posters Part 6 – SPM METHODS

P-61 p. 239	Coaxial tips for scanning microwave microscopy B. Eckmann, H.-J. Lin*, S. de Préville, J. Hoffmann, M. Zeier Federal Institute of Metrology METAS, Lindenweg 50, 3003 Bern-Wabern, Switzerland
F-4 p. 83	Numerical investigation of the nano-contact heat transfer for SThM probes 1) Sarah DOURI, Nolwenn FLEURENCE*, Jacques HAMEURY, Bruno HAY 2) Séverine GOMES 1) Laboratoire national de métrologie et d'essais (LNE), Trappes Cedex, France 2) CETHIL UMR5008, CNRS, INSA-Lyon, Université Claude Bernard Lyon 1, 69621 Villeurbanne, France <i>This presentation was originally intended as talk F-4. For personal reasons, this contribution needs to become a poster and changes places with P-62, which in turn becomes a talk now.</i>
P-63 p. 247	Uncertainty evaluation associated with the measurement of thermal conductivity at the nanoscale 1) Sarah Douri, Nolwenn Fleurence, Séverine Demeyer, Bruno Hay 2) Sarah Douri 1) Laboratoire National de Métrologie et d'Essais (LNE), Trappes, France 2) INSA-Lyon, Université Claude Bernard Lyon 1, Villeurbanne, France

Posters Part 7 – TRANSFER STANDARDS and their CALIBRATION

<p>P-71 p. 255</p>	<p>Grating pitch data evaluation methods – good parameter choices and accuracy</p> <p>1) D. Nečas*, P. Klapetek 2) M. Valtr 3) A. Yacoot</p> <p>1) Brno University of Technology – CEITEC, Brno, Czech Republic 2) Czech Metrology Institute, Okružní 31, 63800 Brno, Czech Republic 3) National Physical Laboratory, Teddington, United Kingdom</p>
<p>P-72 p. 257</p>	<p>Relative grating orientation measurement by detection of diffracted white light</p> <p>V. Heikkinen*, A. Mattila, V. Korpelainen, A. Lassila VTT MIKES, Tekniikantie 21, 02150 Espoo, Finland</p>
<p>P-73 p. 261</p>	<p>Traceable calibration of step heights for CSI microscope substitution measurements</p> <p>V. Byman*, V. Heikkinen, V. Korpelainen, B. Sauvet, A. Lassila VTT MIKES, Tekniikantie 21, 02150 Espoo, Finland</p>
<p>P-74 p. 265</p>	<p>Next generation versatile 3D calibration standards for application in optical and electron microscopy</p> <p>1) C. Hellmich*, L. Heinrich, S. Bütetfisch, T. Weimann 2) M. Hemmleb 3) S. Kroker</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) point electronic GmbH Erich-Neuß-Weg 15, 06120 Halle (Saale) 3) Institut für Halbleitertechnik (LENA), TU Braunschweig, Germany</p>
<p>P-75 p. 269</p>	<p>Orientation influence of a 3D standard on the coordinate marker determination for the development of a calibration method using optical microscopes</p> <p>1) L. Heinrich*, C. Hellmich, A. Felgner, T. Dziomba, D. Hüser, S. Gao 2) M. Hemmleb 3) R. Tutsch</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) point electronic GmbH Erich-Neuß-Weg 15, 06120 Halle (Saale) 3) Institut für Produktionsmesstechnik, TU Braunschweig, Germany</p>

<p>P-76 p. 271</p>	<p>Standardization of AFM roughness measurements for sub-nm surface roughness</p> <p>Victor Bergmann, Abdul Rauf, Ludger Weisser* Park Systems Europe GmbH, Schildkroetstr. 15, 68199 Mannheim, Germany</p>
<p>P-77 p. 273</p>	<p>Analysis of self-affine roughness profiles with white noise for line edge roughness measurements</p> <p>Ryosuke Kizu^{1,2*}, Ichiko Misumi¹, Akiko Hirai¹, Satoshi Gonda¹, and Satoru Takahashi²</p> <p>¹ National Metrology Institute of Japan (NMIJ), National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan ² The University of Tokyo, Hongo 7-3-1, Bunkyo, Tokyo, Japan</p>
<p>P-78 p. 275</p>	<p>Calibration of the bending stiffness of soft AFM cantilevers</p> <p>R. Popadic, Z. Li*, U. Brand, T. Ahbe, F. Pohlenz Physikalisch-Technische Bundesanstalt, Braunschweig, Germany</p>
<p>P-79 p. 277</p>	<p>NanoXSpot project: Design and characterisation of a new gauge for the determination of focal spot size for X-ray tubes used in industrial computer tomography</p> <p>1) V. Korpelainen* 2) F. Pohlenz, G. Dai 3) F. Meli, A. Küng, B. Bircher 4) G.-R. Jaenisch, D. Schumacher 5) J. P. Steffen 6) M. Costin 7) A. Deresch 8) U. Ewert</p> <p>1) Teknologian tutkimuskeskus VTT Oy, Finland 2) Physikalisch-Technische Bundesanstalt, Germany 3) Eidgenössisches Institut für Metrologie METAS, Switzerland 4) Bundesanstalt fuer Materialforschung und -pruefung, Germany 5) X-RAY WorX GmbH, Germany 6) Commissariat à l'énergie atomique et aux énergies alternatives, France 7) Comet Yxlon GmbH, Germany 8) KOWOTEST Gesellschaft für Prüfausrüstung GmbH, Germany</p>

Posters Part 8 – SPECTROSCOPY and ANALYTICS

<p>P-81 p. 283</p>	<p>Characterization of two-dimensional MoS₂ via metrological Raman spectroscopy</p> <p>M. Eckert*, S. Wundrack, R. Stosch</p> <p>Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany</p>
<p>P-82 p. 285</p>	<p>Overcome the Limit of Depth Measurement: Polymer Thickness Determination Down to ~10 nm Using Confocal Raman Microscopy</p> <p>1) Z. Wang*, S. Wundrack, R. Stosch 2) N. Grotkopp, G. Garnweitner</p> <p>1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany 2) Technische Universität Braunschweig, Braunschweig Germany</p>
<p>P-83 p. 287</p>	<p>Multifaceted Materials Characterisation for Advanced Manufacturing: From Thin Films to Perovskites</p> <p>C. Oliphant^{1,2} and F. Hungwe^{1*}</p> <p>¹ National Metrology Institute of South Africa (NMISA), CSIR Campus, Meiring Naude Road, Brummeria 0184, Pretoria, South Africa ² Dept of Physics and Astronomy, University of Western Cape, Robert Sobukwe Road, Bellville 7535, Cape Town, South Africa</p>
<p>P-84 p. 289</p>	<p>Toward analytical validation of the nanomechanical signature for medical devices</p> <p>Ramin Omidvar, Reinier Oropesa Nunez, Philipp Oertle, Marija Plodinec</p> <p>ARTIDIS AG, Hochbergerstrasse 60 C, Basel, Switzerland</p>

Posters Part 9 – NANOWIRES

<p>P-91 p. 295</p>	<p>Nanodimensional characterization on nanowires: an interlaboratory comparison between AFMs</p> <p>Luigi Ribotta* 1) 2), Eleonora Cara 2) 3), Roberto Bellotti 1), Ivan De Carlo 3), Matteo Fretto 3), Alexandra Delvallee 4), Walter Knulst 5), Richard Koops 5), Bruno Torre 6), Luca Boarino 3)</p> <p>1) Istituto Nazionale di Ricerca Metrologica (INRiM), Turin, Italy 2) PiQuET – Istituto Nazionale di Ricerca Metrologica (INRiM), Turin, Italy 3) Istituto Nazionale di Ricerca Metrologica (INRiM), Turin, Italy 4) LNE, Laboratoire National de métrologie et d’Essais, Trappes, France 5) VSL, National Metrology Institute, Delft, The Netherlands 6) Politecnico di Torino, Turin, Italy</p>
<p>P-92 p. 297</p>	<p>Nanowire dimensional characterization with AFM and SEM: pitch, diameter, height and roundness error measurements</p> <p>1) A. Delvallée*, N. Feltin 2) 3) Jiushuai Xu, Erwin Peiner</p> <p>1) LNE, Laboratoire National de métrologie et d’Essais, Trappes, France 2) Institute of Semiconductor Technology, Technische Universität Braunschweig, 38106 Braunschweig, Germany 3) Laboratory for Emerging Nanometrology (LENA), Technische Universität Braunschweig, 38106 Braunschweig, Germany</p>