

List of publications in peer reviewed journals (1990 – 2011, chronological order)
Prof. Dr. U. Kleineberg, status April 2011

1. Spin-polarized LEED from Xe-Pt(111)
G. Hilgers, U. Kleineberg, K. Nolting, S. Wirth, N. Müller, and U. Heinzmann
Vacuum 41 (1-3), pp. 325-327 (1990)
2. Fabrication and characterization of Si-based soft x-ray mirrors
B. Schmiedeskamp, B. Heidemann, U. Kleineberg, A. Kloidt, M. Kühne, P. Müller, K. Nolting and U. Heinzmann
Proceedings SPIE 1343, pp. 64-72 (1990)
3. Multischichten für optische Komponenten im weichen Röntgengebiet
B Schmiedeskamp, T. Döhring, B. Heidemann, U. Kleineberg, A. Kloidt, H. Müller, K. Nolting und U. Heinzmann
VDI Verlag Dünnschichttechnologie '90 Bd. II, pp. 480-502
4. Enhancement of the reflectivity of Mo/Si multilayer x-ray mirrors by thermal treatment
A. Kloidt, K. Nolting, U. Kleineberg, B. Schmiedeskamp, U. Heinzmann, P. Müller, M. Kühne
Appl. Phys. Lett. 58 (23), pp. 2601-2603 (1991)
5. Multischichten für optische Komponenten im weichen Röntgengebiet
B Schmiedeskamp, T. Döhring, B. Heidemann, U. Kleineberg, A. Kloidt, K. Nolting, M. Pröpper, H.-J. Stock, T. Tappe und U. Heinzmann
VDI Verlag Dünnschichttechnologie '92, pp. 329-336
6. Large area soft X-ray projection lithography using multilayer mirrors structured by RIE
S. Rahn, A. Kloidt, U. Kleineberg, B. Schmiedeskamp, K. Kadel, W. K. Schomburg, J. Hormes, U. Heinzmann
Proceedings SPIE 1742, pp. 585-592 (1992)
7. Fabrication, thermal stability and reflectivity measurements of Mo/Si-multilayers as X-ray mirrors and other optical components
A. Kloidt, H. J. Stock, U. Kleineberg, T. Döhring, M. Pröpper, K. Nolting, B. Heidemann, T. Tappe, B. Schmiedeskamp, U. Heinzmann, M. Krumrey, P. Müller, F. Scholze, S. Rahn, J. Hormes, K. F. Heidemann
Proceedings SPIE 1742, pp. 593-603 (1992)
8. Mo_{0.5}Si_{0.5}/Si multilayer soft x-ray mirrors, high thermal stability, and normal incidence reflectivity
H.-J. Stock, U. Kleineberg, A. Kloidt, B. Schmiedeskamp, U. Heinzmann, M. Krumrey, P. Müller, F. Scholze
Appl. Phys. Lett. 63 (16), pp. 2207-2209 (1993)
9. Preparation and microstructure analysis of Mo/Si multilayers as x-ray optical components
A. Kloidt, H. J. Stock, U. Kleineberg, T. Döhring, M. Pröpper, S. Rahn, K. Hilgers, B. Heidemann, T. Tappe, B. Schmiedeskamp, U. Heinzmann
3S'93 Symposium on Surface Science, pp. 115-120, Kaprun/Austria May 9-15, 1993

10. Thermal Stability of Mo/Si Multilayer Soft X-Ray Mirrors Fabricated by Electron-Beam Evaporation
H.-J. Stock, U. Kleineberg, B. Heidemann, K. Hilgers, A. Kloidt, B. Schmiedeskamp, U. Heinzmann, M. Krumrey, P. Müller, F. Scholze
Appl. Phys. A58, pp. 371-376 (1994)
11. Smoothing of interfaces in ultrathin Mo/Si multilayers by ion bombardment
A. Kloidt, H. J. Stock, U. Kleineberg, T. Döhring, M. Pröpper, B. Schmiedeskamp, U. Heinzmann
Thin Solid Films 228, pp. 154-157 (1993)
12. Electron-beam-deposited Mo/Si and $\text{Mo}_x\text{Si}_y/\text{Si}$ multilayer x-ray mirrors and gratings
B. Schmiedeskamp, A. Kloidt, H.-J. Stock, U. Kleineberg, T. Döhring, M. Pröpper, S. Rahn, K. Hilgers, B. Heidemann, T. Tappe, U. Heinzmann, M. Krumrey, P. Müller, F. Scholze, K. F. Heidemann
Optical Engineering 33 (4), pp. 1314-1321 (1994)
13. Interface Stability and Silicide Formation in High Temperature Stable $\text{Mo}_x\text{Si}_{1-x}/\text{Si}$ Multilayer Soft X-Ray Mirrors Studied by Means of X-Ray Diffraction and HRTEM
U. Kleineberg, H.-J. Stock, A. Kloidt, B. Schmiedeskamp, U. Heinzmann, S. Hopfe, R. Scholz
phys. stat. sol. (a) 145, pp. 539-550 (1994)
14. Multilayer Reflection Type Zone Plates and Blazed Gratings for the Normal Incidence Soft X-Ray Region
U. Kleineberg, H.-J. Stock, D. Menke, K. Osterried, B. Schmiedeskamp, U. Heinzmann, D. Fuchs, P. Müller, F. Scholze, K. F. Heidemann, B. Nelles, J. Thieme
Proceedings SPIE 2279, pp. 269-282 (1994)
15. Characterization of GaAs/AlAs Interfaces with Silicon Interlayers
B. Schmiedeskamp, T. Tappe, B. Heidemann, J. Schlosser, G. Haindl, U. Kleineberg, T. Albers, M. Neumann
World Scientific (Singapore 1994)
16. Mo/Si-multilayer-coated ruled blaze gratings for the soft x-ray region
U. Kleineberg, K. Osterried, H.-J. Stock, D. Menke, B. Schmiedeskamp, D. Fuchs, P. Müller, F. Scholze, K. F. Heidemann, B. Nelles, U. Heinzmann
Appl. Optics 34 (28), pp. 6506-6512 (1995)
17. Mo/Si Multilayer Coated Lamellar Phase and Ruled Blaze Gratings for the Soft X-Ray Region
U. Kleineberg, H.-J. Stock, A. Kloidt, K. Osterried, D. Menke, B. Schmiedeskamp, U. Heinzmann, D. Fuchs, P. Müller, F. Scholze, G. Ulm, K. F. Heidemann, B. Nelles
J. Electr. Spectr. Rel. Phenom. 80, pp. 389-392 (1996)
18. Thermal stability of $\text{W}_{1-x}\text{Si}_x/\text{Si}$ multilayer reflective coatings under high intensity excimer laser pulses
E. D'Anna, A. Luches, M. Martino, M. Brunel, E. Majkova, S. Luby, R. Senderak, M. Jergel, F. Hamelmann, U. Kleineberg, U. Heinzmann
Appl. Surf. Sci. 106, pp. 166-170 (1996)

19. Multilayer reflectors for polarization analysis of XUV radiation
D. Schulze, G. Sommerer, M. Drescher, J. Ludwig, U. Kleineberg, P.V. Nickles, U. Heinzmann, W. Sandner
X-Ray Lasers 1996, Int. Phys. Conf. Ser. No. 151, section 10
Eds. S. Svanders, C.-G. Walström, IOP publishing LTD, 1996
20. Thermal stability of W_{1-x}Si_x/Si multilayer under rapid thermal annealing
R Senderak, M. Jergel, S. Luby, E. Majkova, V. Holy, G. Haindl, F. Hamelmann, U. Kleineberg, U. Heinzmann
J. Appl. Phys. 81 (5) (1997)
21. Carbon buffer layer for smoothing superpolished glass surfaces as substrates for Mo/Si multilayer soft x-ray mirrors
H.-J. Stock, F. Hamelmann, U. Kleineberg, D. Menke, B. Schmiedeskamp, K. Osterried, K.F. Heidemann, U. Heinzmann
Appl. Optics 36, (1997), pp. 1650-1652
22. Efficiency of a multilayer-coated, ion-etched laminar holographic grating in the 14.5 - 16.0-nm wavelength region
M.P. Kowalski, R.G. Cruddace, J.F. Seely, J.C. Rife, K.F. Heidemann, U. Heinzmann, U. Kleineberg, K. Osterried, D. Menke, W.R. Hunter
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23. Multilayer-coated laminar grating with 16% normal-incidence efficiency in the 150 Å wavelength region
J.F. Seely, M.P. Kowalski, R.G. Cruddace, K.F. Heidemann, U. Heinzmann, U. Kleineberg, K. Osterried, D. Menke, J.C. Rife, W.R. Hunter
Applied Optics 36(31), pp. 8206-8213 (1997)
24. Multilayer-coated soft x-ray diffraction gratings for synchrotron radiation applications
U. Kleineberg, H.-J. Stock, D. Menke, O. Wehmeyer, U. Heinzmann, D. Fuchs, P. Bulicke, M. Wedowski, G. Ulm, K.F. Heidemann, K. Osterried
Proceedings SPIE 3150, pp. 18-30 (1997)
25. Characterization of the helical undulator HELIOS I in the 520 to 930 eV range using a multilayer polarimeter
M. Drescher, G. Snell, U. Kleineberg, H.-J. Stock, N. Müller, U. Heinzmann, N.B. Brooks
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26. Polarization of the 61st harmonic from 1053 nm laser radiation in neon
D. Schulze, M. Dorr, G. Sommerer, J. Ludwig, P.V. Nickles, T. Schlegel, W. Sandner, M. Drescher, U. Kleineberg, U. Heinzmann
Physical Review A 57(4), pp. 3003-3007 (1998)
27. Carbon/Titanium multilayer as soft x-ray mirrors for the water-window
H.-J. Stock, G. Haindl, F. Hamelmann, D. Menke, O. Wehmeyer, U. Kleineberg, U. Heinzmann, P. Bulicke, D. Fuchs, G. Ulm,
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28. X-ray scattering study of interface roughness correlation in Mo/Si and Ti/C multilayers

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M. Jergel, V. Holy, E. Majkova, S. Luby, R. Senderak, H.-J. Stock, D. Menke, U. Kleineberg, U. Heinzmann
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29. Chemical microanalysis by selected-area ESCA using an electron energy filter in a photoemission microscope

O. Schmidt, Ch. Ziethen, G.H. Fecher, M. Merkel, M. Escher, D. Menke, U. Kleineberg, U. Heinzmann, G. Schönhense
Journal of Electron Spectroscopy and Related Phenomena 88-91, pp. 1009-1014 (1998)

30. STM writing of artificial nanostructures in ultrathin PMMA and SAM resists and subsequent pattern transfer in a Mo/Si multilayer by Reactive Ion Etching

J. Hartwich, L. Dreeskornfeld, V. Heisig, S. Rahn, O. Wehmeyer, U. Kleineberg, U. Heinzmann
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31. Time-of-flight photoelectron emission microscopy TOF-PEEM : First results

H. Spiecker, O. Schmidt, Ch. Ziethen, D. Menke, U. Kleineberg, R.C. Ahuja, M. Merkel, U. Heinzmann, G. Schönhense
Nucl. Instrum. Meth. A 406(3), pp. 499-506 (1998)

32. STM writing Artificial Nanostructures in Alkanethiol-type Self-Assembled Monolayers

J. Hartwich, M. Sundermann, U. Kleineberg, U. Heinzmann
Appl. Surf. Sci 144-145, 538-542 (1999)

33. W/Si multilayers deposited by hot-filament MOCVD

F. Hamelmann, S.H.A. Petri, A. Klipp, G. Haindl, J. Hartwich, L. Dreeskornfeld, U. Kleineberg, P. Jutzi, U. Heinzmann
Thin Solid Films 338(1-2), pp 70-74 (1999)

34. Reactive ion etching with end point detection of microstructured Mo/Si multilayers by optical emission spectroscopy

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35. Photoemission Microscopy with Microspot-XPS by use of Undulator Radiation and a High-Throughput Multilayer Monochromator at BESSY

U. Kleineberg, D. Menke, F. Hamelmann, U. Heinzmann, O. Schmidt, G.H. Fecher, G. Schönhense
Journal of Electron Spectroscopy and Related Phenomena 101-103 (1999) pp. 931-936

36. Application of Reactive Ion Etching to the Fabrication of Microstructure on Mo/Si Multilayer

Zi-chun Le, L. Dreeskornfeld, S. Rahn, R. Segler, U. Kleineberg, U. Heinzmann
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37. Comparison of mechanical ruled varied line spacing grating vs. laminar-type holographic grating for soft X-ray flat field spectrograph (short note)

T. Yamazaki, N. Miyata, Y. Harada, M. Yanagihara, E. Gullikson, S. Mrowka, U. Kleineberg,

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38. Thermal behaviour of Co/Si/W/Si multilayers under rapid thermal annealing,
S. Luby, M. Jergel, A. Anopchenko, A. Aschentrup, F. Hamelmann, E. Majkova, U.
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39. Lifetime studies of Mo/Si and Mo/Be multilayer coatings for extreme ultraviolet
lithography
M. Wedowski, S. Bajt, J. A. Folta, E.M. Gullikson, U. Kleineberg, L.E. Klebanoff, M.E.
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40. Nanopatterning of Au absorber films on Mo/Si EUV multilayer mirrors by STM
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M. Sundermann, J. Hartwich, K. Rott, D. Meiners, E. Majkova, U. Kleineberg, M. Grunze, U.
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Surf. Science 454-456, 1104-1109 (2000)

41. In Situ Controlled Deposition of Thin Silicon Films by Hot-Filament MOCVD with
(C₅Me₅)Si₂H₅ and (C₅Me₅)SiH₃ as Silicon Precursors,
F. Hamelmann, A. Klipp, S.H.A. Petri, G. Haindl, J. Hartwich, U. Kleineberg, P. Jutzi, U.
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F. Hamelmann, G. Haindl, J. Hartwich, A. Klipp, E. Majkova, U. Kleineberg, P. Jutzi, U.
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43. Pentamethylcyclopentadienyl Disilane as a Novel Precursor for the Chemical Vapor
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44. Metaloxide/Siliconoxide Multilayers with Smooth Interfaces Produced by in-situ
Controlled Plasma-Enhanced MOCVD
F. Hamelmann, A. Klipp, G. Haindl, J. Schmalhorst, E. Majkova, U. Kleineberg, P. Jutzi, U.
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45. Effect of ion-beam polishing on the interface quality in a Ti/C multilayer mirror for "water
window"
M. Jergel, V. Holy, E. Majkova, S. Luby, R. Senderak, H.J. Stock, D. Menke, U. Kleineberg,
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47. Microcharacterization of the surface oxidation of Py/Cu multilayers by scanning X-ray absorption spectromicroscopy

U. Kleineberg, G. Haindl, A. Hütten, G. Reiss, E.M. Gullikson, M.S. Jones, S. Mrowka, S.B. Rekawa, J.H. Underwood, D.T. Attwood,
Applied Physics A 73(4), 515-519 (2001)

48. Fabrication and characterization of EUV multilayer mirrors optimized for small spectral reflection bandwidth

Y.C. Lim, T. Westerwalbesloh, A. Aschentrup, O. Wehmeyer, G. Haindl, U. Kleineberg, U. Heinzmann,
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49. Giant magnetoresistance of hysteresis-free Cu/Co-based multilayers

A. Hütten, T. Hempel, W. Schepper, U. Kleineberg, G. Reiss,
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50. Effect of substrate heating and ion beam polishing on the interface quality in Mo/Si multilayers-X-ray comparative study

A. Anopchenko, M. Jergel, E. Majkova, S. Luby, V. Holy, A. Aschentrup, I. Kolina, Y-C Lim, G. Haindl, U. Kleineberg, U. Heinzmann.
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51. Silicon oxide nanolayers for soft X-ray optics produced by plasma enhanced CVD

F. Hamelmann, A. Aschentrup, J. Schmalhorst, U. Kleineberg, U. Heinzmann, K. Dittmar, P. Jutzi.
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53. Sub-micron EUV Imaging using high harmonic radiation

M. Wieland, R. Frueke, Th. Wilhein, Ch. Spielmann, F. Krausz, M. Pohl, U. Kleineberg
Applied Physics Letters 81, 14-16 (2002)

54. Steering attosecond electron wave packets with light

R. Kienberger, M. Hentschel, M. Uiberacker, Ch. Spielmann, M. Kitzler, A. Scrinzi, M. Wieland, Th. Westerwalbesloh, U. Kleineberg, U. Heinzmann, M. Drescher, F. Krausz.
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55. Time-resolved atomic inner-shell spectroscopy

M. Drescher, M. Hentschel, R. Kienberger, M. Uiberacker, V. Yakovlev, A. Scrinzi, Th. Westerwalbesloh, U. Kleineberg, U. Heinzmann, F. Krausz.
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56. Effect of substrate roughness on Mo/Si multilayer optics for EUVL produced by UHV-e-beam evaporation and ion polishing

U. Kleineberg, Th. Westerwalbesloh, W. Hachmann, U. Heinzmann, J. Tümmeler, F. Scholze, G. Ulm, S. Müllender.

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57. Characterization of DMPC bilayers and multilamellar islands on hydrophobic Self-Assembled Monolayers of ODS/Si(100) and mixed ODS-DDS/Si (100)

A. Brechling, M. Sundermann, U. Kleineberg, U. Heinzmann;

Thin Solid Films 433 (1-2), 281-286 (2003)

58. Determination of layer-thickness fluctuations in Mo/Si multilayers by cross-sectional HR-TEM and X-ray diffraction

A. Aschtrup, W. Hachmann, T. Westerwalbesloh, Y.C. Lim, U. Kleineberg, U. Heinzmann;

Appl. Phys. A 77 (5), 607-611 (2003)

59. Zone plate interferometry at 13 nm wavelength

M. Wieland, Th. Wilhein, Ch. Spielmann, U. Kleineberg.

Appl. Phys. B-Laser and Optics 76 (8), 885-889 (July 2003)

60. Transmission Photoelectron Microscopy of Diatoms at the Multilayer Monochromator Beamline U125-1/ML at BESSY II

M. Pohl, U. Kleineberg, U. Heinzmann;

AIP Conferenc Proceedings 708 (Synchrotron Radiation Instrumentation San Francisco), 1360-1363 (2004)

61. Nanostructuring of Mo/Si multilayers by means of reactive ion etching using a three-level mask

L. Dreeskornfeld, G. Haindl, U. Kleineberg, U. Heinzmann, F. Shi, B. Volland,

I.W. Rangelow, E. Majkova, Stefan Luby, Kostic, L. Matay, P. Hrkut, P. Hudek, Hsin-Yi Lee;

Thin Solid Films 458 (1-2), 227-232 (2004)

62. Structural Organization of DMPC lipid layers on chemically micropatterned Self Assembled Monolayers as biomimetic systems

A. Brechling, M. Pohl, U. Kleineberg, U. Heinzmann;

Journal of Biotechnoogy 112 (1-2), 115-124 (2004)

63. Aperiodic nanometer multilayer systems as optical key components for attosecond electron spectroscopy

A. Wonisch, Th. Westerwalbesloh, W. Hachmann, N. Kabachnik, U. Kleineberg, U. Heinzmann;

Thin Solid Films 464-465, 473-477 (2004)

64. Atomic transient recorder

R. Kienberger, E. Goulielmakis, M. Uiberacker, A. Baltuska, V. Yakovlev, F. Bammer, A.

Scrinzi, Th. Westerwalbesloh, U. Kleineberg, U. Heinzmann, M. Drescher, F. Krausz.

Nature 427 (6977), 817-821 (2004)

65. Transmission Photoelectron Microscopy of Dry and Wet Biomaterials

M. Pohl, A. Oelsner, G. Schönhense, M. Möller, N. Hellmann, H. Decker, U. Kleineberg, U. Heinzmann.

Ultramicroscopy (in press 2004)

66. Direct measurement of light waves
E. Goulielmakis, M. Uiberacker, R. Kienberger, A. Baltuska, V. Yakovlev, A. Scrinzi, T. Westerwalbesloh, U. Kleineberg, U. Heinzmann, M. Drescher, F. Krausz.
Science 305 (5688), 1267-1269 (2004)
67. Time-resolved electron spectroscopy of atomic inner shell dynamics
M. Drescher, M. Hentschel, R. Kienberger, M. Uiberacker, T. Westerwalbesloh, U. Kleineberg, U. Heinzmann, F. Krausz.
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68. Aperiodic nanometer multilayer systems as optical key components for attosecond electron spectroscopy
A. Wonisch, T. Westerwalbesloh, W. Hachmann, N. Kabachnik, U. Kleineberg, U. Heinzmann
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69. Characterization and tests of planar Co₃O₄ model catalysts prepared by chemical vapour deposition
N. Bahlawane, EF. Rivera, K. Kohse-Hoinghaus, A. Brechling, U. Kleineberg.
Applied Catalysis B – Environmental 53 (4), 245-255 (2004)
70. Towards time-resolved soft x-ray microscopy using pulsed fs-high-harmonic radiation
M. Wieland, Ch. Spielmann, U. Kleineberg, Th. Westerwalbesloh, U. Heinzmann, T. Wilhein
Ultramicroscopy 102(2), 93-100 (Jan 2005)
71. Reproducible generation and measurement of isolated sub-fs XUV pulses with phase-controlled few-cycle light
R. Kienberger, E. Goulielmakis, A. Baltuska, M. Uiberacker, Th. Westerwalbesloh, U. Kleineberg, U. Heinzmann, M. Drescher, F. Krausz
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72. Application of high-harmonic radiation for EUV interferometry and spectroscopy
M. Wieland, Ch. Spielmann, U. Kleineberg, U. Heinzmann, T. Wilhein
in "Ultrafast Optics IV" eds. F. Krausz et. al.; Springer, Series in Opt. Scien. Vol 95, p. 467 (2004)
73. Time-resolved inner-shell spectroscopy with sub-fs EUV pulses
M. Drescher, M. Hentschel, R. Kienberger, M. Uiberacker, V. Yakovlev, A. Scrinzi, Th. Westerwalbesloh, U. Kleineberg, U. Heinzmann and F. Krausz
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74. Multilayer EUV Optics for Applications of Ultrashort High Harmonic Pulses
T. Westerwalbesloh, U. Kleineberg, Y.C. Lim, P. Siffalovic, M. Drescher and U. Heinzmann
in "Ultrafast Optics IV" eds. F. Krausz et. al. Springer, Series in Opt. Scien. Vol 95, p. 231 (2004)
75. High resolution actinic defect inspection for EUVL multilayer mask blanks by photoemission electron microscopy

U. Neuhäusler, A. Oelsner, M. Schicketanz, J. Slieh, N. Weber, M. Brzeska, A. Wonisch, T. Westerwalbesloh, H. Brückl, M. Escher, M. Merkel, G. Schönhense, U. Kleineberg and U. Heinzmann

Appl. Phys. Lett. **88**, (2006)

76. A new approach for actinic defect inspection of multilayer mask blanks : Standing wave photoemission electron microscopy

U. Neuhäusler, J. Lin, A. Oelsner, M. Schicketanz, J. Slieh, N. Weber, M. Brzeska, A. Wonisch, T. Westerwalbesloh, H. Brückl, M. Escher, M. Merkel, G. Schönhense, U. Kleineberg and U. Heinzmann

Microelectronic Engineering **83**(4-9), 680-683 (April-Sept 2006)

77. Design, fabrication and analysis of chirped multilayer mirrors for reflection of XUV attosecond pulses

A. Wonisch, U. Neuhäusler, N.M. Kabachnik, Th. Uphues, M. Uiberacker, V. Yakovlev, F. Krausz, M. Drescher, U. Kleineberg, U. Heinzmann

Applied Optics **45** (17), 4147-4156 (June 2006)

78. Actinic extreme ultraviolet lithography mask blank defect inspection by photoemission electron microscopy

Jingquan Lin, Ulrich Neuhäusler, Jawad Slieh, Ulf Kleineberg, Ulrich Heinzmann, Andreas Oelsner, Dima Valdaitsev, Gerd Schoenhense, Nils Weber, Matthias Escher, Michael Merkel
Journal Vac. Sci. Technol. B **24**(6), 2631-2635 (Nov. 2006)

79. Actinic EUVL mask blank defect inspection by EUV photoelectron microscopy

U. Kleineberg, Jingquan Lin, Ulrich Neuhäusler, Jawad Slieh, Ulrich Heinzmann, Nils Weber, Matthias Escher, Michael Merkel, Andreas Oelsner, Dima Valsaitsev, Gerd Schoenhense
Proc. SPIE **6151**(1), 542-552 (2006)

80. Chirped multilayer soft X-ray mirrors for attosecond soft X-ray pulses

U. Kleineberg, W. Hachmann, U. Heinzmann, S. Hendel, N. Kabachnik, F. Krausz, U. Neuhäusler, M. Uiberacker, Th. Uphues, A. Wonisch, V. Yakovlev,
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81. Actinic inspection of EUVL mask blank defects by photoemission electron microscopy : Effect of inspection wavelength variation

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