

Name: Wacek Swiech

Research fields of interest and experience:

- General materials characterization.
- Electron microscopy.
- Ultra-thin film growth.
- Surface analysis.
- Development/Design of Ultra-High Vacuum instrumentation

Summary: 35 years of surface physics and chemistry experience in a UHV environment using surface sensitive laterally resolving techniques. 25 years of experience with LEEM/PEEM. 15 years of experience with TEM/SEM/FIB.

In the early years involved in an electron emission group (field electron emission, FEM and ion microscopies, FIM). FEM studies on Si(111) nanowires grown by vapor-liquid-solid method. Later fully responsible to develop understanding of the principles of operation of the single LEEM instrument in the world (at that time). Learned the principles of electron optical devices utilizing low-energy immersion lenses. Developed extended and new modes of operation. Self-fabricated Schottky-like emitters for the electron gun. Research encompassed very early topics of surface science aspects tackled by LEEM as e.g. growth of ultrathin layers of various metallic adsorbates on both metallic and semiconducting single crystal substrates (all types included: F. v.d. Merwe, Stranski-Krastanov and Volmer-Weber), phase transformations on silicon and single and double monolayer metallic films (purely structural, strain-induced and adsorbate-induced), transition between two-dimensional layers and three-dimensional islands, faceting transitions on vicinal silicon surfaces. Moved to the field of surface chemistry. Pioneered studies of laterally resolved structure of the spatio-temporal investigations of the reaction-diffusion front propagation in redox systems of heterogeneous catalysis. Later pioneered investigations of surface magnetism with elemental sensitivity. Additional experiments were dedicated to buried magnetic structures and domain wall profiles (X-PEEM with Synchrotron Radiation using X-ray Magnetic Circular Dichroism effect). Studies of heavy fermion systems etc. At FS-MRL worked with LEEM on real-time studies of microtopography evolution of bcc(011) thin single-crystal metal layers at elevated temperatures including substrate miscut-dependent behavior (both polar and azimuthal) and characterization of dislocation creation and movement; co-develop and apply Step Fluctuation Spectroscopy (capillary wave analysis of step fluctuations) to investigations of numerous both bcc(011) and fcc(111) closed packed surfaces of metals; studies of both surface diffusion and surface/bulk diffusion transitions; studies of adsorbate-induced 3-dimensional faceting; studies of nanowire systems on silicon; studies of 2-dimensional phase transformations on silicon (mostly (011)); studies of dislocation-driven spiral step dynamics; studies of diffusion, step permeability and step-step interactions on Ti(111)); fundamental investigations of nano-scale phenomena in ion beam-assisted nucleation, growth and erosion (e.g. erosion by self and noble gas ions, nucleation of correlated step structures, ripening of ripples, quantitative studies of surface diffusion – both of adatom and advacancy structures, step fluctuation on driven surfaces, epitaxial growth with hyper-thermal self-ions, surface sinks during irradiation, chemistry patterning and nanoenergetics with beams of foreign ion etc.

Instrumentation/core of responsibility within the MRL:

Transmission Electron Microscopy (TEM) , Scanning Electron Microscopy (SEM), Low-Energy Electron Microscopy (LEEM), Photoexcitation Emission Electron Microscopy (PEEM)

Other instruments qualified to operate:

-Focused Ion Beam Dual-Beam SEMs, Auger Electron Spectroscopy

Education:

- Ph.D. Physics – University of Wroclaw, Wroclaw, Poland, June 1991
(applications of Low-Energy Electron Microscopy)
- M.S. Physics – University of Wroclaw, Wroclaw, Poland, March 1981
Summa Cum Laude
(phase transformations in ferroelectrics)

Appointments (Professional experience):

- 2012-present Senior Research Scientist,
 Frederick Seitz Materials Research Laboratory, University of Illinois, Urbana,
 IL
- 1996-2012 Research Electron Microscopist,
 Frederick Seitz Materials Research Laboratory, University of Illinois, Urbana,
 IL
- 1994-1996 Senior Research Associate (wissenschaftlicher Mitarbeiter)
 Johannes Gutenberg University of Mainz, Institute of Physics
 Mainz, Germany
- 1991-1993 Max-Planck Postdoctoral Fellow (Max-Planck-Stipendiat)
 Fritz-Haber-Institute of the Max-Planck-Society, Berlin, Germany

Selected publications (if applicable):

- W. Yang, S. Mao, J. Yang, T. Shang, H. Song, J. Mabon, W. Swiech, J.R. Vance, Z. Yue, S.J. Dillon, H. Xu and B. Xu
“Large-deformation and high-strength amorphous porous carbon nanospheres”
Scientific Reports **6**, 24187 (2016); Online at: doi 10.1038/srep24187
- W. Gao, J. Wu, X. Zhang, A. Yoon, J. Mabon, W. Swiech, W.L. Wilson, H. Yang and J.-M. Zuo
“Surface atomic diffusion processes observed at millisecond time resolution using environmental TEM”
Microscopy and Microanalysis **20**(3), 1590 (2014)
- W. Swiech, M. Ondrejcek and C.P. Flynn

“LEEM investigations of ion beam effects on clean metal surfaces: quantitative studies of the driven steady state”

J. Phys.: Condens. Matter **21**, 314021 (2009)

- M. Ondrejcek, W. Swiech, I. Petrov, M. Rajappan and C.P. Flynn
“LEEM investigations of surfaces using a beam of energetic self-ions”
Microscopy Research and Technique **72**, 197 (2009)

- C.P. Flynn, M. Ondrejcek and W. Swiech
“Synthesis of pans and mesas using a beam of self-ions”
J. Phys.: Cond. Matter **20**, 395001 (2008)

- C.P. Flynn, W. Swiech and M. Ondrejcek
“Universal growth of islands driven by ion beams”
Phys. Rev. **B78**, 075420 (2008)

- W. Swiech, M. Rajappan, M. Ondrejcek, E. Sammann, S. Burdin, I. Petrov and C.P. Flynn
“Real-time imaging of surface evolution driven by variable energy ion impact”
Ultramicroscopy **108**, 646 (2008)

- C.P. Flynn, W. Swiech, M. Ondrejcek and M. Rajappan
“Surface islands nucleated by a beam of energetic self-ions”
Phys. Rev. **B77**, 045406 (2008)

- M. Rajappan, W. Swiech, M. Ondrejcek and C.P. Flynn
"Surface sinks action during irradiation for Pt⁻ on Pt(111) by (LEEM)"
Phil. Mag. **87**, 4501 (2007)

- M. Rajappan, W. Swiech, M. Ondrejcek and C.P. Flynn
"Surface mass diffusion over an extended temperature range on Pt(111)"
J. Phys. Cond. Matter **19**, 226006 (2007)

- M. Ondrejcek, M. Rajappan, W. Swiech and C.P. Flynn
"Surface mass diffusion and step stiffness on V(011)"
J. Appl. Phys. **100**, 083523 (2006)

- M. Ondrejcek, W. Swiech and C.P. Flynn
“Surface mass diffusion and step stiffness on an anisotropic surface: Mo(011)”
Surf. Sci. **600**, 4673 (2006)

- J. Barenó, S. Kodambaka, S.V. Khare, W. Swiech, I. Petrov and J.E. Greene
"Orientation-dependent mobilities from analyses of two-dimensional TiN(111) island decay kinetics"
Thin Solid Films **510**, 339 (2006)

- S.-J. Tang, S. Kodambaka, W. Swiech, I. Petrov, C.P. Flynn and T.-C. Chiang
"Sublimation of atomic layers from a chromium surface"
Phys. Rev. Lett. **96**, 126106 (2006)
- M. Ondrejcek, M. Rajappan, W. Swiech and C.P. Flynn
"Step fluctuation studies of surface diffusion and step stiffness for the Ni(111) surface"
Phys Rev. **B73**, 035418 (2006)
- M. Ondrejcek, W. Swiech and C.P. Flynn
"From step fluctuations to nanostructure energetics on Nb(011)"
Phil. Mag. **86**, 1387 (2006)
- S. Kodambaka, S.V. Khare, W. Swiech, K. Ohmori, I. Petrov and J.E. Greene
"Dislocation-driven surface dynamics on solids"
Nature **429**, 49 (2004)