Matej JERGEL, Dipl. Ing., D.Sc.

CURRICULUM VITAE

Born : 1954, Bratislava, Slovakia

Education and scientific degrees :

1972-1977 studies at Slovak University of Technology - Faculty of Electrical Engineering, Bratislava

1977 Dipl.Ing. diploma work "Electrical conductivity of chalcogenide glasses", Slovak University of Technology - Faculty of Electrical Engineering, Department of Solid State Physics, Bratislava

1985 Ph.D. thesis "Study of the structure of amorphous Ti-based alloys and its changes after a low temperature annealing", Institute of Physics of the Slovak Academy of Sciences, Bratislava

2004 D.Sc. thesis "Application of X-ray scattering to interface studies in planar and patterned multilayers for soft X-EUV optics", Comenius University – Faculty of Mathematics, Physics and Informatics, Bratislava

Professional career :

since 1977 Institute of Physics of the Slovak Academy of Sciences, Bratislava

1977-1980	assistant
1981-1984	PhD student
1985-1990	research fellow
1991-1996	independent research fellow
since 1997	senior research fellow
since 1991	Head of the Laboratory of X-ray structural analysis
since 1997	Deputy Head of the Department of multilayers and nanostructures
since 2018	Head of the Department of multilayers and nanostructures

Research scope

before 1992

materials amorphous and nanocrystalline alloys prepared by rapid quenching of the melt

experimental techniques X-ray diffraction; EXAFS spectroscopy (at synchrotron); magnetostriction measurements; densitometry; dilatometry

problems studied structure solution - radial distribution analysis; thermal stability and structural relaxation

1992 – 2003

structures — planar multilayer mirrors and multilayer gratings for X-ray and UV optics; magnetic multilayers and granular films with giant magnetoresistance (GMR) effect; semiconductor thin films for solar cells; ionic conductor films for solid oxide fuel cells (SOFCs); high-k dielectric thin films; high-temperature superconducting thin films; optical and protective coatings

experimental techniques — specular and non-specular X-ray reflectometry; interface X-ray diffuse scattering; reciprocal space mapping; X-ray diffraction including grazing incidence and non-ambient conditions; X-ray magnetic resonant scattering and X-ray magnetic circular dichroism (at synchrotron)

problems studied — complex interface characterization in nanometer-scale artificial multilayer structures; dependence of interface quality on preparation conditions with the aim to maximize GMR or reflectivity; thermal stability and radiation hardness of multilayer structures; studies of non-coplanar X-ray scattering effects in multilayer gratings; defect passivation in semiconducting films for solar cells; phase composition, surface morphology and microstructure of various thin films with the aim to enhance their funcionality (SOFCs, high-k dielectric and MgB_2 superconducting thin films, optical and protective coatings)

2003 - 2010

structures — soft X-ray ultrashort period and aperiodic multilayer mirrors; planar spin valves; patterned spin valves (nanopillars) with current–induced magnetization switching; hybrid spintronic nanostructures with magnetic nanoparticles; nanoparticle 3D structures prepared by solvent evaporation or spin coating of colloidal nanoparticles of metals and metal oxides; mono- and multilayer nanoparticle assemblies prepared by Langmuir-Schaefer technique; supported and self-standing nanoparticle membranes

experimental techniques — small-angle X-ray scattering and grazing-incidence small-angle X-ray scattering

problems studied — ISO standardization of X-ray reflectometry (ISO standard 16413:2013); thermal stability of multilayer mirrors for X-ray microfocus sources and FEL; induced magnetism in magnetic multilayers; Néel coupling in spin valves; current–induced magnetization switching (CIMS); Coulomb and spin blockade in hybrid spintronic structures; nanoparticle self-assembly phenomena at the liquid/air interface; nanoparticle lift-off lithography;

nanoparticle photolysis and ozonolysis; utilization of nanoparticle membranes for sensors

since 2010 the research has been extended by -

structures — organic solar cells and hybrid perovskite solar cells; Langmuir films and nanofilms of nanoparticles and 2D nanomaterials (metal oxide nanoparticles, carbon quantum dots, nanoflakes of graphene and transition metal dichalcogenides); functionalized nanoflakes of 2D nanomaterials for biomedicine; van der Waals heterostructures of organic molecules and 2D nanomaterials; tailored V-shaped channel-cut crystal monochromators for X-ray nanometrology and X-ray imaging

experimental techniques — time-resolved small- and wide-angle non-coplanar X-ray scattering at grazing incidence (GISAXS and GIWAXS); coplanar grazing-incidence X-ray diffraction (GIXRD); UV-visible-NIR spectroscopy; confocal Raman microscopy; multimode atomic force microscopy; stylus profilometry; laser scatterometry; spectroscopic and imaging ellipsometry

problems studied — application of plasmonic nanoparticles, quantum dots and 2D nanomaterials in organic and hybrid perovskite solar cells for efficiency and stability improvement; development of functionalized 2D nanomaterials (graphene oxide, MoS2) for diagnostics and targeted treatment of cancer cells; application of 2D nanomaterials to the orientation control of small organic molecules in van der Waals heterostructures; development of nanomachining technology for the next generation of X-ray crystal optics; tailored design of new elements and setups of X-ray crystal optics for X-ray nanometrology and X-ray imaging

since 2020 the research has been extended by -

structures — combined 2D/3D perovskites for optoelectronics, solid-state electrolytes for batteries, MXenes

experimental techniques — Nano-FTIR, simultaneous *in-operando* measurements of photoluminiscence, GIWAXS and J-V curves; space- and time-resolved measurements of residual stress by GIWAXS (at synchrotron)

študované problémy — formation of 2D/3D perovskite structures with enahanced stability for solar cells, optimization of power conversion efficiency of perovskite

photovoltaic structures by admixtures (MXenes, carbon nanodots), evolution of spatial distribution of internal stress in batteries with solid-state electrolyte during charge-discharge cycling

Publication activity (author and co-author)

- chapters in books - 11
- papers in international journals – more than 300
- papers in conference proceedings - more than 250
- patents - 2
- invited lectures - 40
- presentations at conferences - more than 300

Publication response (without self-citations)

- SCI, WOS – more than 2000
- Others – 82
- H index - 25

Stays abroad (3 months and more)

- Hamburger Synchrotronstrahlungslabor (HASYLAB) am DESY, Hamburg (1989)
- International Centre for Theoretical Physics, Trieste (1991, 1993, 1995)
- Laboratoire pour l'utilisation du Rayonnement Electromagnétique (LURE), Paris-Orsay (1992)
- Laboratoire de Cristallographie du CNRS, Grenoble (regularly each year 1993-2000)
- Centro de Investigaciónes y de Estudios Avanzados del Instituto Politécnico Nacional, Mexico City (1997, 1999, 2001-2003)

Membership in Scientific Bodies and Expert Activities

- Council of the Slovak Society for Chemistry and Physics of Solids (1993-2001)
- Council of the European Synchrotron Radiation Society – National Representantive (1995-2001)
- Scientific Board of the Czech and Slovak Crystallographic Society (1996-2001)
- National grant agency VEGA (1996-2001, 2012-2021)
- Scientific Board of the Institute of Physics of SAS (1996-2001 Deputy Chairman, 2010-2018 member)
- Management Committee of the COST P7 Action "X-ray and Neutron Optics" (2002-2006) – Working Group 3 Leader
- Expert Guarrantee of IP SAS for PhD study in the subject 5.2.13 Electronics (since 2008-2016)
- Common Domain Commission for PhD study in the domains 4.1.3 Solid State Physics and Acoustics and 4.1.4. Quantum Electronics and Optics and Optical Spectroscopy (FMPI CU – IP SAS) (since 2009)
- Collegium of SAS for Mathematics, Physics and Informatics (2010-2018)

- European Academy of Sciences and Arts in Salzburg (since 2010)
- Management Committee of the COST MP1203 Action "Advanced X-ray Spatial and Temporal Metrology" (2012-2016)
- National Committee of IUPAP (since 2013)
- permanent member of the Examination Board for the national PhD study final examinations in study programmes Physical Engineering and Solid State Physics and Acoustics at FEEI SUT (since 2013)
- Board for Natural Sciences of the Slovak Research and Development Agency (2014-2018)
- national delegate of Slovakia in European Synchrotron and FEL Users Organization (2014-2023)
- Learned Society of Slovakia (since 2016)
- SAS Commission for evaluation of international projects (2017-2024)
- Expert of the European Union in the 6th and 7th Framework Programmes and Horizon 2020 (Nanotechnologies and Nanosciences, Information and Communication Technologies)
- Strategic Expert Group of M-ERA.NET Call 2019
- Administrative Board of the Insitute of Physics SAS (since 2022)
- European Crystallographic Association
- Slovak Physical Society
- Union of Slovak Mathematicians and Physicists
- Slovak Vacuum Society

Participation in research projects

- international (FP of EU, COST, VAMAS, ERA-Net, bilateral) – 36 (5x principal investigator)
- projects of Structural Funds of EU and Block Grants of EEA - 15 (2x principal investigator)
- national (VEGA, APVT, APVV, CE, state order) – 39 (6x principal investigator, 1x deputy principal investigator)

Organization of scientific events -

- member of Programme or Organization Committees of 18 international and 3 national conferences

Awards

- Prize of the Union of the Slovak Mathematicians and Physicists 1985
- Medal of of the Slovak Academy of Sciences for young scientists 1986
- SAS Prize for infrastructure development for science 2011
- member of the research team identified as top team by an audit of the Academic Ranking and Rating Agency (www.arra.sk) 2011
- Honorary Plaque SAS of Dionýz Ilkovič for merits in physico-chemical sciences 2014
- principal investigator of the APVV-0308-11 project that was selected for a representative publication of SRDA Agency on the most successful completed projects of the VV 2011 call

- Prize of the Slovak Physical Society for science 2024