

**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 functionality (SOFCs, high-k dielectric and MgB<sub>2</sub> 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, MoS<sub>2</sub>) 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

#### **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 – >1600
- Others – 70
- H index - 23

### **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 Investigaciones 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 Representative (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 Guarantee 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 (since 2017)
- Expert of the European Union in the 6<sup>th</sup> and 7<sup>th</sup> 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 Institute 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) – 35 (4x 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](http://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