

## CURRICULUM VITAE

**Name:** Mile Ivanda, Date of birth: 24.08.1961, Gender: Male,

**Current role:** Head of Laboratory for Molecular Physics and Synthesis of New Materials and head of New Functional Materials Unit of the Center of Excellence for Advanced Materials and Sensing Devices, Ruđer Bošković Institute (RBI). Senior scientist at RBI. PhD in physics at University of Zagreb, 1992. Alexander von Humboldt post-doctoral fellow in 1994-96 at University of Wuerzburg, Germany. Visiting scientist in 2000-01 at University of Trento, Italy.

**Current scientific focus:** Silicon hybrid nanostructures for gas sensing, silicon hybrid organic infrared light sensor, SERS sensor and its applications in food technology, silicon hybrid optical micro-resonators for molecular sensing. In general, structure and vibrational dynamics of semiconductor and oxide nanostructures, LPCVD depositions, anodization, Raman and FTIR spectroscopes, surface enhanced Raman spectroscopy (SERS), vibrational characterizations and computational analysis. Published about 250 papers among 162 are indexed in the base Web of Science (cited 2560 times; h-index 24) and in the Google Scholar (cited 3460 times; h-index 29). Principal investigator on 15 scientific projects. Guiding 12 PhD students. More than 30 invited talk and 2 plenary lectures. In last 5 years published 60 CC papers.

### Current projects:

2019-2022 *Cooperation Agreement with the City of Zagreb for the design of clean room* for the Center of Excellence for Advanced Materials and Sensors, Research Unit for New Functional Materials, Laboratory for Molecular Physics and Synthesis of New Materials. Principal investigator, HRK 980,000.00

2019-2021 Bilateral project *Functionalized silicon and plasmon for biological sensors of cooperation* between the Republic of Croatia and Hungary. Principal investigator, EUR 6500.00

2017-2022 *Center for Excellence for Advanced Materials and Sensors*, a project co-financed by the Government of the Republic of Croatia and the European Union through the European Regional Development Fund - Operational Program for Competitiveness and Cohesion (KK.01.1.1.01.0001). Principal investigator, 1.3M euros

2015-2019 *Hybrid Silicon Nanostructure for Sensors*, Funding Source: Croatian Scientific Foundation, Project Number: IP-2014-09-7046. Principal investigator, HRK 996,000.00

2014-2023 *New Functional Materials, Center of Excellence for Advanced Materials and Sensors*, Funding Source: Ministry of Science and Technology of the Republic of Croatia and European Union Structural Funds. Principal investigator, about 260,000 HRK per year.

2016-2019 *Contract for the examination of thin semiconductor films*, Funding source: Crodux plin d.d. Principal investigator, HRK 150,000.00.

### Related competence:

- leadership activities and writing reports for many projects,
- experience in organizing national and international workshops and meetings,
- experience in coordinating project activities, financial management, administration, reporting and applying for EU projects,
- leadership - currently responsible for the team of 15 people in the Lab
- reviewer for domestic and EU projects

**PERSONAL INFORMATION**

Name and surname **Mile Ivanda**  
Academic title Dr. / Senior Scientist  
Year and institution of PhD obtained 1992, University of Zagreb  
Address BIJENIČKA C. 54  
Phone +3851-4560-928  
Fax +3851-4680-112  
E-mail ivanda@irb.hr  
Personal web page <http://www.irb.hr/eng/People/Mile-Ivanda>  
Citizenship Croatian  
Date and place of birth 24<sup>th</sup> August 1961

**WORK EXPERIENCE (CHRONOLOGICALLY)**

Date (from – until) 2005 -  
Institution *Ruđer Bošković Institute*  
Position *Senior Scientist*  
Work field *Materials Science, Nanoscience*

Date (from – until) 1998 - 2005  
Institution *Ruđer Bošković Institute*  
Position *Senior Research Associate*  
Work field *Materials Science*

Date (from – until) 1995 - 1998  
Institution *Ruđer Bošković Institute*  
Position *Research Associate*  
Work field *Materials Science*

Date (from – until) 1986 - 1990  
Institution *Ruđer Bošković Institute*  
Position *Research Assistant*  
Work field *Materials Science*

**EDUCATION (CHRONOLOGICALLY)**

Date 1992  
Place *Zagreb*  
Institution University of Zagreb  
Title of qualification PhD

Date 1990  
Place *Zagreb*  
Institution University of Zagreb  
Title of qualification *MSc*

Date 1986  
Place *Zagreb*  
Institution University of Zagreb  
Title of qualification *BSc*

**TRAINING**  
(CHRONOLOGICALLY)

Year 2005  
Place Florence  
Institution Institute for Applied Physics "N. Carrara"  
Subject and skills covered *Structure and optical properties of nanocrystalline silicon and cadmium sulfide-selenide for optoelectronics*

Year 2003  
Place Würzburg  
Institution University of Würzburg, Institute for Physical Chemistry  
Subject and skills covered Structure and optical properties of II-VI Semiconductors

Year 2002  
Place Würzburg  
Institution University of Würzburg, Institute for Physical Chemistry  
Subject and skills covered Structure and optical properties of II-VI Semiconductors

Year 2001  
Place Würzburg  
Institution University of Würzburg, Institute for Physical Chemistry  
Subject and skills covered Structure and optical properties of II-VI Semiconductors

Year 1999  
Place Trieste  
Institution International Centre for Theoretical Physics  
Subject and skills covered *Spectroscopy and Applications*

**LANGUAGES**

MOTHER TONGUE Croatian

Language English  
Speaking excellent  
Writing excellent  
Reading Excellent

Language German  
Speaking very good  
Writing very good

- 2019-2022 **Contract on cooperation with the City of Zagreb** on the design of a clean room for the center of excellence for advanced materials and sensors, research unit new functional materials, laboratory for molecular physics and synthesis of new materials. Project leader Mile Ivanda
- 2019-2021 **Bilateral project Funkcionalized silicon and plasmonics for biological sensors** of cooperation between the Republic of Croatia and Hungary. Project leader Mile Ivanda
- 2017-2022 **Center of Excellence for Advanced Materials and Sensing Devices**, a project co-financed by the Croatian Government and the European Union through the European Regional Development Fund - the Competitiveness and Cohesion Operational Programme (KK.01.1.1.01.0001), Principal investigator
- 2015 -2019 **Hybrid Silicon Nanostructures for Sensing**, Principal investigator, Funding source: Croatian Science Foundation, project no.: IP-2014-09-7046.
- 2014 -2024 **"New functional materials"**, Center of excellence for new materials and sensors, Principal investigator, Funding source: Ministry of Science and Technology of Croatia.
- 2016-2019 **Contract for examination of thin semiconductor films**, Funding source: Crodux plin d.d., Principal investigator,
- 2015-2016 **Contract for examination of liquid mixtures**, Funding source: CEI Microelectronics d.o.o., Principal investigator
- 2014 - **Contract for research on development of nanostructured gas sensors**, Principal investigator, Funding source: Končar Institute for Electrotechnique
- 2010 -2013 **"Physics and application of nanostructures and bulk materials"**, Principal investigator, Funding source: Ministry of Science and Technology of Croatia
- 2012 -2014 **"New nanostructural materials for thermoelectrics"**, Principal investigator, Croatian-Slovenian bilateral project financed by Ministry of Science and Technology of Croatia.
- 2010 -2013 **"Novel silicon based materials for optoelectronics"**; Collaborator; Funding source: FP7 "People" - "Campaign Marie Curie" – COFUND, by Autonome Province Trento (PAT project).
- 2007 -2010 **"Physics and application of nanostructures and bulk materials"**, Collaborator, Funding source: Ministry of Science and Technology of Croatia.
- 2002 -2006 **"Physics and application of nanostructures"**, Collaborator, Funding source: Ministry of Science and Technology of Croatia.
- 2005 **"Structure and optical properties of nanocrystalline silicon and cadmium sulfide – selenide for optoelectronics"**; Principal investigator, Funding source: NATO.
- 2003-2005 **"Research on disordered materials; nano-optical layers"**, Principal investigator; Croatian-Slovenian bilateral project financed by the Ministry of Science and Technology of Croatia.
- 2002 -2004 **"Implementation and development of the LPCVD process"**, Principal investigator, Funding source: Ministry of Science and Technology of Croatia in the program of the technological development of Croatia.
- 2000 -2001 **"Study by Raman and optical techniques of nanostructures synthesized by ion bombardment"**, Collaborator, Istituto Nazionale per la Fisica della Materia - MURST within the program COFIN-98.
- 1996 -2002 **"Scattering of light, interaction and dynamics of matter"**, Collaborator, Funding source: Ministry of Science and Technology of Croatia.
- 1995 -1996 **"Structure and metastable states of a-Si:H and a-SiC:H"**, Principal investigator, Funding source: Alexander von Humboldt Foundation
- 1991-1996 **"Vibrations phenomena and interactions in condensed matter"**, Collaborator, Funding source: Ministry of Science and Technology of Croatia.
- 1995 **"Selektive Reaktionen Metall - Aktivierter Moleküle"**, Collaborator, Funding source: Deutsche Forschung Gemeinschaft
- 1994 **"Structural properties and metastable states of a-Si: and a-Si<sub>x</sub>C<sub>1-x</sub>:H"**, Principal investigator, Funding source: European Community.

- 2014- **Physics and Chemistry of Nanostructured Surfaces and Materials**, University of Zagreb's scientific postgraduate study at Faculty of Chemical engineering and technology
- 2013 - **Introduction to Nanomedicine**, Inter-university postgraduate study "Molecular Biosciences», Josipa Jurja Strossmayera University in Osijek, Ruđer Bošković Institute in Zagreb and University of Dubrovnik.
- 2007-2013 **Experimental methods of physics in natural science**, Inter-university postgraduate study "Molecular Biosciences», Josipa Jurja Strossmayera University in Osijek, Ruđer Bošković Institute in Zagreb and University of Dubrovnik.
- 2006-2013 **Basics and applications of nanostructures**, University of Zagreb's scientific postgraduate study at Faculty of Chemical engineering and technology.
- 2005 **Experimental methods of modern physics**, Graduate study of physics at the Faculty of Natural Sciences and Mathematics, University of Zagreb.
- 1987-1988 **Physical Practicum III**, Graduate study of physics at the Faculty of Natural Sciences and Mathematics, University of Zagreb.

## Mentorship

of defended doctoral and master dissertations  
and training of young researchers and scientists (chronologically)

1. Vedran Đerek, **HYBRID JUNCTION OF STRUCTURED SILICON AND ORGANIC SEMICONDUCTOR FOR DETECTION OF INFRARED LIGHT**, Doctoral thesis, University of Zagreb, Faculty of Engineering and Computing, February 2016., 162 p.
2. Lara Mikac, **SURFACE-ENHANCED RAMAN SCATTERING: FROM THE COLLOID TO THE STABLE SUBSTRATE**, Doctoral thesis, University of Zagreb, Faculty for Natural Sciences and Mathematics, 12.02.2016. 175 p.
3. Sanja Žonja, **ANALYSIS OF STRUCTURE, ELECTRONIC AND TRANSPORT PROPERTIES OF HEAVILY DOPED POLYCRYSTALLINE SILICON THIN FILMS**, Doctoral thesis, University of Zagreb, Faculty of Engineering and Computing, June 2013., 132 p.
4. Romana Baltić, **STRUCTURAL AND OPTICAL PROPERTIES OF MICROSTRUCTURAL SILICON COATED WITH SILVER NANOPARTICLES**, Master thesis, University of Zagreb, Faculty for Natural Sciences and Mathematics, 14.02.2013., 80 p.
5. Maja Balarin, **ELECTROCHEMICAL ETCHING OF SILICON ON INSULATOR**, Doctoral thesis, University of Zagreb, Faculty for Natural Sciences and Mathematics, 12.07.2011. 145 p.
6. Diana Car, **SPHERICAL ACOUSTIC VIBRATIONS OF ZrO<sub>2</sub> NANOPARTICLES DOPED WITH Ti<sup>4+</sup>**, Master thesis, University of Zagreb, Faculty of natural sciences and mathematics, 20.06.2011. 103 p.
7. Vedran Đerek, **PREPARATION AND CHARACTERIZATION OF POROUS SILICON OBTAINED BY CHEMICAL METHODS**, Master thesis, University of Zagreb, Faculty of natural sciences and mathematics, 11.03. 2011. 120 p.
8. Davor Ristić, **DEPOSITION AND CHARACTERIZATION OF NANOCRYSTALLINE SILICON**, Doctoral thesis, University of Zagreb, Faculty of natural sciences and mathematics, 12.04.2010, 99 p.
9. Marijan Marciuš, **DEPOSITION AND CHARACTERIZATION OF OXYGEN ENRICHED THIN SILICON FILMS**, Diploma work, University of Zagreb, Faculty of natural sciences and mathematics, 06.07.2010, 112 p.
10. Zdenko Tijanić, **DEPOSITION AND CHARACTERIZATION OF NONSTOICHIOMETRIC AMORPHOUS SILICON NITRIDE THIN FILMS**, Diploma work, University of Zagreb, Faculty of natural sciences and mathematics, 15.12.2010, 84 p.
11. Viktor Vilman, **DEPOSITION OF THIN SEMICONDUCTOR LAYERS**, Diploma work, University of Zagreb, Faculty of natural sciences and mathematics, 20.12.2007, 92 p.
12. Hrvoje Gebavi, **DEPOSITION AND CHARACTERIZATION OF THIN SILICON FILMS**, Diploma work, University of Zagreb, Faculty of natural sciences and mathematics, 28.06.2006, 122 p.
13. Davor Ristić, **RAMAN SPECTROSCOPY OF SILICON NANOPARTICLES**, Diploma work, University of Zagreb, Faculty of natural sciences and mathematics, 19.06.2006, 82 p.

14. Sanja Žonja, **CHARACTERIZATION OF POYSILICON LAYERS OBTAINED BY LPCVD METHOD**, Diploma work, University of Zagreb, Faculty of Engineering and Computing, 21.09.2006. 102 p.
15. Ozren Gamulin, **STRUCTURE AND OPTICAL PROPERTIES OF THIN HALCOGENIDE SEMICONDUCTORS**, Doctoral thesis, University of Zagreb, Faculty of natural sciences and mathematics, 2004, 144 p.
16. Ozren Gamulin, Master science thesis, University of Zagreb, Faculty of natural sciences and mathematics, 1996, 96 p.
17. Ozren Gamulin, Diploma work, University of Zagreb, Faculty of natural sciences and mathematics, 1989, 92 p.

## PEER REVIEW OR EVALUATION

Expert in field of physics, materials science, nanotechnology:

1	European Union, 2018, reviewer of 9 research projects for Maria Curries program for postdoctoral and visiting scientists research projects.
2	University of Rijeka, Croatia, 2015-2019, reviewer of around 70 research projects.
3	National Science Center, Poland, 2015, reviewer of the grant proposal "Non-linear effects in hybrid silicon-organic materials with different molecular and supramolecular structure."
4	Serbian Ministry of Science, 2011, reviewer of the project "CVD Diamond films produced from hydrocarbons by use of the flat flame method".
5	University of Zagreb, Faculty of Chemical Engineering and Technology, 2015, reviewer of the book "Introduction to Nanotechnology".
6	Astronomical Observatory, Zagreb, 2014, reviewer of the book "Oton Kučera".
7	Elsevier, reviewer of the New Edition book proposal "Nanotechnologies for Microelectronics and Optoelectronics".

## VISITS TO FOREIGN RESEARCH AND EDUCATION INSTITUTIONS (CHRONOLOGICALLY; ONLY VISITS LONGER THAN 1 MONTHS)

1993	<b>Three months post doctoral fellow of the European Community</b> at the Institute for Physical Chemistry, University of Würzburg (Prof. Dr. W. Kiefer) on the project Structural properties and metastable states of a-Si: and a-Si <sub>x</sub> C <sub>1-x</sub> :H.
1994	<b>One and half year ALEXANDER VON HUMBOLT post-doctoral fellow</b> at the Institute for Physical Chemistry, University of Würzburg (Prof. Dr. W. Kiefer) on the project "Structure and Metastable States of a-Si:H and a-SiC:H".
1995	<b>Three months visiting scientist</b> at the Institute for Physical Chemistry, University of Würzburg (Prof. Dr. W. Kiefer) on the project "Selektive Reaktionen Metall - Aktivierter Moleküle"
2000	<b>One year visiting scientist</b> at the Department of Physics, University of Trento (Prof. G. Mariotto) on the project "Study by Raman and optical techniques of nanostructures synthesized by ion bombardment" .

2001	<b>Two months visiting scientist</b> at the Institute for Physical Chemistry, University of Würzburg (Prof. Dr. W. Kiefer) on the project "II-VI Semiconductors".
2002	<b>Two months visiting scientist</b> at the Institute for Physical Chemistry, University of Würzburg (Prof. Dr. W. Kiefer) on the project "II-VI Semiconductors".
2003	<b>Two months visiting scientist</b> at the Institute for Physical Chemistry, University of Würzburg (Prof. Dr. W. Kiefer) on the project "II-VI Semiconductors".
2004	<b>One month visiting scientist</b> at CNR-IFN, Trento (Dr. M. Ferrari) on the project "Er doped SiO <sub>2</sub> -TiO <sub>2</sub> planar waveguide".
2005	<b>Two months visiting scientist</b> at the Institute for Applied Physics "N. Carrara", Firenze (Dr. G. Righini) on the project "Structure and optical properties of nanocrystalline silicon and cadmium sulfide-selenide for optoelectronics".

#### AWARDS AND RECOGNITIONS (CHRONOLOGICALLY)

1992	University of Würzburg, European Community Postdoc. Fellowship Award, 3 month
1993 – 1995	University of Würzburg, Alexander von Humboldt Fellowship Award, 18 month
2000 – 2001	University of Trento, Department of Physics, Guest researcher, 12 month
2005	Institute "Nello Carrara", NATO Research Fellowship Award, 2 month
2007	Award for the best scientific paper at MIPRO Conference
2013	Award for the best scientific paper at MIPRO Conference

#### MEMBERSHIP IN SCIENCE ORGANIZATIONS AND BODIES (CHRONOLOGICALLY; HOME AND INTERNATIONAL ORGANIZATIONS AND BODIES)

2015-	Member of the Croatian Vacuum Society
1996-	Member of the European Physical Society
1996-	Member of the Croatian Physical Society
1997-	Member of the Croatian Humboldt Club
1990-	Member of the Croatian Astronomical Society

#### ORGANIZATIONAL SKILLS AND COMPETENCES, COMMISSIONS, COMMITTEES, BOARDS AND WORK GROUPS (CHRONOLOGICALLY; ORGANIZATION OF HOME AND INTERNATIONAL SCIENCE EVENTS)

1990-2010	<b>Member of the State Commission</b> for the Primary and Secondary School Competition in Astronomy
1997-2001	<b>Treasurer</b> of the Croatian Physical Society
2001 -2009	<b>Member of the State Commission</b> for the Standardization TC 76 "Safety of optical radiation and laser equipment" of the State Department for Standardization and Measurements
2005 -2019	Every year - MIPRO Conference / <b>Member of Steering Committee</b> /international congress / 800 participants / Opatija, Croatia,
2006 -2016	<b>Deputy Chairman</b> of the Scientific Council of Physics of RBI.
2010	<b>Associate Editor</b> of ISRN Spectroscopy



2010	<b>Member of the Jury Board</b> , International Fair of Innovations, New Products and Technologies, ARCA 2010, Zagreb
2010	Nanotechnologies – New challenges in the Republic of Croatia / <b>Head and organizer of the Round Table</b> at the conference 33rd MIPRO / 80 participants / Opatija, Croatia
2010	SPIE - Silicon Photonics and Photonic Integrated Circuits, <b>Member of Steering Committee</b> /International congress / 900 participants / Strasbourg, France
2011	<b>Guest editor</b> of Croatica Chemica Acta, Vol.85 No.1, editing of Proceedings of the 34th MIPRO, May 23-27, 2011, Opatija, Croatia.
2011	<b>President of the Scientific Board</b> of the Croatian Physical Society.
2011	Croatian Physical Society Meeting / <b>President of the Scientific Committee</b> / 200 participants / Primošten, Croatia.
2012	<b>Editor of Proceedings</b> of the 2nd Adriatic School on nanoscience (ASON-2), Ruđer Bošković Institute,
2012	2012 2nd Adriatic School on Nanoscience (ASON-2) / <b>Chairmen and the main organizer of the conference</b> / international summer school& conference / 90 participants / Dubrovnik, Croatia
2013	Spring World Congress on Engineering and Technology (SCET 2014) / <b>Member of International Advisory Board</b> / international congress / 900 participants / Shanghai, China.
2014	13th International Ceramics Congress - CIMTEC 2014 / <b>Member of International Advisory Board</b> / international congress / 700 participants / Montecatini Terme, Italy.
2014 - 2016	<b>Secretary</b> of Croatian Humboldt Club
2015	<b>Chair</b> of Training School on Raman Spectroscopy under the COST action MP1302 Nanospectroscopy, Zagreb, Croatia, September 23-25, 2015.
2016	<b>Chair</b> of the 2nd MC meeting & 1st Annual conference of the COST action MP1401, Zadar, Croatia, April 12-15, 2016
2016 - 2020	<b>President</b> of Croatian Humboldt Club
2017	<b>Chair</b> of 25th Croatian Humboldt Club Anniversary, Zagreb, Croatia, May 18, 2017.

## INSTITUTIONAL RESPONSIBILITIES

2018-2022	<b>President of Governing Council</b> of the Institute of Physics, Zagreb
2018-2022	<b>President of Croatian Humboldt Club</b> , Zagreb
2018-2019	<b>Head of Center of excellence for new materials and sensors</b> , Ruđer Bošković Institute, Croatia
2014-2019	<b>Head of research unit New functional materials</b> of Center of excellence for new materials and sensors, Ruđer Bošković Institute, Croatia
2006-2015	<b>Deputy Chairman of the Scientific Council of Physics</b> , Ruđer Bošković Institute, Croatia
2011-2019	<b>Head of Laboratory for Molecular Physics and Synthesis of New</b>



	<b>Materials, Ruđer Bošković Institute, Croatia</b>
2011-2012	<b>Main Coordinator</b> for the implementation of the Croatian Center for Advanced Materials and Nanotechnology appointed by three institutions: Ruđer Bošković Institute, University of Zagreb and Institute of Physics.
2010-2012	<b>Organizer and proposer of the RBI new division:</b> Institute for Functional Materials and Nanostructures which was supported by 90 employee of RBI.
1997- 2001	<b>Treasurer, Croatian Physical Society</b>

## INVITED LECTURES

(CHRONOLOGICALLY; HOME AND INTERNATIONAL)

1. **The effects of crystal size on the Raman spectra of nanophased  $Cd_xSe_{1-x}$ ,  $TiO_2$  and  $GaAs$** , International Conference on Physics and Technology of Nanostructured, Multicomponent Materials, Uzghorod, Ukraine, 1998.
2. **Comparison of high resolution transmission electron microscopy and low frequency Raman scattering in determination of particles size distribution of nanosized  $TiO_2$** . 1st International Workshop on Nanoscale Spectroscopy and Its Applications to Semiconductor Research, Trieste, Italy, 2000.
3. **Experimental observation of optical amplification in silicon nanocrystals**, "Optical Amplification and Stimulation in Silicon" NATO Advanced Research Workshop TOWARDS THE FIRST SILICON LASER, Trento, Italy, 2002.
4. **Application and Development of the LPCVD Process on Ruđer Bošković Institute**, The 26th International Conv. MIPRO, Opatija, Croatia 19.-23.05. 2003.
5. **Photonics Based on Nano-Silicon**, The 27th International Convention MIPRO, 2004 Opatija, Croatia.
6. **Vibracijska svojstva nano-čestičnih materijala**, ZNANSTVENI PROJEKTI I PROGRAMI, Klub hrvatskih humboltovaca, Zagreb, 03.04.2004.
7. **Tehnoloski projekt "Usvajanje i razvoj LPCVD proces**, ZNANSTVENI PROJEKTI I PROGRAMI, Klub hrvatskih humboltovaca, Zagreb, 03.04.2004.
8. **Raman Technique in Determination of Size Distribution of Oxide and Semiconductor Nanoparticles**, International Conference on Opto-electronics and Spectroscopy of Nano-Structured Thin films and Materials, 02.-05.08.2004. Peking, China
9. **Low Frequency Raman Scattering of Glasses Containing Si Nanoparticles**, The 28th International Convention MIPRO, 2005 Opatija, Croatia.
10. **Raman scattering technique in characterisation of glasses containing silicon nanoparticles for optoelectronics**, Barcelona, ICTON, 2005.
11. **Nanocomposite Photonics Materials**, MIPRO, 2005 Opatija, Croatia.
12. **Nanocomposite Photonic Glasses and Confined Structures Tailoring  $Er^{3+}$  Spectroscopic Properties**, MIPRO, 2007, Opatija, Croatia.
13. **Low Frequency Coherent Raman Scattering of Spherical Acoustical Vibrations of Three-Dimensional Self-Organized Germanium Nanocrystals**, 3rd International Conference "Smart Materials, Structures and Systems" - Smart Optics, CIMTEC 2008, Acireale, Italy.
14. **Low frequency Raman scattering in characterization of nanostructured materials**, E-MRS Fall Meeting, Warszawa, Poland, September 15-19, 2008,
15. **Optical Properties and Fabrication of Glass-Based Erbium Activated Micro-Nano Photonic Structures**, Croatia, MIPRO, Opatija, 26-30. 5. 2008.
16. **Low-Frequency Raman Scattering in Materials Research**, Plenary talk, European Conference of Molecular Spectroscopy (EUCMOS) 2008, Croatia, Opatija, 31.08-05.09. 2008.
17. **Rare-earth-activated nano-structures fabricated by sol-gel route**, 32nd International Convention MIPRO, Opatija, May 2009.
18. **Low frequency Raman scattering of nanostructured materials**, The 2nd International Meeting on Clusters and Nanostructured Materials (CNM-2), Uzghorod , Ukraine 27-30. 09. 2009.

19. ***Porous Silicon by Electrochemical Anodisation of Silicon Epitaxial Layer, Silicon Polycrystalline Layer and Silicon on Insulator as New Substrates for Sensing Applications***, NATO Advanced Research Workshop Technological Advances in CBRNE Sensing and Detection for Safety, Security, and Sustainability, Yerevan, Armenia, Sept. 29-Oct. 02, 2012.
20. ***Vibrations of Nanoparticles***, 13<sup>th</sup> International Ceramics Congress, CIMTEC 2014, Symposium CL, Inorganic Materials Systems for Optical and Photonic Applications, June 8-20/2014, Montecatini Terme, Italy.
21. ***Materials Science Research in Croatia and Its Sustainability***, International sustainability Days "Euro-Ibsa" - workshop, Wurzburg, Germany, 2014.
22. ***Istraživanja naprednih materijala u Republici Hrvatskoj i njihova održivost***, 5. Festival znanosti, Sinj, 14-18 rujan, 2014.
23. ***Silicon Nanostructuring for SERS Applications and Hybrid Infrared Light Sensing Device***, Progress In Electromagnetics Research Symposium PIERS 2015, Prague, July 6–9, 2015, Czech Republic.
24. ***Silicon Nanostructuring For Advanced Applications***, 22nd International Scientific Meeting on Vacuum Science and Technique, Slovenian Society for Vacuum Technique and Croatian Vacuum Society, Osilnica, 21-22 May 2015, Slovenia.
25. ***Silicon Nanostructuring For Advanced Applications***, International Workshop on Soft & Complex Matter, Norwegian Academy of Science and Letters, Oslo, October 15-16, Norway.
26. ***Development and applications of SERS techniques***, Mediterranean Conference on the Applications of the Mössbauer Effect, Zadar, 7-10 June 2015, Croatia.
27. ***Perspektive razvoja novih tehnologija u Centru izvrsnosti za napredne materijale i senzore***, 6. Festival znanosti, Sinj, 28.-29. listopada 2015.
28. ***Nanostrukturiranje silicija za napredne primjene***, Centar izvrsnosti za znanost i tehnologiju, Split, 2. rujan 2015.
29. ***Silicon Nanostructuring For Advanced Applications***, институт проблем машиноведения РАН, Sankt-Peterburg, Rusija, DeceMBER 13, 2016.
30. ***Nano- and microstructured silicon/organic hybrid near-infrared photodetectors***, "Silicon Photonics and Photonic Integrated Circuits" conference of SPIE Photonics Europe, 3-7 April 2016, Brussels, Belgium.
31. ***Development and Applications of Silicon Nanostructuring***, Annual International Workshop on Soft & Complex Matter, Norwegian Academy of Science and Letters, Oslo, Norway, October 6-7, 2016.
32. ***Development and Applications of Silicon Nanostructuring***, 16th Joint Vacuum Conference/14th European Vacuum Conference/23th Croatian Slovenian International Scientific Meeting on Vacuum Science and Technique, Portorož, Slovenia, June 6-10, 2016.
33. ***Opto-Electronic Devices and Sensors Based on Nanostructured Silicon***, EAGLES International Conference on Rare-Earth Doped Glass Materials and Fibre Lasers, MPNS COST MP1401, 18-19 October 2016, Povo-Trento, Italy
34. ***Nanostructured silicon hybrid devices for IR light sensing and SERS detection***, FORESEEN consortium meeting, April 21, 2017, Paris, Francuska
35. M. Ivanda: ***CROATIAN HUMBOLDT CLUB AND SCIENCE IN CROATIA***, HUMBOLDT KOLLEG, „Humboldtians and Scientific Progress in the Central and Eastern European (CEE) Countries“, 16–18. 11. 2017. Sofija, Bugarska.
36. M. Ivanda: ***Nanostrukturiranje silicija i Ramanova spektroskopija u Laboratoriju za molekulsku fiziku i sinteze novih materijala Instituta Ruđer Bošković***, MINI SIMPOZIJ posvećen prof. emeriti Mirjani Metikoš-Huković, 14. prosinca 2017., Fakultetu kemijskog inženjerstva i tehnologije, Zagreb, Croatia.
37. M. Ivanda: ***SMALL COUNTRIES IN THE PROCESSES OF SCIENCE GLOBALIZATION*** HUMBOLDT KOLLEG, At the door of European Union: The role of the science and research for sustainable development of the Balkan region, April 20 – 23, 2018, Ohrid, R. Macedonia
38. M. Ivanda: ***Low Wavenumber Raman Scattering on Semiconductor and Metal Oxide Nanoparticles***, "International Congress on Microscopy & Spectroscopy", April 24-30, 2018 in Fethiye, Mugla - Turkey.
39. M. Ivanda: ***SUSTAINABLE ECONOMICAL ADVANCING IN DEVELOPING COUNTRIES BY SCIENCE DEVELOPMENT***, Humboldt-Kolleg "Sustainable Development and Climate Change: Connecting Research, Education, Policy and Practice" from the 19th to 22nd of September, 2018, Belgrade, Serbia.

40. M. Ivanda: **ROLE OF CENTER OF EXCELLENCE FOR ADVANCED MATERIALS AND SENSING DEVICES IN TECHNOLOGICAL DEVELOPMENT OF CROATIA** Humboldt Kolleg - New Frontiers, from 30.11. to 1.12.2018, Budapest, Hungary.
41. M. Ivanda: **POROUS SILICON AND SILICON NANOWIRES FOR SENSING**, 26<sup>th</sup> International Scientific Meeting on Vacuum Science and Technique Njivice, 16-17. May 2019.
42. M. Ivanda: **HYBRID SILICON NANOSTRUCTURES FOR SENSING**, VIII Ukrainian scientific conference on physics of semiconductors (USCPS-8), October 2-4, 2018.
43. M. Ivanda: **ZNANOST, TEHNOLOGIJA I GLOBALIZACIJA**, 6. UTRKU SOLARNIH AUTOMOBILA SOELA, 8. i 9. Svibnja 2018, Sisak, Croatia.

#### PAPERS

(CHRONOLOGICALLY; RESEARCH BOOKS, HOME AND INTERNATIONAL RESEARCH JOURNALS, HOME AND INTERNATIONAL CONFERENCE PROCEEDINGS; PLEASE WRITE THEIR IMPACT FACTOR)

*M. Ivanda has published 161 papers with 2560 citations and Hirsh index  $H=24$  (under the base Web of Science) or 255 papers with 3560 citations and Hirsh index  $H=29$  (under the base Google Scholar) in the area of structure and vibrational dynamics of semiconductor and oxide nanostructures and development of new sensing techniques.*

#### **Mile Ivanda's 5-year track-record, Five publications (\*-corresponding author):**

1. T Janči, D Valinger, JG Kljusurić, L Mikac, S Vidaček, M Ivanda\*, Determination of histamine in fish by Surface Enhanced Raman Spectroscopy using silver colloid SERS substrates, *Food Chemistry* 224, 48-54, (2017). IF=4.85, Cit.=25.
2. L Mikac, M Ivanda\*, V Đerek, M Gotić, Influence of mesoporous silicon preparation condition on silver clustering and SERS enhancement, *J. Raman Spectr.* 47, 1036-1041, 2016. IF=3.01, Cit.=14.
3. V. Đerek, E. D. Glowacki, M. Sytnyk, W. Heiss, M. Marcuiš, M. Ristić, M. Ivanda\*, and N. S. Sariciftci, Enhanced near-infrared response of nano- and microstructured silicon/organic hybrid photodetectors, *Applied Physics Letters* 107, 083302 (2015). IF=3.41, Cit.=16.
4. M Kosović, M Balarin, M Ivanda, V Đerek, M Marcuiš, M Ristić, O Gamulin, Porous silicon covered with silver nanoparticles as surface-enhanced Raman scattering (SERS) substrate for ultra-low concentration detection, *Applied spectroscopy* 69 (12), 1417-1424, 2015. IF=1.52, Cit.=18.
5. D. Ristic, M. Mazzola, A. Chiappini, A. Rasoloniaina, P: Féron, R. Ramponi, G. Righini, G. Cibiel, M.Ivanda\*, and M. Ferrari, Tailoring of the free spectral range and geometrical cavity dispersion of a microsphere by a coating layer, *Optics Letters* 39, 5173-5176 (2014), IF=3.39, Cit.=22.

#### **List of 15 selected publications:**

1. M. Ivanda, K. Babocsi, C. Dem, M. Schmitt, M. Montagna, W. Kiefer, *Low Wavenumber Raman Scattering From Nanosized CdS<sub>x</sub>Se<sub>1-x</sub> Crystals Embedded In Glass Matrix*, *Phys. Rev. B* 67, 235329-235337 (2003). IF=3.77, Cit.=63
2. M Ristić, M Ivanda, S Popović, S Musić, *Dependence of nanocrystalline SnO<sub>2</sub> particle size on synthesis route*, *J. Non-Cryst. Solids* 303, 270-280 (2002). IF=1.59, Cit.=110
3. M Ristić, S Musić, M Ivanda, S Popović, *Sol-gel synthesis and characterization of nanocrystalline ZnO powders*, *J. Alloys and Compounds* 397, L1-L4 (2005). IF=2.39, Cit.=95
4. M. Ivanda, I. Hartmann, and W. Kiefer, Boson peak in Raman spectra of amorphous gallium arsenide: Generalization to amorphous tetrahedral semiconductors, *Phys. Rev. B* 51, 1567-1571 (1995). IF=3.77, Cit.=30
5. M. Ivanda, S. Musić, M. Gotić, A. Turković, A. M. Tonejc and O. Gamulin, The effects of crystal size on the Raman spectra of nanophase TiO<sub>2</sub>, *J. Mol. Struct.* 480-481, 641-644 (1999). IF=1.45, Cit.=73

6. M. Ivanda, A. Hohl, M. Montagna, G. Mariotto, M. Ferrari, Z. Crnjak Orel, A. Turković, and K. Furić, Raman Scattering Of Acoustical Modes Of Silicon Nanoparticles Embedded In Silica Matrix, *J. Raman Spectr.* 37, 161-165 (2006). IF=3.13, Cit.=28
7. Ivanda, M., Waasmaier, D., Endriss, A., Ihringer, J., Kirfel, A., & Kiefer, W. Low-Temperature Anomalies of Cuprite Observed by Spectroscopy and X-Ray Powder Raman Diffraction. *Journal of Raman spectroscopy*, 28, . (1997) 487-493. IF=3.13, Cit.=56
8. M. Ivanda, K. Furić, S. Musić, M. Ristić, M. Gotić, D. Ristić, A.M. Tonejc, I. Djerdj, M. Montagna, M. Ferrari, A. Chisaera, Y. Jestin, G. C. Righini, W. Kiefer, Low Wavenumber Raman Scattering of Nanoparticles and Nanocomposite Materials, The review paper in the Special Issue: Raman Spectroscopy on Nanomaterials, *J. Raman Spectr.* 38, 647-659 (2007). IF=3.13, Cit.=65
9. Ristić, D., Ivanda, M., Speranza, G., Siketić, Z., Bogdanović-Radović, I., Marciuš, M., Ristić, M., Gamulin, O., Musić, S., Furić, K., Righini, G.C., Ferrari, M., Local site distribution of oxygen in silicon-rich oxide thin films: A tool to investigate phase separation, *J. Phys. Chem. C*, 116 (2012) 10039-10047. IF=4.81, Cit.=19
10. Kosović, M., Gamulin, O., Balarin, M., Ivanda, M., Đerek, V., Ristić, D., ... & Ristić, M. Phonon confinement effects in Raman spectra of porous silicon at non-resonant excitation condition. *Journal of Raman Spectroscopy*, 45, (2014) 470-475. IF=2.71, Cit.=19
11. Đerek, V., Głowacki, E. D., Sytnyk, M., Heiss, W., Marciuš, M., Ristić, M., ... & Sariciftci, N. S. Enhanced near-infrared response of nano- and microstructured silicon/organic hybrid photodetectors. *Applied Physics Letters*, 107 (2015) 84\_1. IF=3.30, Cit.=15
12. Janči, T., Valinger, D., Kljusurić, J. G., Mikac, L., Vidaček, S., & Ivanda, M. Determination of histamine in fish by Surface Enhanced Raman Spectroscopy using silver colloid SERS substrates. *Food Chemistry*, 224, (2017) 48-54. IF=4.31, Cit.=24.
13. Buljan, M., Desnica, U.V., Ivanda, M., Radić, N., Dubček, P., Dražić, G., Salamon, K., Bernstorff, S., Holý, V., *Formation of three-dimensional quantum-dot superlattices in amorphous systems: Experiments and Monte Carlo simulations*, *Physical Review B - Condensed Matter and Materials Physics*, 79, 035310, (2009). IF=3.77, Cit.=24
14. M Kosović, M Balarin, M Ivanda, V Đerek, M Marciuš, M Ristić, O Gamulin, *Porous silicon covered with silver nanoparticles as surface-enhanced Raman scattering (SERS) substrate for ultra-low concentration detection*, *Applied spectroscopy* 69 (12), 1417-1424, 2015. IF=1.52, Cit.=18.
15. D. Ristic, M. Mazzola, A. Chiappini, A. Rasoloniaina, P: Féron, R. Ramponi, G. Righini, G. Cibieli, M.Ivanda\*, and M. Ferrari, *Tailoring of the free spectral range and geometrical cavity dispersion of a microsphere by a coating layer*, *Optics Letters* 39, 5173-5176 (2014), IF=3.39, Cit.=22.

## MAJOR SCIENTIFIC COLLABORATIONS

**Wolfgang Kiefer**, Raman spectroscopy, semiconductor nanoparticles, University of Würzburg, Germany

**Maurizio Montagna**, Raman spectroscopy, nanoparticles, , University of Trento, Italy

**Maurizio Ferrari**, photonics, transparent ceramics, spherical optical resonators, CNR-IFN, Trento, Italy

**Giancarlo Righini**, silica spherical optical microresonators, IFAC, Firenze, Italy

**Serdar Sariciftci**, hybrid organic devices, LIOS, Linz, Austria

**Vladimir Mitsa**, halcogenide semiconductors, University of Uzghorod, Ukraine

**Gino Mariotto**, Raman spectroscopy, semiconductors, University of Trento, Italy

## OTHER RESEARCH ACTIVITIES

(CHRONOLOGICALLY; CHIEF EDITOR OR EDITOR OF RESEARCH BOOK, HOME AND INTERNATIONAL RESEARCH JOURNALS, HOME AND INTERNATIONAL CONFERENCE PROCEEDINGS AND OTHER)

*Derek V, Głowacki E D, Sariciftci S N, Ivanda M, Optoelektronischer Infrarotsensor, Austrian National Patent application (pat.app.nr. A 50534/2014) 2018.*

Excellent

## DESCRIPTION OF RESEARCH TOPICS

**The research topics:**

The research is focused on nanostructural silicon thin films for advanced applications. The Low Pressure Chemical Vapor Deposition (LPCVD) and Physical Vapor Deposition (PVD) were implemented and developed at Ivanda's group. The different type of silicon based thin films are preparing like silicon rich oxide, silicon rich nitride, amorphous silicon, polycrystalline silicon, doping with boron, phosphorus, erbium and europium, silicon carbide and porous silicon by electrochemical etching. The structural, optical, electrical and transport properties are investigating with a goal of development of doped silicon nanostructured films (dots, wires, porous structure) for thermoelectric elements (Peltier cooler and heater, low temperature sensor); silicon nanocrystals thin films doped with rare earths for photonics (spherical microresonators, optical amplifiers, lasers), silicon carbide thin films on silicon and porous silicon for gas and/or chemical sensing. Beside, different aspects of Raman scattering as a powerful analytic tool has been developed: low frequency Raman scattering for determination of size distribution of nanoparticles, portable Raman spectrometer as well as new techniques for SERS spectroscopy.

**Nanostructured silicon for thermoelectrics**

Thermoelectric (TE) devices are able to convert the waste heat from combustion engines, solar energy or from radioactive sources into electrical or some other kind of energy on a pure and non-pollutant way. Silicon, the basic material of semiconductor electronics, is widely available, comparatively cheap, ecologically friendly and technologically well developed. Those are reasons enough to seek a marriage between silicon and thermoelectric properties. Recently, Ivanda's group has found a large Seebeck coefficient of 200  $\mu\text{V}/\text{K}$  (the main physical property of TE materials), in a heavily boron doped polysilicon sample obtained by the LPCVD method. By using the LPCVD method, they are producing various kinds of doped silicon nanostructures (dots and wires) in order to obtain those with good TE properties. They also search for advanced TE properties on nanoporous silicon prepared by anodisation technique.

**Novel silicon based materials for photonics**

The research include the production and the characterization of novel silicon based materials for optoelectronics, namely silicon rich oxides (nitrides), silicon oxide /silicon rich oxide (nitride) multilayers, nanocrystalline silicon and europium doped silicon nanocrystals in silica layers. All of these new materials will be studied in combination with silica microspheres. These thin films on silica microspheres will be investigated in order to examine different non-linear properties under the high laser light intensity excitation conditions. The Stimulated Raman Scattering and optical amplification being the most promising for the construction of silicon-based laser will be searched on this silicon based thin films deposited on silica microspheres. The project includes cooperation between the IFN-CNR in Trento and the Ruđer Bošković Institute in Zagreb under the 150.000 euros value research project.

**Porous silicon for sensors**

Silicon Epitaxy and Poly-Silicon layers. Silicon, an indirect gap semiconductor, can emit light with 10% efficiency at room temperature, provided that it is in the form of low-dimensional (quantum dots or wires) nanostructures. Ivanda's group is producing porous silicon from three types of silicon layers: Silicon On Insulator (SOI), Silicon Epitaxy and Poly-Silicon layers. Anodizing with DC and AC current of these layers creates new morphology that show intense photoluminescence. The research objectives are new simple and inexpensive techniques for preparation of porous silicon for the development of high sensitive gas sensors, thermoelectric and biocompatible materials. The structures with novel morphologies that exhibit strong photoluminescence were discovered. The luminescence mechanisms and the relationship between bandgap energy, luminescence energy, and size of nanostructures are investigating.

**Development of new techniques of Raman spectroscopy**

The group has significant contribution in development of Raman scattering technique in

determination of size distribution of free nanoparticles, of the nanoparticles in matrices and more generally of the size distribution of various nanocomposite materials. Besides, the portable Raman spectrometer and new methods of SERS spectroscopy are developing for versatile application in environmental, medicine and food analysis.