



# JOŽEF STEFAN INTERNATIONAL POSTGRADUATE SCHOOL

## Performance Self-Evaluation

Summary of the self-evaluation report for the 2019/2020 academic year

Mission • Integration into Environment • Study Programmes • Teaching Staff • Students

# Mission of Jožef Stefan IPS

The mission of the Jožef Stefan International Postgraduate School (hereinafter IPS) is **to ensure the highest quality of master and doctoral postgraduate studies** with the help of a research and educational process in an intensive R&D and innovative environment. Additionally, the school aims to **contribute to strengthening the role of excellent science and high technologies** in the development **potential of the society**, which can significantly contribute to the **economic power and harmonious social development**. The IPS acts as a centre of excellence closely interlacing basic research with postgraduate education and innovation development. Research achievements

are directly incorporated into innovation projects aimed at developing production, service activities, and management. IPS masters and doctors, together with their supervisors and co-supervisors, **contribute to new achievements** in basic research and innovation development.

Slovenian Quality Assurance Agency for Higher Education (**NAKVIS**) established that in addition to the legal provisions the IPS also meets the Criteria for Accreditation and Reaching Quality Standards, as defined in the Criteria, and therefore prolonged the accreditation of the school until 30 September 2024.

## COLLABORATION WITH NATIONAL INSTITUTES AND CENTRES OF EXCELLENCE

The basic strategy of the IPS is **to invite leading researchers** from the founding and partner institutes in the selected fields, and include them in the research and educational process of the school. Thus, in collaboration with the IPS founders and partners, who also provide state-of-the-art research infrastructure, the school ensures material and intellectual capacities in order to educate new masters and doctors of science.

**Jožef Stefan Institute (JSI)**  
**Institute of Metals and Technology (IMT)**  
**National Institute of Biology (NIB)**  
**Centre of Excellence on Nanoscience and Nanotechnology (CENN Nanocentre)**  
**Centre of Excellence for Integrated Approaches in Chemistry and Biology of Proteins (CE CIPKeBiP)**  
**Centre of Excellence for Advanced Materials and Technologies for the Future (CE NAMASTE)**

## INDUSTRIAL PARTNERS

17 founders and associate partners:

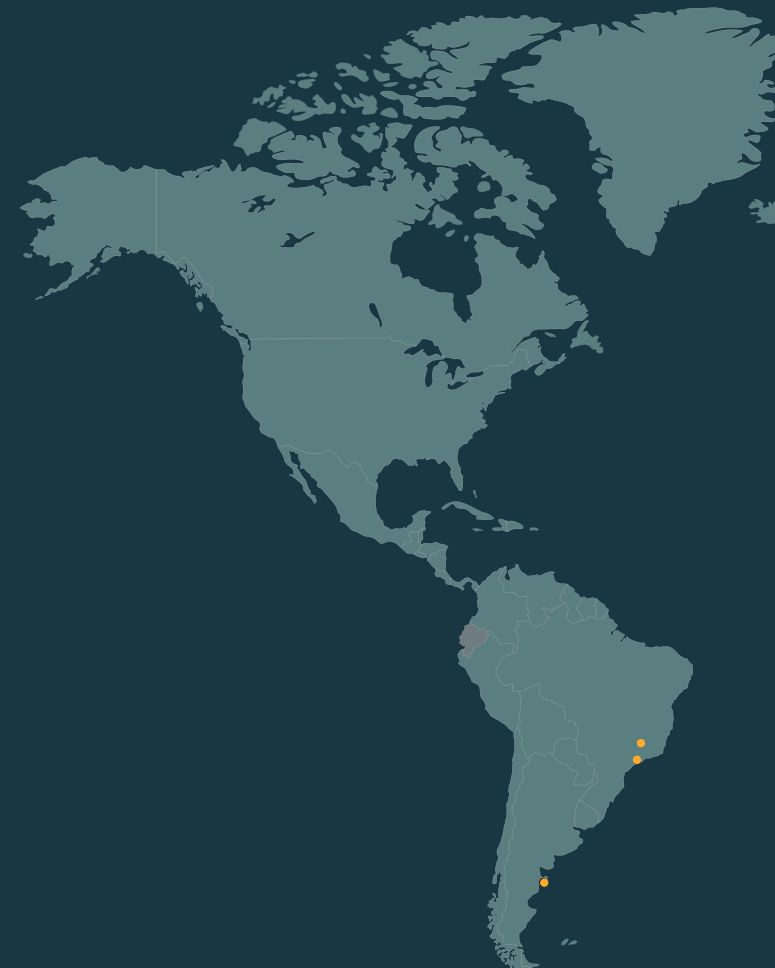
**BSH**, Nazarje  
**Cosylab**, Ljubljana  
**Domel**, Železniki  
**ETI**, Izlake  
**Gorenje**, Velenje  
**HYB**, Sentjernej  
**Kolektor Group**, Idrija  
**LTH Castings**, Škofja Loka  
**Luka Koper**, Koper

**Premogovnik Velenje**, Velenje  
**Salonit**, Anhovo  
**Slovenian Insurance Association**, Ljubljana  
**Štore Steel**, Štore  
**Telekom Slovenije**, Ljubljana  
**Termoelektrarna**, Šoštanj  
**Trimo**, Trebnje  
**Unior**, Zreče



The IPS was established mostly out of **the need for an efficient transfer of excellent research achievements to the industry and the service sector**.

In collaboration with other institutes and the industry, the IPS sets up joint development projects with excellent foreign and Slovenian professors and students.



# Integration of IPS into Environment

The IPS cultivates this integration by directly connecting and implementing all its activities with founding and partner institutes, by contributing to the world treasury of knowledge, and by increasing the efficiency of drawing from it. Great concern is devoted to inviting excellent Slovenian and foreign institutions

to collaborate with the IPS in the field of study programmes, projects and special actions by individually including international leading scientists as IPS visiting professors and by encouraging collaboration between IPS professors and leading research groups in the framework of joint projects.

## IPS STUDENTS FROM AROUND THE WORLD

**47 % of IPS students come from outside of Slovenia**  
(shown as grey on the map), mostly from Europe:

Bosnia and  
Herzegovina  
Montenegro  
Croatia  
Kosovo  
North Macedonia  
Serbia

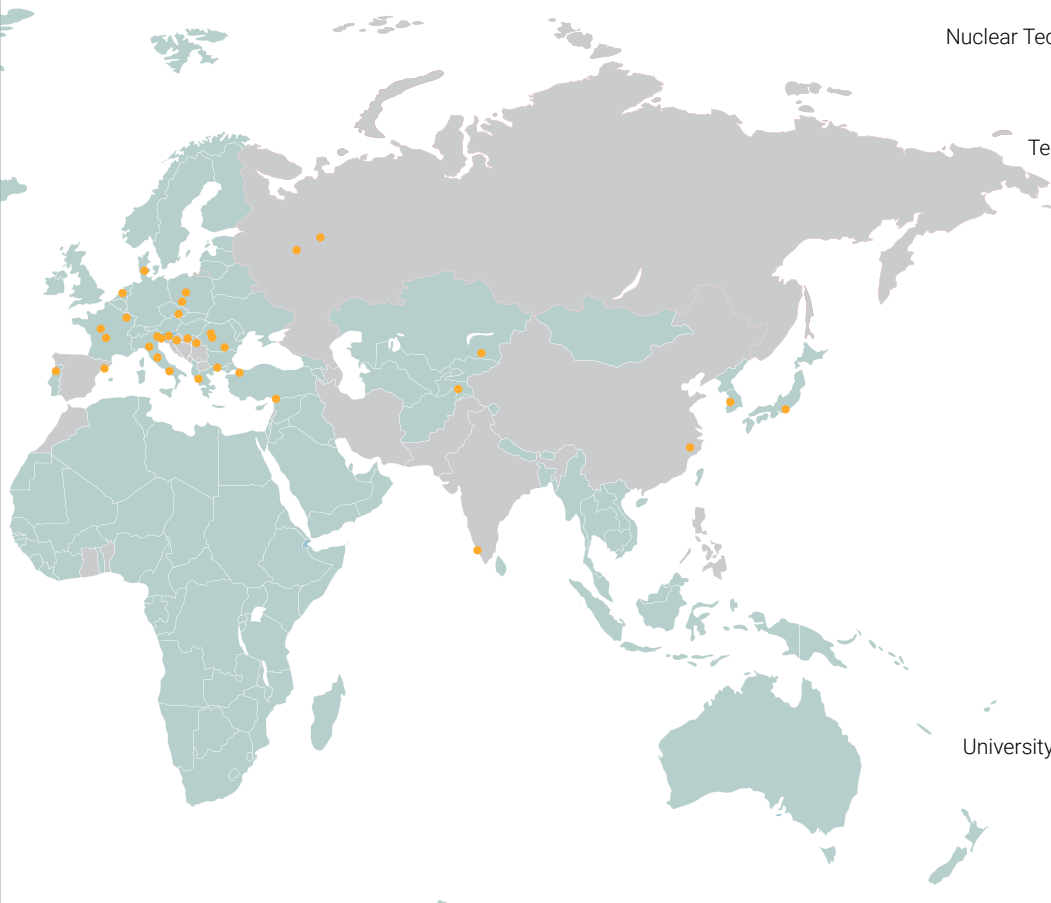
Spain  
Azerbaijan  
the Philippines  
India  
Iran  
China  
Lebanon

Pakistan  
Russian Federation  
Ecuador  
Benin  
Ghana  
Morocco

## COLLABORATION AGREEMENTS

The IPS currently holds **37 collaboration agreements** with foreign and national research and higher education organisations (shown as dots on the map):

Adam Mickiewicz University, Poznań, Poland  
Al-Farabi Kazakh National University, Almaty, Kazakhstan  
Aristotle University of Thessaloniki, Greece  
Babeş-Bolyai University, Cluj-Napoca, Romania  
Bauman University, Moscow, Russia  
Joint Institute for Nuclear Research, JINR, Dubna, Russia  
Josip Juraj Strossmayer University of Osijek, Croatia  
Korea Advanced Institute of Science and Technology, KAIST, Daejeon, South Korea  
Mahatma Gandhi University, Kottayam, Kerala, India  
Mining-Metallurgical Institute of Tajikistan, Tajikistan  
Mustafa Kemal University, Antakya, Turkey  
Nuclear Technology Development Center (CDTN), Belo Horizonte, Brazil  
Roskilde University, Denmark  
Sabanci University, Istanbul-Tuzla, Turkey  
Technical University of Cluj-Napoca, Romania  
Tokushima Bunri University, Tokyo, Japan  
Tomas Bata University in Zlín, Czech Republic  
Universidade de São Paulo, Brazil  
Universidad Nacional del Sur, Bahía Blanca, Argentina  
Universitat de Barcelona, Spain  
Universitatea din Bucuresti, Romania  
University of Amsterdam, the Netherlands  
University of Ioannina, Greece  
University of Porto, Portugal  
University of Salerno, Italy  
University of Udine, Italy  
University of Wrocław, Poland  
University of Zagreb, Croatia  
Università degli Studi di Perugia, Italy  
Université de Limoges, France  
Université de Lorraine, Nancy, France  
Université François Rabelais, Tours, France  
University of Belgrade, Serbia  
University of Ljubljana, Biotechnical Faculty, Slovenia  
University of Parma, Italy  
University of Nova Gorica, Slovenia  
Zhejiang University, Hangzhou, China





# Study Programmes

## NANOSCIENCES AND NANOTECHNOLOGIES STUDY PROGRAMME

master and doctoral degree programme

The Nanosciences and Nanotechnologies programme represents a field at the crossroads of physics, chemistry, and biology, combined with elements of electrical engineering, medicine, and environmental sciences. It explores nature and the use of systems with components of nanometric size. Potential applications can also be found in almost all economic sectors.

### PROGRAMME OBJECTIVE

The principal objective of studying nanosciences is **to acquire the understanding of the structure and dynamics of materials at an atomic and molecular level**, which is also the basis for their macroscopic properties. Through knowledge of methods of atomic and molecular micromanipulation we can build **new molecules, devices and machines with entirely new properties and possibilities of application**. Some examples are projects aimed at building atomic-scale computer components, constructing new sensors at a molecular level, which can sense specific viruses and bacteria, magnets at a level of specific molecules, nanoparticles that serve as carriers of active substances for targeted cancer therapies, micromotors and molecules which can use sunlight to control environmental contaminants.

### PROGRAMME VIRTUES

One of the programme's virtues is also **successfully ensuring multidisciplinary approaches** of nanophysics, nanochemistry, biosciences, material sciences and nanomechanics. This systematic cultivation of coordinated inter- and multi-disciplinary approaches allows for a **fast discovery of new fields of applications**. This is also supported by the project-oriented structure of the study programme, as all students are **directly involved in economic, national, and international projects**. Within the framework of projects and alongside research work, they learn and deepen the methods for creating, transferring and applying knowledge. Being involved in the projects gives the students access to the **state-of-the-art research equipment** within the JSI, associate institutes, and centres of excellence.

### PROGRAMME IN THE CONTEXT OF USER NEEDS

Nanosciences and Nanotechnologies is an interdisciplinary study programme covering the following research fields:

- 1 new nanomaterials and nanochemistry,**
- 2 nanophysics** (including physics of artificial nanostructures and the development of methods of research and nanomanipulation of atoms and molecules, and their dynamics),
- 3 biosciences** (including biomedicine),
- 4 advanced metallic materials,**
- 5 nanomechanics** (including mechanics of time-dependent materials).

All the fields also include the fundamental knowledge needed for establishing successful communication with experts in the field of **commercial and civil law, microeconomics of companies and project management, and the basics of sustainable development**.

More information:

MASTER STUDIES

DOCTORAL STUDIES



The programme attracts a lot of students each year. The principal reasons behind that are the prospects of nanotechnologies in relation to the development of high technologies and products with high added value. To the same extent, young researchers are also attracted by breakthrough research in this particular field, interesting international projects and excellent researchers acting as their supervisors.



The implementation of the study programme is interlaced with national and especially EU projects within which ICT achieves enviable results in both the scope and complexity of research which also directly involves the students of the school.

## INFORMATION AND COMMUNICATION TECHNOLOGIES STUDY PROGRAMME

master and doctoral degree programme

Information and Communication Technologies is an interdisciplinary postgraduate study programme following the latest tendencies in the field. With excellent research results it also directly contributes to surpassing the existing boundaries of knowledge and technologies in the field. The study programme includes the following fields: knowledge technologies, advanced internet technologies, computer structures and systems, information security systems, intelligent systems and robotics, and advanced concepts in telecommunications.

### PROGRAMME OBJECTIVE

The study programme is oriented towards **solving actual problems and challenges of the modern society**. Examples of such challenges are the **Future Internet** and the **Internet of Things** as factors that will have a decisive impact on the life of the society in the future years, and lately also the digitalisation of economy, the development of services of the digital market, and artificial intelligence. Despite concerns that these fields interfere with the living space of an individual, they should in fact be accepted as a **challenge for further development, an opportunity to realise creative ideas, and support for the analysis of data in interdisciplinary research**. The reoccurring economic crises will also shape the future of workplaces in numerous branches of economy. Basic knowledge of information and communication technologies is crucial even for our sole survival, while a more profound knowledge of the field is becoming **vital in research work, development of new products and services, economic analyses, medicine, and the entire field of sustainable development**.

### PROGRAMME IN THE CONTEXT OF USER NEEDS

**Modern information and communication technologies are of key importance for the economic and social progress:** new and efficient ways of exchanging information expand the development possibilities of production, the service sector, scientific, cultural and social establishments, and in addition fundamentally support the transfer of knowledge with the aim of sustainably developing a knowledge society. In the increasingly globalised economy, the information and communication technologies are crucial for ensuring competitiveness and economic growth of companies, and also entire countries.

**Development of the knowledge society primarily depends on the development of the knowledge-based economy** which further on depends on the most educated and enterprising experts who master quick access to information, efficient ways of managing it and recognising essential messages, as well as its incorporation into problem solving within the development and optimisation of new procedures, products, and services. **Information and communication technologies play an important role in increasing the employment structure** in every single field since Europe – and Slovenia within – can face the world competition only with a highly competent workforce that masters digital skills and where the ability of quickly acquiring, managing, transferring and applying information is an inevitable requirement of the modern

management. For the needs of integration into the emerging European digital market, attention in delivering the learning content will be devoted to the digitalisation of the economy, which is a prerequisite for an equal position of economic operators in the implementation and operation of the digital market and related trust services.

The Information and Communication Technologies postgraduate study programme therefore provides to future masters and doctors of science fundamental knowledge in the given fields, while at the same time it prepares them for **solving key development problems**, such as increasing the efficiency of production and marketing processes, management support in companies, administrative authorities and in banking, upgrading business processes with ICT technology, ensuring business security, developing new branches of economy, environment and health protection, as well as creating new quality employment opportunities in all the given fields.

Within the programme, research is mostly conducted in the following fields:

- 1 knowledge technologies,
- 2 advanced internet technologies,
- 3 computer structures and systems,
- 4 intelligent systems and robotics,
- 5 modern concepts in telecommunications.

The application of acquired knowledge includes **management of networks, high performance computer resources and artificial intelligence technologies, as well as data mining for computer-assisted analysis of databases/data warehouses** generated as a result of scientific research in the fields of physics, chemistry, biology, biochemistry and pharmacology, bioinformatics, environmental sciences, and also in the fields of social and economic sciences, as well as the data that is accumulated as a result of ambient measurements and data acquisition on the Internet.

More information:

MASTER STUDIES

DOCTORAL STUDIES

# ECOTECHNOLOGIES STUDY PROGRAMME

## master and doctoral degree programme

The Ecotechnologies programme incorporates science that supports the efforts of meeting the needs of the humankind in harmony with nature while causing as little damage to the environment as possible, especially by efficiently incorporating natural processes. As it is oriented towards solving actual problems, which calls for a comprehensive approach, ecotechnologies are characterised by bringing together achievements from natural, technological and social sciences, which are oriented towards sustainable development. That makes the multidisciplinary approach a strong characteristic of the Ecotechnologies programme. Emphasis is also placed on the environmental and economic approach.

### PROGRAMME OBJECTIVE

The strategy of sustainable development **incorporates the integration of environmental, technological, economic and social objectives, especially in production and consumption.**

The study programme provides the acquisition of knowledge and the development of skills in order to be able to carry out competent research, establish **international connections, and manage sustainability-oriented development**, transfer and application of ecotechnologies.

The emphasis is placed on threefold qualifications:

- **broadening and deepening of scientific content, methods and techniques** in selected fields of natural sciences, technologies, engineering and informatics, which will support the strategic choice, development, transfer, optimisation, exploitation and supervision of selected ecotechnologies for **improving business efficiency while at the same time satisfying broader social interests in sustainable development**,
- developing competences and skills for **raising the quality of processes, products and services, and increasing the added value** while striving for excellence and maximal implementation of the principles of sustainable development,
- **developing an integral way of thinking** which surpasses individual fields and develops competences for: communicating with experts from other disciplines and fields, **comprehensive problem definition, systemic approaches, decision-making and solving complicated problems** in teams, and strategic planning with a long-term perspective.

### PROGRAMME VIRTUES

It should specifically be emphasised that the school **systematically steers** the Ecotechnologies postgraduate study programme from the previously predominant environment protection content to a **more comprehensive orientation towards sustainable development, especially for improving the efficiency of using input materials and energy sources.** This requires a significantly stronger emphasis on a more efficient development and transfer of ecotechnologies and introducing sustainability-oriented consumption. Considering these demands, the Ecotechnologies programme requires the development and implementation of multidisciplinary synthesis methods, which the IPS systematically cultivates in the framework of postgraduate research oriented towards sustainable development.

**The implementation of the study programme is intertwined with national and especially EU projects within which the Ecotechnologies programme achieves enviable results – both in the scope and complexity of research which also directly involves the postgraduate students of the school.**

### PROGRAMME IMPLEMENTATION

The Ecotechnologies study programme is embedded in **development projects intended to achieve ecotechnological reform and progress in the production, service activities, and public services.** The programme emphasises economic efficiency alongside environment protection.

Most research is tied to solving actual problems in the following fields:

- |  |   |
|--|---|
| <b>1</b> <b>tools for environmental quality control</b> which also include integrated modelling tools for political decision-making, | <b>5</b> <b>water management,</b>   |
| <b>2</b> <b>development and testing of environmentally acceptable materials,</b>   | <b>6</b> <b>plasma technologies,</b>  |
| <b>3</b> <b>development and testing of clean technologies,</b>   | <b>7</b> <b>development of intelligent systems for environmental quality control,</b> |
| <b>4</b> <b>characterisation and treatment of waste and waste waters,</b>  | <b>8</b> <b>sustainable civil engineering,</b>  |
|  | <b>9</b> <b>food and environmental health technologies.</b>                           |

One of the programme's virtues is also that it successfully ensures **multidisciplinary approaches** which include the following fields: chemistry, geology, biochemistry, biological sciences, biotechnology, hydrology, ecotoxicology, chemical engineering, biostatistics, and modelling. In addition, these disciplines are to a great extent intertwined with tools that ensure support to **political decision-making in the field of environment and human health and/or ensure a practical value in the industrial environment.** This is also supported by the project organisation of executing the study programme, as all students are directly involved in economic, national, and international projects. Within the framework of projects and alongside research work, they discover and deepen the methods for creating, transferring and applying knowledge. Being directly involved in these projects gives the students access to the state-of-the-art research equipment within the JSI, associate institutes, and centres of excellence.

More information:

MASTER STUDIES

DOCTORAL STUDIES



# SENSOR TECHNOLOGIES STUDY PROGRAMME

## doctoral degree programme

The Sensor Technologies programme is an interdisciplinary doctoral study programme that was first implemented in the 2016/2017 academic year.

Sensors have become an invisible yet indispensable part of our world. For example, our cars are full of sensors for regulating the engine functioning, speed, fuel consumption, temperature, ventilation and, last but not least, our own safety. Environmental sensors are crucial for pollution control.

Biosensors, among which nanosensors, promise considerable progress, especially in healthcare.

Designing and manufacturing of so many different sensors is enabled by sensor technologies which are based on outstanding achievements in science and technology.

The Sensor Technologies study programme connects knowledge from the fields of physics, chemistry, biology, materials, environmental and technical sciences, nanosciences and nanotechnologies, as well as information and communication technologies.

### PROGRAMME OBJECTIVE

The objective of the doctoral degree programme is **to acquire knowledge of sensors and sensor technologies** from the selected fields of physics, chemistry, materials, environmental and technical sciences, nanosciences and nanotechnologies, as well as information and communication technologies. **It also encourages the development of an integral way of thinking** as a foundation for interdisciplinary research. Beside mastering the methods and techniques of research work, the students will also develop competences for conducting independent and team R&D work and for using the acquired knowledge in practice..

### PROGRAMME IN THE CONTEXT OF USER NEEDS

The programme systematically **connects knowledge from the field of sensors and sensor technologies with great international expertise in order to educate a highly-skilled workforce** to support the penetration of economic development projects to the global market while at the same time ensuring socially balanced sustainable development.

### PROGRAMME IMPLEMENTATION

This interdisciplinary study programme **provides the acquisition of knowledge and the development of skills in order to be able to carry out competent research, transfer the scientific achievements to industrial development, and establish international connections in the following fields of sensor technologies:**

- 1 sensors for ionizing photons and particles,
- 2 physical and chemical sensors,
- 3 biosensors,
- 4 information and communication technologies in sensorics.

The implementation of the study programme is intertwined with **national and international projects**, especially within the framework of the European Community, and projects carried out with partners from the industry.

More information:

[DOCTORAL STUDIES](#)



Sensors help us recognise selected conditions in the environment in real time and react to them systematically. Their application possibilities therefore stretch to almost all fields of human activity. With increasing economic and environmental demands, the sensors have become an important integral part of the so-called "smart" devices and thus a promising opportunity for the economy.



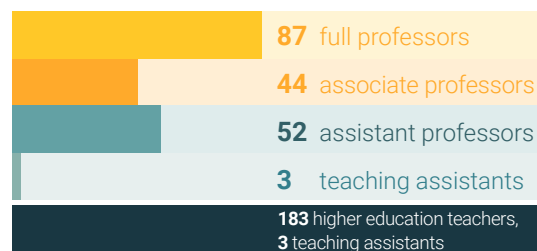


# IPS Teaching Staff

A great majority of IPS professors are employed full time at IPS founders and partners, especially at the Jožef Stefan Institute which is also the seat of the IPS. Supervisors are therefore available to collaborate with the students directly.

The structure of academic titles for 183 IPS professors is the following: 87 full professors, 44 associate professors, 52 assistant professors. We only have 3 teaching assistants as the research and education process of the postgraduate studies requires a predominantly highly demanding and individualised supervision work. The share of less demanding group forms of study, which normally require the help of teaching assistants, is very small. Considering the study fields and the standard of studies at the IPS, our postgraduate students are in fact already at the level of teaching assistants.

## STRUCTURE OF ACADEMIC TITLES



**A significant factor of quality is the fact that the students work in their supervisors' research groups and are therefore normally in contact with them on a daily basis.**

## TEACHING STAFF SELECTION CRITERIA

The basic criteria for selecting the teaching staff of the Jožef Stefan International Postgraduate School are their **internationally highly acclaimed scientific quality, development-oriented attitude, and talent for supervising students**.

Since 2019, a domain has been available on the SICRIS website, which gives access to bibliographic indicators of performance for appointment to title.

Among other criteria is also their creative role in national, European and international projects, to which they also include the IPS students, and their willingness to adapt the study programmes according to the specific needs of a student's research work, i.e. the so-called "tailored studies".

## VISITING PROFESSORS

The IPS is especially interested in directly including **brilliant scientists** from leading research groups around the world in IPS programmes. Such groups usually operate within **acclaimed institutions**. The IPS systematically maintains personal contacts of its professors with colleagues from such research groups and invites them individually as visiting professors. These are as a rule brilliant scientists – experts in fields selected based on the **achievements** of the leading branches of science and economic interests.

## SUPERVISION

Master theses and doctoral dissertations are the main part of the studies at the IPS. **The quality of conceptualising the topic of a master thesis or a doctoral dissertation** is therefore at the centre of all student interactions with their professors and especially their supervisors.

**Supervision** initiates the moment students first come to the IPS, when they start **discussing their "tailored studies"**, generally in breakthrough research fields or in fields that are economy and development oriented. It starts with the **conceptualisation of the research topic**, which is then discussed by the Study Commission and approved by the IPS Senate, and concludes with **carefully monitoring the realisation of the master thesis or doctoral dissertation**. Special attention of the IPS is therefore devoted to the supervisor selection procedure which takes place in two phases. **The first supervisor** helps the student as a mentor before the enrolment, especially in outlining the individually selected study programme, and monitors the student during the first semester. **After that, the student can keep the same supervisor or select a new one.** If the topic covers several specific fields, the student is appointed **one or more co-supervisors**. If the topics are directly development oriented, the students are also appointed **supervisors from the industry** who help direct their research work systematically and apply their achievements into practice in real time.



## QUALITY OF THE TEACHING STAFF

The quality of the majority of professors and assistant professors at the IPS is at an **enviably high level** according to scientific criteria. The same goes for their participation in **national and international projects**, whereas a lot of them are still gaining experience in directly transferring the research achievements into practice. To this end, we **enhanced our collaboration with the industry and the service sector**.

The IPS regularly monitors the work of its professors by:

- assessing the **scope and quality of their scientific publications** in internationally renowned scientific journals and the scope of their citations – with a special emphasis on including the research achievements of IPS students,
- monitoring the participation of IPS supervisors and students in **national and international projects**,
- supporting the **collaboration** of IPS professors with the **industry**, especially in regard to target-oriented R&D projects, and protecting the intellectual property of their achievements,
- **evaluating, with the help of committees**, the interim results of the research and educational process for each student at research seminars held in each study year, and giving assessment and pointers for future work,
- **regularly monitoring the work of supervisors** within the framework of the Programme and Central Study Commissions with special committees designated for this purpose, from conceptualising the topic of doctoral dissertations to gradually realising the set out plans and finally assessing the quality of the submitted dissertations.
- In the 2019/2020 academic year, the IPS processed: 33 doctoral dissertation topic proposals and 30 approval proposals for submitted dissertations,

- anonymously surveying the students at the end of each academic year regarding the quality of the IPS teaching staff and informing all the participants of the outcomes. If the given results show less than 80 % of the maximum quality assessment (below 4 out of 5), the IPS Dean carries out individual interviews with the concerned parties and addresses the problems in board meetings. In the 2019/2020 academic year, the questionnaire was updated with new questions which were improved based on acquired experience.

**The results of the questionnaire** for the 2019/2020 academic year were the following:

professors were given an average grade of **4.56**, while courses were graded with an average grade of **4.34**.

## OUTSTANDING ACHIEVEMENTS AND AWARDS RECEIVED BY PROFESSORS IN 2019/2020

**Prof. Tamara Lah Turnšek** – Zois Lifetime Achievement Award,  
**Prof. Barbara Malič** – Zois Award for Top Achievements in the Field of Electrocaloric Ceramic Materials Research,  
**Asst. Prof. Aleš Lapanje** and  
**Asst. Prof. Hana Uršič Nemevšek** – “Excellent in Science” Award,  
**Prof. Marina Dermastia** – Miroslav Zei Lifetime Achievement Award,  
**Prof. Lovrenc Lipej** and  
**Dr. Jon Gutierrez Aguirre** – Miroslav Zei Award for Exceptional Achievements in the Research Domains of NIB.

1:2

The professor : student ratio at the IPS is generally higher than 1 : 2.



The quality of the majority of professors and assistant professors at the IPS is at an enviably high level according to scientific criteria. The same goes for their participation in national and international projects.



Our professors receive prestigious awards and recognitions every year.

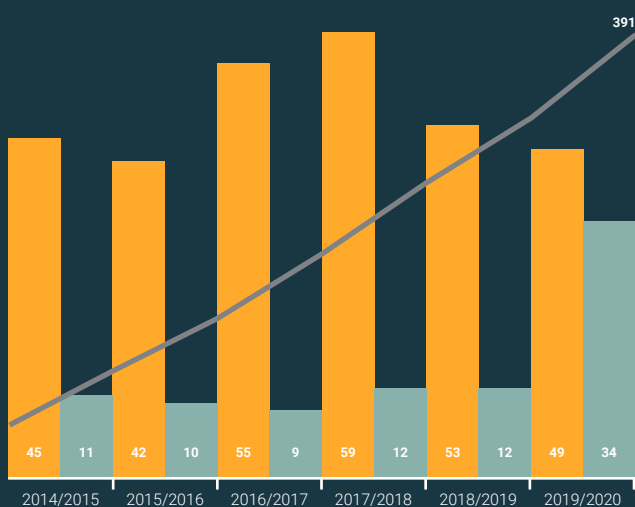


# IPS Students

The school informs potential students about the studies at the IPS through responsible government institutions, media, invitations to IPS and JSI Open Days, IPS research and industrial partners, and, most efficiently, through personal contacts among potential candidates, students and the teaching staff.

## STARTING THE STUDIES

The IPS predominantly enrolls students with considerable achievements from their undergraduate studies – the average grade of all students upon first enrolment at the IPS is above 8.5. However, undergraduate achievements are not the only criteria. The school holds systematic interviews with candidates for enrolment where we assess their creative disposition and research talent. An important role is also played by their potential employers, especially in the field of research and economy.



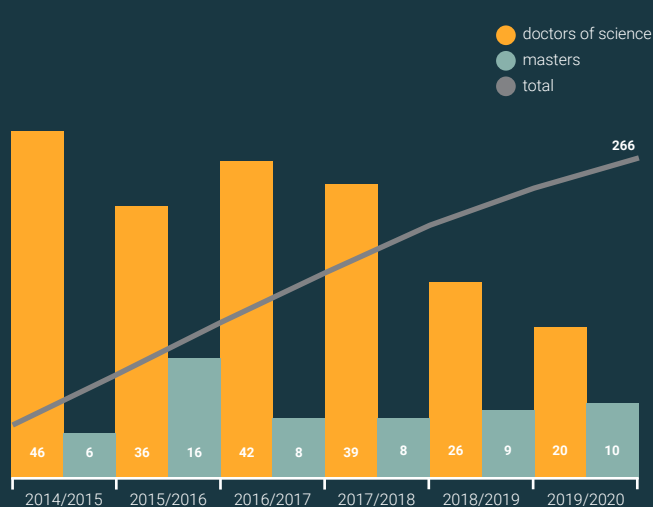
The graph shows the number of students enrolled in doctoral and master programmes, and the total per year.

The average grade from undergraduate studies of newly enrolled doctoral students per academic year:

• 2014/2015	8.76	• 2017/2018	8.75
• 2015/2016	8.78	• 2018/2019	8.85
• 2016/2017	8.71	• 2019/2020	<b>8.78</b>

## COMPLETING THE STUDIES

The quality of master theses and especially doctoral dissertations at the IPS is high. The quality of the study process is at the European or even global level, as attested by student achievements, publications in high quality scientific journals, and patents.



The graph shows the number of completed master and doctoral studies, and the total per year.

Average time needed to complete the studies (applies to 2019/2020):

- doctoral studies: **5.4 years**
- master studies: **2 years**





## STUDENT COUNCIL

The Student Council is an **official body of the Jožef Stefan International Postgraduate School (IPS)**, as defined in the IPS Statute, and therefore participates and takes equal part in joint decision-making in the IPS Senate, Academic Council, and Governing Board sessions. The Student Council has the right and duty to **give opinion and take part in joint decision-making regarding all matters related to the rights and duties of students**. The Student Council consists of **12 elected representatives** of students who select two representatives from among the members as the president and the vice-president.



## EMPLOYMENT PREPARATIONS

The IPS prepares its students for employment from the very beginning. **Employment is an important conversation topic** from the initial enrolment interview and the first meeting with a potential supervisor. Consequently, it also helps design the student's curriculum. The emphasis is even stronger when selecting the topic of a master thesis or a doctoral dissertation which is usually at least roughly related to the future employment of the candidate. **The IPS offers its students possibilities of establishing direct contact with founders and partners from the industry and organises activities designated for this purpose** (arranging visits of students and their supervisors to the industry, holding talks with responsible development officials in the economy and the service sector, organising meetings with IPS students and potential employers, etc.).

### Employment of IPS graduates:

In 2019, the IPS doctors and masters were employed in **27 different countries**. Out of **20 graduates** who completed their studies in the 2019/2020 academic year, **15 were employed in Slovenia and 5 abroad**.

- **Share of employed graduates** who completed their studies in the last academic year (2019/2020): **100 %**.
- **Number of countries** where they are employed: **5**. (Slovenia, Egypt, Belgium, France, China).
- Number of graduates who are employed **at prestigious foreign universities and research institutes: 3** (KU Leuven, VUB Brussels, CentraleSupélec).

## ALUMNI CLUB

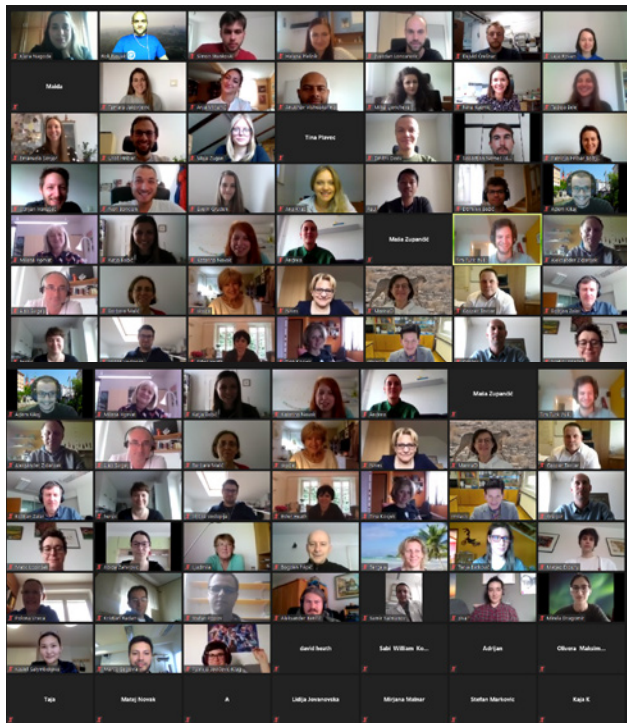
The IPS established an Alumni programme. The primary tasks of the IPS Alumni Club are:

- providing study information,
- establishing connections for project work,
- organising visits to institutes and the industry in Slovenia and abroad,
- giving suggestions on how to improve the quality at all levels,
- increasing collaboration with research and industrial partners,
- organising an annual meeting with an excellent expert programme and a more relaxed social gathering.

## IPS STUDENTS' CONFERENCE (IPSSC)

The most important event organised by the Student Council is the **annual Jožef Stefan International Postgraduate School Students' Conference** where the students from our school and also other faculties have the **opportunity to promote their research work**. At the beginning of the academic year, the students are invited to prepare a presentation of their best research achievements in the form of a **contribution and a poster for the conference** in May. The quality of submitted contributions is assured by a careful **review which is done by established researchers in specific fields**. Thus we can assure that students get a proper feedback on their work from experienced scientists and learn how to improve the quality of their contributions.

Faced with the unusual circumstances caused by the COVID-19 pandemic, the organising committee of the **12th traditional IPS and CMBE Students' Conference** concluded in late March 2020 to move the event online. Now, in March 2021, a year after the pandemic started, plenty of tools have become available for organising such an event on line, however in 2020, the options (and especially knowledge and experience) were scarce and we had to figure out together how to organise an "on-line conference". Despite the challenges, we managed to **bring together students from NANO, ST, ECO, ICT and CMBE** programmes and organise a conference with more than **100 participants**, which was full of interesting topics and contributions. The conference participants were first welcomed by Prof. Milena Horvat, who mentioned that on the same date we also celebrate the **IPS Day** which marks the anniversary of the school's establishment. The students were asked to present their work within 3 minutes, which was followed by a Q&A session and a discussion. Awards were finally presented to Mark Paul S. Rivarez, Mirjana Malnar, Stefan Marković, and Rok Novak. The conference was concluded with a group photo of all the participants.





# Student achievements

## ICT STUDENT ACHIEVEMENTS

### MATEJ PETKOVIĆ

Matej successfully defended his doctoral dissertation titled "Feature ranking for structured output prediction" in October 2020. The dissertation deals with the problem of estimating the relevance of features in complex data analysis. The dissertation was prepared under the supervision of Prof. Sašo Džeroski and Dr. Dragi Kocev. It stands out for its quality, extensive and in-depth examination of the modern topic of machine learning, and its publications in acclaimed journals and in high-level conferences.

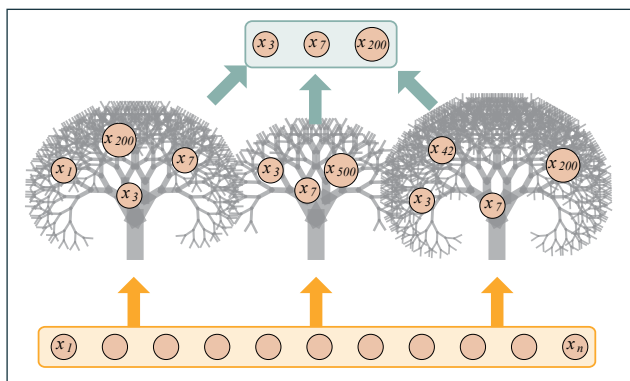
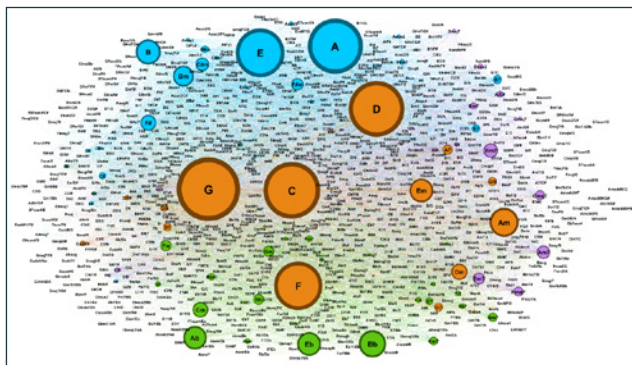


Diagram of feature ranking and selection using an ensemble of unsupervised trees for predictive clustering.

### LIDIJA JOVANOVSKA IN BOJAN EVKOSKI

In October 2020, Lidija and Bojan received an award for the Best Documentation for the Analysis of Chord Progression Networks project at the HAMR (Hacking Audio and Music Research) Hackathon held as part of the ISMIR conference.



They built and analysed a network which is based on 12000 popular songs which were preprocessed to obtain guitar chords. In the generated network, the chords are represented with nodes which are connected more strongly if there is a transition from one chord to another. On this network, they used several methods from the field of network analysis: they found chord communities, identified influential chords and compared differences between chord progressions across decades and genres. They applied stochastic walks to generate new chord progressions.

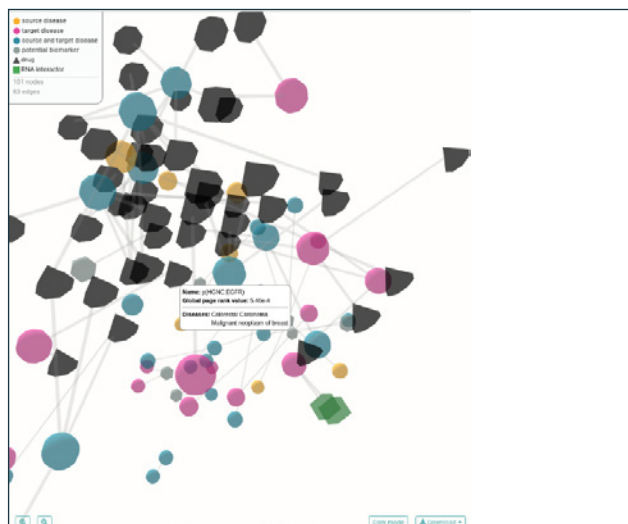
### BOJAN EVKOSKI

Bojan also received a recognition for the Best Lightning Presentation at the Complex Networks and Their Applications international conference.



### BLAŽ ŠKRLJ

In 2020, Blaž (co)authored 20 articles, of which 7 in journals. We would like to highlight the article titled "CaNDiS: a web server for investigation of causal relationships between diseases, drugs and drug targets"<sup>1</sup> which was published in the Bioinformatics journal.



CaNDiS web server enables research of empirically confirmed interactions between proteins, nucleic acids and FDA-approved drugs. Networks are enriched with information on previous associations with complex diseases which enables the web server to discover new biomarkers in the field of comorbidity.



## GORJAN POPOVSKI

In the previous academic year, Gorjan started and successfully concluded his master studies. During this short period, he published 5 articles in journals with impact factor and 8 conference papers. Together with his department colleagues he won first place at the Open Optimisation Competition 2020 within the GECCO 2020 and PPSN 2020 conferences.



## GROUPS OF ICT STUDENTS

Publication<sup>2</sup> authored by Martin Gjoreski, Vito Janko, Gašper Slapničar, Miha Mlakar, Nina Reščič, Jani Bizjak, Vid Drobnič, Matej Marinko, Nejc Mlakar, Mitja Luštrek and Matjaž Gams was prepared following their participation in the Sussex-Huawei Locomotion Recognition Challenge where they won first place.



IPS students and associates participated in various IT competitions in the field of text data analysis, in which they developed new open-access software tools. The JSI-IPS team consisting of Boshko Koloski, Senja Pollak and Blaž Škrlič won 3rd place at the CLEF-PAN competition on profiling fake news spreaders, and 2nd place at the CLEF-PAN competition on celebrity profiling. Matej Martinc and his colleagues from the University of Helsinki won 11th and 5th place at the SemEval2020-Task1 competition on unsupervised detection of lexical semantic change. A team comprising Boshko Koloski, Timen Stepišnik-Perdih, Senja Pollak and Blaž Škrlič also achieved good results at the AACL-Identification of Covid Fake News (2021) competition.

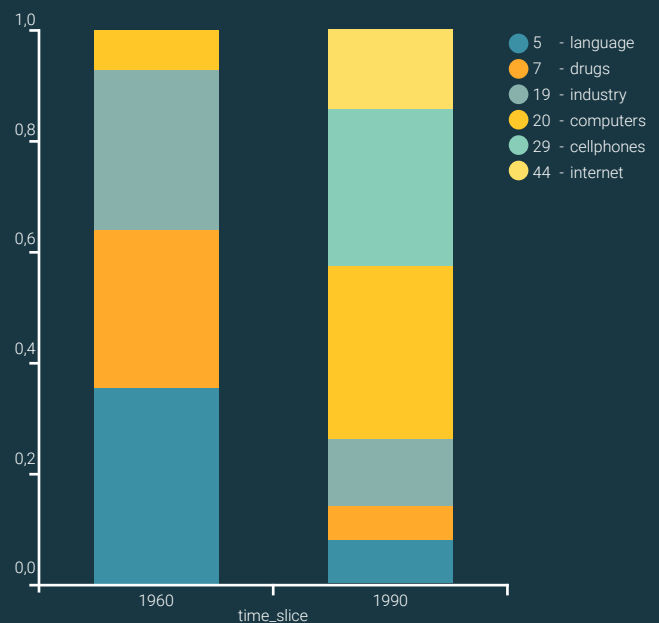
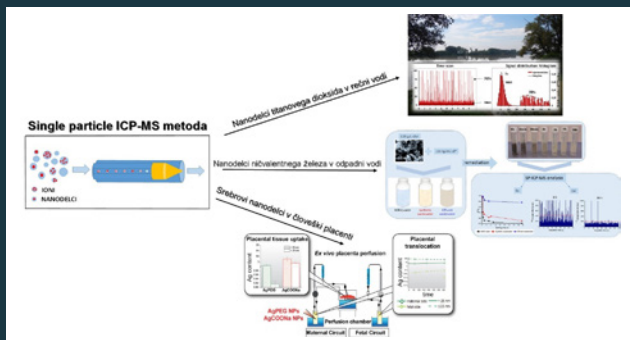


Figure: Methods for detection of lexical semantic change: in the 60s, word "user" was often used in the context of using drugs (orange), while in the 90s, it was mostly used in relation to using the internet (yellow).

## ECO STUDENT ACHIEVEMENTS

### JANJA VIDMAR

Janja won the JSI Golden Emblem prize in 2020 for her notable doctoral dissertation entitled "Quantification and sizing of metal-based nanoparticles in the environmental and biological samples". In her doctoral dissertation she used mass spectrometry with inductively coupled plasma in single particle mode (spICP-MS) to follow the occurrence and fate of titanium dioxide nanoparticles in river waters and zero-valent iron nanoparticles after their use in nanoremediation of wastewater, and studied the transfer and accumulation of silver nanoparticles in the human placenta.



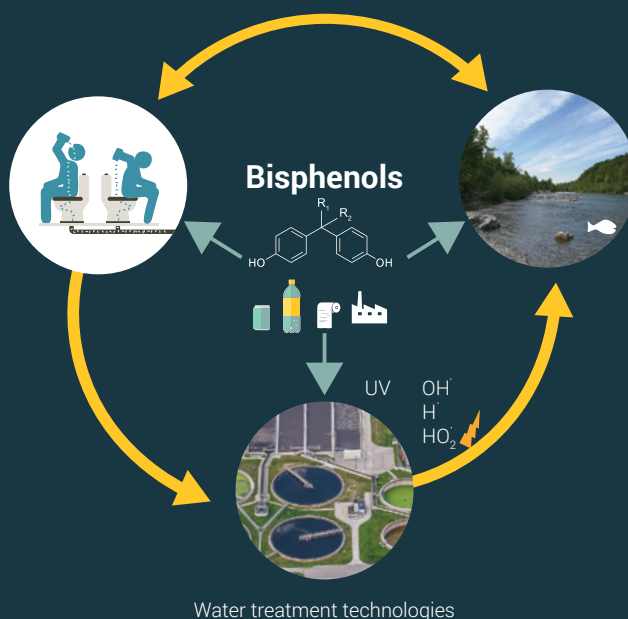
### DORIS POTOČNIK

Doris published an article titled "Application of DD-SIMCA for milk authentication" in the Food Chemistry journal.<sup>4</sup> The work examined the use of stable isotopes and elemental composition for determining geographical origin and authenticity of cow milk from four geographical regions of Slovenia: Alpine, Dinaric, Pannonian and Mediterranean. The research showed that it was possible to discriminate milk samples according to the year, season and production region using discriminant analysis and that three samples from the Slovenian market did not conform to suitability criteria which may point to mislabelling of products.



### ANA KOVAČIČ

Ana's doctoral dissertation confirms the presence of bisphenol A, an industrial chemical causing disruption of the endocrine system, and its analogues in the aqueous environment, and emphasises the need for new treatment technologies or combinations of the existing ones for complete removal (mineralisation) of these compounds from the aqueous environment. The work delivers new insights into the stability of bisphenols and their fate during water treatment, addressing not only the parent compounds but also their metabolites/transformation products. It also provides new knowledge about the migration of bisphenols from food contact materials which represent a significant source of human exposure.<sup>3</sup>



### ALEXANDROS SOTIRIDIS

Alexandros received an award from the Slovenian Research Agency for completing his doctoral studies before the set deadline.

## NANO STUDENT ACHIEVEMENTS

### BOJAN AMBROŽIČ

Under the supervision of Prof. Sašo Šturm and in the framework of his doctoral studies, Bojan presented, in the renowned Chemical Science journal, a holistic approach to describing the processes of radical-induced redox chemistry in Liquid-Cell Transmission Electron Microscopy (LCTEM), including the complex kinetics of the radiolysis species and their influence on the nanomaterials under investigation.<sup>5</sup>

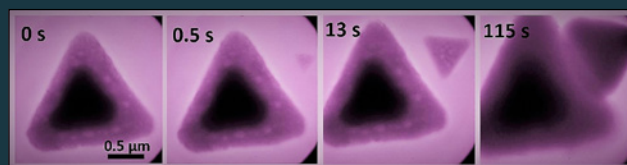


Figure: Growth of prismatic Au nanoparticles from solution in a liquid cell.



## XUAN XU

Editorial board of the prominent Green Chemistry journal selected Xuan's article describing a greener method of recycling Nd – Fe – B magnets as one of the 2020 Green Chemistry HOT Articles. Nd – Fe – B magnets typically contain between 28–35 wt % rare-earth elements, such as Nd, Pr, Tb, and Dy. As such, the end-of-life magnets are an important secondary resource for rare-earth elements, which are considered by the EU as the most critical materials. Xuan Xu and his colleagues from the Jožef Stefan Institute developed a green and facile electrochemical method for recycling such magnets. The proposed procedure enables simultaneous selective recovery of rare-earth elements and transition metals, significantly lowering energy consumption and environmental impact as it works in a closed loop.

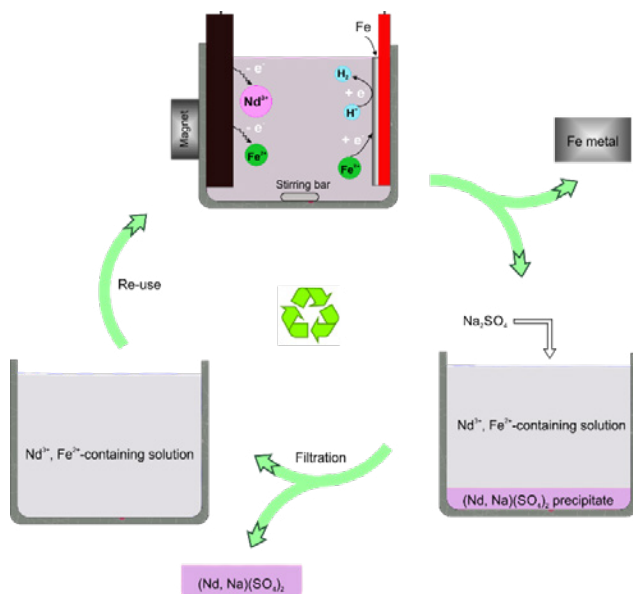
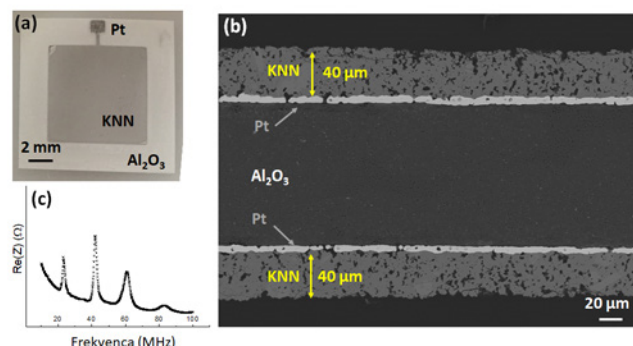


Figure: Electrochemical procedure for recycling end-of-life magnets based on the Nd–Fe–B system which works in a closed loop.

## HUGO MERCIER

Hugo's research focused on the preparation and characterisation of thick-film structures based on environmentally benign piezoelectric materials for harvesting energy from the environment using piezoelectric harvesters. Image of the sample (a) and image of the cross-section taken with a scanning electron microscope (b) show a sodium potassium niobate (KNN)-based piezoelectric layer deposited with electrophoretic deposition on top and bottom sides of the 110- $\mu\text{m}$ -thick aluminium oxide substrate ( $\text{Al}_2\text{O}_3$ ). Impedance measurement at the resonance frequency (image c) showed that a 40- $\mu\text{m}$ -thick layer of KNN has a suitable electrochemical reaction which confirms that electrophoretic deposition is an appropriate method for the preparation of the bimorph structure for piezoelectric energy harvesting from the environment.



## ŠPELA TRAFELA

For her research work done during her doctoral studies, Špela received a national fellowship from the L'Oréal – UNESCO "For Women in Science" programme in 2020. Her doctoral dissertation dealt with the topic of preparing receptor elements as component parts of sensory elements for detecting toxic formaldehyde. She studied the parameters of synthesis and mechanism of formaldehyde detection, which called for an in-depth interdisciplinary study. Through pooling of knowledge she successfully explained the fundamental mechanisms of formaldehyde detection and created a receptor element with the lowest limit of detection so far. She upgraded the acquired knowledge and created sensory platforms based on screen-printed electrodes for a wide application in the paper industry and for environmental monitoring. Špela has demonstrated in-depth fundamental knowledge which she used to build sensory properties, elevating the topic of her doctoral dissertation to a level of applicability.



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# Publications and Projects

Within the framework of all study programmes, the students are systematically encouraged to write scientific articles for acclaimed international journals, scientific contributions for conferences, abstracts and independent scientific compositions or chapters in monographs, patent applications, project proposals, and research reports, as well as to publish their research achievements in internationally acclaimed scientific journals and as patents.

## PUBLICATIONS

The DELO newspaper analysed the data of eight Slovenian universities and postgraduate schools (published on 23 August 2019) and established that **the average number of publications per new doctor of science is the highest at the IPS**. A detailed examination of the published articles shows that their number amounts to, **on average, 4 articles per obtained doctoral degree in a 4-year period**, which is well above the average in the field of postgraduate studies of most universities. It should also be stressed that **more than a half of articles were published in international journals with impact factors** which contributed to a high number of citations. The articles written by IPS students and professors are also published in journals with the highest impact factor, i.e. **Nature and Science**. In the 2019/2020 academic year, **20 graduates issued 65 publications in JCR altogether**.



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In the scope of the **Creative Path to Knowledge** programme, we successfully carried out the **RESPO2** project.



The school also prolonged the **Competence Centre for Factories of the Future (KOC-TOP)** project until 2022 and expanded the consortium to **50 partners**.



Within their research and educational programme, the IPS students have access to **state-of-the-art research equipment**.

## Research Equipment

Within their research and educational programme, the IPS students have **access to state-of-the-art research equipment** within the framework of the founding and partner institutes (**JSI, IMT, and NIB**), and especially within the centres of excellence (**Nanocentre, CIPKeBiP and NAMASTE**). In the scope of the projects designed for industrial partners, the IPS students are also directly involved in their respective

**research laboratories**. The IPS also established its **own research laboratory for developing measuring instruments for selective proximity detection of materials**.

In this context, the IPS students have access to modern research equipment to work on their research tasks and are provided the expertise of highly qualified research instructors within the framework of expert groups from responsible institutions.



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**SUMMARY OF SELF-EVALUATION REPORT FOR  
2019/20 ACADEMIC YEAR**  
Jožef Stefan International Postgraduate School

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