Questionnaire
Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2016 - December 31, 2021

1. Basic information on the institute:

1.1. Legal name and address

Polymer Institute of the Slovak Academy of Sciences,
Dúbravská cesta 9, 845 41 Bratislava, Slovak Republic

1.2. URL of the institute website

https://polymer.sav.sk/

1.3. Executive body of the institute and its composition

Directoriat	Name	Year of birth	Years in the position, from - to
Director	Igor Lacík, DSc.	1962	3, till 12/2018
Deputy director	Jaroslav Mosnáček, DSc.	1975	3, till 12/2018
Director	Jaroslav Mosnáček, DSc.	1975	3, since 1/2019
Deputy director	Zuzana Benková, PhD.	1978	3, since 1/2019

1.4. Head of the Scientific Board

Juraj KRONEK, PhD.

1.4.1 Composition of the International Advisory Board

- Dr. Martin HRUBÝ, Institute of Macromolecular Chemistry AS CR, Prague, Czech Republic (since 2018)
- Prof. Dr. György MAROSI, University of Technology and Economics, Budapest, Hungary
- Prof. Dr. Christos N. LIKOS, University of Vienna, Computational Physics, Faculty of Physics, Vienna, Austria
- Prof. Dr. Robert LISKA, Vienna University of Technology, Institute of Applied Synthetic Chemistry, Vienna, Austria
- Ing. Martin MINÁRIK, Axxence Slovakia, s.r.o., Bratislava, Slovakia (since 2018)

Previous members; till 2017

- Dr. František Rypáček, Institute of Macromolecular Chemistry AS CR, Prague, Czech republic
- Dr. Jozef Kristofcak, Saneca Pharmaceutical a.s., Hlohovec, Slovakia

1.5. Basic information on the research personnel

1.5.1. Fulltime equivalent work capacity of all employees (FTE all), FTE of employees with university degrees engaged in research projects (FTE researchers)

2016		2017		2018		2019		2020		2021		2016-2021	
FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	average FTE all per year	average FTE researchers per year
63,32	48,52	61,37	42,40	58,96	38,81	56,80	35,41	64,64	40,97	65,50	40,59	**61,77**	**41,12**

1.5.2. If applicable, add also a short information on the merger of the institute in the evaluation period. You can also add rows in the above table corresponding to the founding institutes

1.6. Basic information on the funding of the institute

1.6.1. Institutional salary budget, other salary budget[1], non-salary budget[2]

Salary budget	2016	2017	2018	2019	2020	2021	average
Institutional salary budget *[millions of EUR]*	0,758	0,880	1,171	1,091	1,142	1,183	**1,038**
Other salary budget *[millions of EUR]*	0,231	0,200	0,342	0,085	0,053	0,047	**0,160**
Total salary budget *[millions of EUR]*	0,989	1,080	1,513	1,176	1,195	1,230	**1,197**
Non-salary budget *[millions of EUR]*	1,330	1,348	1,631	1,190	1,123	0,821	**1,241**

[1] Salary budget originating outside the regular budgetary resources of the organization, e.g. from the project funding.
[2] Includes Goods and Services and PhD fellowships

1.7. Mission Statement of the Institute as presented in the Foundation Charter indicating the years when it was adopted and revised

Slovak Academy of Sciences
Presidium

Bratislava, September 10, 2010
Number: 472/G/12/2010

DECISION
of the Presidium of the Slovak Academy of Sciences
Issuing the Foundation Deed of the Polymer Institute of the Slovak Academy of Sciences
(Resolution of the Presidium of SAS no. 371 dated September 01, 2010)

The Presidium of Slovak Academy of Sciences, acting pursuant to Art. 21 of the Act of the National Council of the Slovak Republic no. 523/2004 Coll. on Budget Rules in Public Administration as amended and pursuant to Art. 10 and Art. 15 of the Act of the National Council of the Slovak Republic no. 133/2002 Coll. on the Slovak Academy of Sciences, hereby issues the following

F o u n d a t i o n D e e d:

Name of organization:	**Polymer Institute of the Slovak Academy of Sciences**
Seat of organization:	**Dúbravská cesta 9, 845 41 Bratislava 45**
Identification number:	**00586927**
Financing form:	**Contribution organization**
Organization type:	**Scientific organization**
(Art, 15 of the Act no. 133/2002 Coll. of the Slovak Academy of Sciences)	
Established on:	**December 17, 1962**
Title of statutory body:	**Director**

Slovak Academy of Sciences, Štefánikova 49, 814 38 Bratislava

Art. I
Main Purpose and Scope of Activities

1. The Institute concentrates on primary research of polymers and biopolymers in relation to their properties.
2. The Institute aims at development of the science about macromolecules, preparing and improving new experimental and theoretical methods of study of polymer systems.
3. The Institute performs scientific research activities in majors: macromolecular chemistry, organic chemistry, technology of macromolecular substances, material chemistry, physical chemistry, nanomaterials, nanotechnologies, molecular electrotechnics, theoretical and computer chemistry, biomaterials, bioplastics, composites, paper, and cellulose.
4. The Institute develops products, technologies, special substances and materials on the basis of previous research and investigation of opportunities of the application there of both nationally and in abroad. After patenting, the Institute seeks potential interested partners, and in case of conclusion of a contract, licences for specific products and/or services are sold.
5. The Institute organizes doctoral studies pursuant to generally valid law.
6. The Institute develops cooperation with organizations of related scientific majors, with universities, and with research institutes both nationally and internationally.
7. The Institute provides for publishing of results of scientific research activities in periodical and non-periodical press. Publishing periodical and non-periodical press is governed by the resolutions of the Presidium of the SAS.
8. The Institute provides for promotion of the results by various forms pursuant to valid law with professionals and with the general public.

9. The Institute provides for organizing national and international conferences, workshops, and seminars for the employees of the Institute, for national and foreign scientific workers, and for students.
10. The Institute provides advising and expert services related to the main activity of the Institute.

Art. II
Material and Financial Determination of Assets Administered as State Assets by the Polymer Institute of the Slovak Academy of Sciences

1. The Polymer Institute of the Slovak Academy of Sciences administers assets acquired by own activities and assets entrusted to the Institute to perform its purpose and scope of activities. These assets are registered in the books and operative registers of the Institute.
2. Immovable assets are formed by the real estate registered with the relevant land registers as of the date of issue of this Foundation Deed.
   Real estate in land register area of Bratislava-Karlova Ves, according to Extract from Ownership Deed no. 2552, plot no. 2706, 2710/9, building number 5798 on plot no. 2706, building number 5799 on plot no. 2710/9.
3. Movable assets administered by the Polymer Institute of the Slovak Academy of Sciences are formed by tangible assets, intangible assets, small tangible assets, small intangible assets, and assets in operative registers according to the financial statements.
   Assets – Balance sheet as of December 31, 2009, residual value: EUR 832,706.04
   Other movable assets:
   Library fund as of December 1, 2009: 5275 library units
   The financial value of this fund is in line with the records of the accrual list.

Art. III
Historical Development of the Organization

By the Resolution no. V/1 of the Presidium of Slovak Academy of Sciences dated December 17, 1962, the Polymer Laboratory of the Slovak Academy of Science was separated from the Polymer Department of the Wood, Cellulose and Synthetic Fibres Institute. By the Resolution no. IV/1 of the Presidium of Slovak Academy of Sciences dated September 12, 1966, the Polymer Laboratory was renamed to Polymer Institute of the Slovak Academy of Science. Effective on January 01, 1981, the Institute was integrated into the Chemical Research Center of the Slovak Academy of Sciences by the Resolution no. 509 of the Presidium of the Slovak Academy of Sciences dated November 25, 1980. On the basis of the Resolution no. 16 of the Presidium of the Slovak Academy of Sciences dated February 22, 1990, the Polymer Institute of the Slovak Academy of Sciences became separate since April 01, 1990.
By its Resolution no. 172 dated December 17, 1992, the Presidium of the Slovak Academy of Sciences approved the change of the financing form of the Polymer Institute of the Slovak Academy of Sciences from a budget organization to a contribution organization, effective since January 01, 1993.

Art. IV
Legal Personality of the Organization

The Polymer Institute of the Slovak Academy of Sciences is a legal entity able to acquire rights and liabilities independently.

Art. V
Organization Structure of the Organization

The organization structure of the Polymer Institute of the Slovak Academy of Sciences is regulated in more detail by the Organization Code of the Polymer Institute of the Slovak Academy of Sciences, issued by the Director after approval by the 2nd Department of Sciences of the Slovak Academy of Sciences

Art. VI

The Polymer Institute of the Slovak Academy of Sciences shall have perpetual existence.

Art. VII
Final Provision

On the effective date of this Foundation Deed, the validity of the Foundation Deed of the Polymer Institute of the Slovak Academy of Sciences no. 474/G/12/2009 dated July 28, 2008 shall end.

prof. RNDr. Jaromír Pastorek, DrSc.
President of the SAS

1.8. Summary of R&D activity pursued by the institute during the evaluation period in both national and international contexts. Describe the scientific importance and societal impact of each important result/discovery. Explain on general level – the information should be understandable for a non-specialist (recommended 5 pages, max. 10 pages for larger institutes with more than 50 average FTE researchers per year as per Table 1.5.1.)

The Polymer Institute of the Slovak Academy of Sciences (PI SAS) is the leading academic institution in the field of macromolecular chemistry, polymer physics and polymer material science in the Slovak Republic with its focus shifting in recent years also to biomaterial sciences. The activities and outcomes in basic and applied polymer science possess a significant role in both national and international context. A large portion of research output is the result of international cooperation within the EU research area and other countries worldwide, where PI SAS acts in a role of both as a principal investigator and as a partner with significant contribution to formulation of ideas and providing solutions. This is well-documented in the selected publications and projects, respectively.

The research profile of PI SAS is reflected by the organization structure consisting of four research departments listed below together with the main research topics dealt with:

1. **Department of Composite Materials:** polymer (nano)composites, biopolymers, blends, electrically and thermally conductive polymers and composites, adhesives, surface treatment of (nano)fillers and polymers, phase change materials,
2. **Department for Biomaterials Research:** design of polymeric microspheres for diabetes treatment, polymers for cancer treatment, bioconjugates designed for diverse aims at the interface of polymer chemistry and biomedicine, drug delivery systems, stimuli sensitive polymers, precise modification of polysaccharides, hydrogels, radical polymerization mechanism in aqueous solutions,
3. **Department of Molecular Simulation of Polymers:** molecular simulations of polymers, confined polymers (DNA in nanochannels), folding of model proteins, polymer brushes, simulation of structural and material properties of condensed polymers, and
4. **Department of Synthesis and Characterization of Polymers:** development of controlled/living (photo)polymerization techniques, synthesis of well-defined functional polymers from renewable monomers, synthesis of nanoparticles and hybrids, flammability and degradation of polymers, structure/properties relation studies.

During the evaluation period, three Core research topics and five Key research topics were identified by the Scientific Board and the Institute Management. While the Core research topics cover the research expertise across the institute for broad international cooperation and projects, the Key research topics cover the topics in which the Institute is recognized internationally as a key player.

Core research topics of the institute:

- Polymers as biomaterials
- Polymeric materials for reduction of environmental threats
- Multiphase polymer/based materials with tailored properties

Key research topics at the institute:

- Immobilization of pancreatic cells for diabetes treatment
- Electroconductive polymers, composites and nanocomposites
- Mechanism and kinetics of free-radical polymerization in aqueous solutions
- Photochemically induced reversible deactivation radical polymerization techniques
- Understanding confined polymers through molecular simulation

Both the Core and Key topics, which can overlap, have significance in the international context and the most of the below selected most important research activities are in the line with these topics.

Immobilization of pancreatic cells for diabetes treatment

The subject belongs to the most acknowledged topics investigated at PI SAS. The team led by Dr. I. Lacík works on a design of alginate-based microspheres for immunoprotection of transplanted insulin-producing cells for diabetes treatment. The multicomponent microcapsule composed of sodium alginate, sodium cellulose sulfate and poly(methylene-co-cyanoguanidine) developed during the previous evaluation period was further optimized in the current evaluation period with respect to synthesis of polymers, process of encapsulation, physico-chemical, in vitro characterization, and in vivo performance. The alginate beads crosslinked by divalent cations were also optimized as another type of immobilization materials. In vivo testing in rodent (immunocompetent mice) as well as preclinical (non-human primates) animal models resulted in a successful preclinical study in non-human primates using alginate beads and promising results with multicomponent microcapsules in a mice model. The preclinical testing of multicomponent microcapsules in non-human primates turned out to be only partially successful, showing that a direct data translation from rodents to non-human primates is not fully valid in this case. The latter data initiated currently ongoing studies towards microspheres of higher stability in vivo. The synthetic and characterization strategies also involve permanently charged derivatives of chitosan in a microcapsule design which were developed to obtain a controlled degree of modification. Extensive international impact of this research is demonstrated by the facts that during the evaluating period, PI SAS was a member (in a role of co-PI and PI of the project) of the Encapsulation consortium of the Juvenile Diabetes Research Foundation (USA), and The Chicago Diabetes Project (USA). The significance of PISAS contribution to this field is also demonstrated by national SRDA-funded projects, contracts with companies in Belgium, Israel, Japan (ongoing) and USA, and cooperation with research centers in USA, Norway and Czechia.

Polymer nanomaterials for drug delivery.

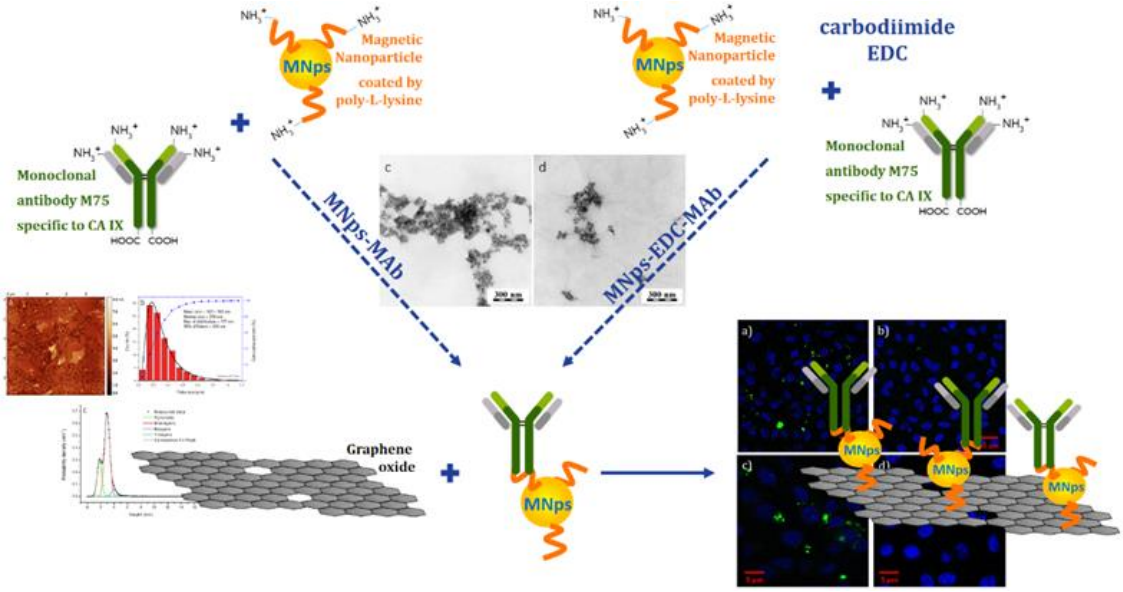
Nanostructured polymer materials represent efficient drug delivery systems for solubilization of poorly soluble drugs, improving drug availability, and avoiding side effects. Amphiphilic polymer nanoparticles have been developed for the delivery of simvastatin, a drug that lowers LDL cholesterol, and its auxiliary component, coenzyme Q10. The particles were designed to ensure the transport of the drug directly to the affected area without influencing other parts of the body. The effects of simvastatin- and coenzyme Q10-loaded polymeric nanoparticles on lipid profile and nitric oxide/reactive oxygen species balance in the heart and aorta of adult male obese Zucker rats were studied. The results showed that the particles, especially those combining both simvastatin with coenzyme Q10, were found to be a promising tool for the treatment of cardiometabolic diseases.

A new type of gradient copolymers consisting of alkyl and aryl homologs of 2-oxazoline monomers capable of self-assembling in aqueous solutions was designed. High colloidal stability, excellent drug loading capacity, and efficient cell internalization were demonstrated for nanoparticles prepared from gradient copolymers loaded with efficient anticancer drugs curcumin and hypericin. The biodistribution and photodynamic activity of hypericin was regulated by the chemical composition of gradient copolymers. The effect of the ultrasound, as a non-invasive external stimulus, on the drug release from poly(2-oxazoline) micelles was also investigated. For the sustained release of anti-

inflammatory drugs, drug conjugates of poly(2-isopropenyl-2-oxazolines) were synthesized. The release of drugs from prepared conjugates is pH dependent and the release of the drug in specific tissues and organs can be controlled.
Similar procedure was used and tested by incorporating anti-inflammatory agents into electrospun natural fibres such as silk or cellulose as well as certain biopolymers (PCL, PLA, or mixtures of PLA and PHB) for preparation of mats to be applied as wound/healing materials.

A multifunctional graphene oxide platform for cancer targeting

A new type of graphene-oxide multifunctional nanoplatform (GO-MFN) for the detection of tumor cells was developed. In a first step, 300 to 500 nm graphene oxide (GO) nanolayers were prepared and functionalized with magnetic nanoparticles and a monoclonal antibody (MAb) specific for cancer identifying marker (CIM). GO platforms were prepared from exfoliated graphite after several cycles of centrifugation and ultrasonication. Subsequently, GO platforms were characterized in terms of oxidation degree, nanoparticle size and level of exfoliation, using various physical and chemical methods. Magnetic metal-based nanoparticles (MNps) were prepared by the chemical precipitation method and their surface-was modified by poly-L-lysine (PLL). CIM-specific antibody was attached via an amide bond to a modified magnetic nanoparticle that was conjugated to the GO platform again via an amide bond. Toxicological tests on various cell lines, have proven that no effect of the cytotoxicity of the multifunctional GO platforms appeared. The immunofluorescence assay indirectly confirmed binding between graphene oxide and monoclonal antibody conjugated magnetic nanoparticles. The selectivity of GO-modified platforms to target tumour cells has been demonstrated. Obtained results have provided evidence of tumour cell targeting with a wide potential for visualization and promising expectation for tumour treatment in the future.



Sustainable environmentally friendly polymeric materials

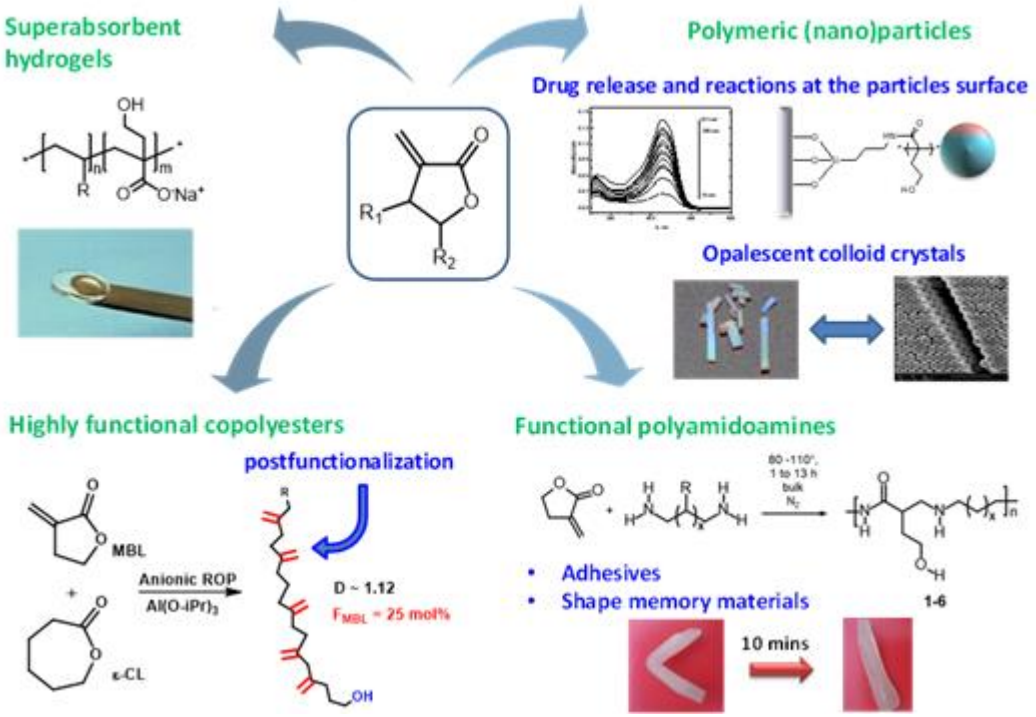
The area of biodegradable plastics achieved important outcomes in recent years. First, the unique blend of polyhydroxy butyrate (PHB) and polylactic acid (PLA) developed as joint research of PI SAS with Slovak Technical University and patented in 2011 was recently commercialized by a Slovak company Panara which obtained a license from PI SAS for EU while the patent was awarded also in several other countries, especially Japan, Korea, Singapore, Russia and China. The biodegradable PLA/PHB blend is suitable to be applied e.g. for packaging production substituting the polymers produced from fossil raw materials.

Important achievements were obtained in the investigation of advanced thermoplastic starch based (TPS) materials, developed through an efficient crosslinking procedure using dialdehyde starch. The novel modification approaches resulted in an increase of strength of the TPS and higher moisture resistance. New TPS compositions resulted in a triple increase of tensile strength by the application of reinforcing fillers, especially carbon blacks or montmorillonite. By such a way the TPS may be considered as a biodegradable biobased matrix suitable for demanding applications.

Within the globally important topic of recovery of plastic waste such as disposable packaging (PET bottles) or textiles (PA) the products with higher added value were developed. Recycled plastic waste (rPET and rPA) was used for development of filtering membranes that could cover the current demand for personal protective masks or could be part of air purification equipment. The outcome of this research gives Slovak producers and entrepreneurs a new alternative for the disposal and recovery of certain types of plastics. Since 2020, progress was achieved in improving membrane performance while maintaining their excellent filtration properties. The membranes achieved similar efficiencies and much lower production costs compared to commercial filters.

Monomers from renewable resources for production of new functional polymers.

Biomass derived monomers may represent suitable candidates to replace petrochemical monomers in the production of polymers with similar or even with additional new properties, especially taking into account the higher functionality of the biobased compounds. A wide range of compounds containing a butyrolactone ring can be found or obtained after some process from various types of plants. Extensive studies were focused at the institute on the synthesis of functional polymers using renewable alpha-methylene-gamma-butyrolactone (MBL), known also as a Tulipalin A and currently, the PI SAS has an internationally leading position in the development of new functional polymers from this renewable monomer. Polymers prepared from MBL by radical polymerization are characterized by high glass transition temperature and render good optical properties, heat, weathering, scratch, and solvent resistance.

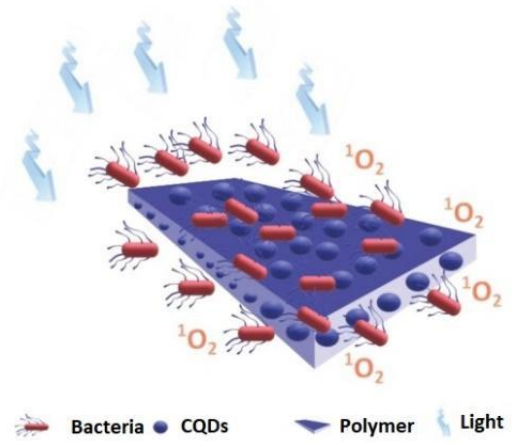


Moreover, as it was found, the applicability of these materials is enhanced by the fact that butyrolactone structure can be hydrolysed to produce hydrophilic compounds and hydrogels with superior degree of swelling, so that highly tunable characteristics can be prepared. Such materials can be applied in biomedicine or in agriculture. In addition, MBL was used as a source of polymeric nanoparticles prepared via emulsion polymerization. Such nanoparticles dispersed in continuous media are frequently applied industrial as e.g. adhesives, paints and coatings. The lactone groups at the surface of polymeric nanoparticles could also be hydrolyzed to provide amphiphilic particles, or postmodified by reaction with amines. Such modification can be used for drug delivery targeting. Ring opening copolymerization of MBL with epsilon-caprolactone was used to synthesize degradable polyesters with pendant unsaturated bonds, which were used for postfunctionalization by reaction with thiols. Such systems can be used for active compounds bounding or preparation of vitrimeric networks. Polyaddition of MBL with diamines provided polyamidoamines. Final properties depended on the molar mass and structure of diamine comonomer. Thus, either adhesives, shape memory polymers or vitrimers were obtained.

Synthesis of new materials based on hybrid (nano)particles.

Surfaces of various inorganic or carbon-based (nano)particles were modified by organic species and/or polymer chains in order to prepare new materials with tailored properties for special applications. The multi-walled carbon nanotubes (MWCNT) were modified by surface initiated reversible addition-fragmentation chain transfer (RAFT) polymerization of 2-hydroxyethyl methacrylate with subsequent ring-opening polymerization (ROP) of epsilon-caprolactone from the pendant hydroxyl groups. The surface modification of carbon nanotubes provided, for the first-time, a photoactuating hybrid material. The advanced methods of radical polymerization techniques developed at PI SAS were used for modification of various (nano)materials in order to achieve specific properties: a) Recently developed ultrasound assisted atom transfer radical polymerization (Mechano-ATRP) was for the first time applied for surface modification of magnetic iron oxide nanoparticles while improved stability of magnetorheological suspension with increased yield stress upon magnetic field application was achieved; b) ATRP was used for simultaneous modification and reduction of graphene oxide while electrically conductive composite was directly prepared.

Polymer nanocomposites with antibacterial properties based on hydrophobic carbon quantum dots



The main goal of the research consists in a development of a new polymeric (nano) composite with adjustable antibacterial effects. Carbon quantum dots (CQDs) working on the principle of photodynamic therapy are able to produce reactive oxygen species, especially singlet oxygen. The material has been physically tested by by determining material characteristics, as well as using biotests for biocompatibility, antibacterial properties as well as level of cytotoxicity, proliferation and hemolysis. Currently, material is tested against viruses. The developed material has highly selective effect on bacterial cells without being cytotoxic or initiate hemolysis. The antibacterial effect is permanent also after long-term application since no signs of the antibiotic resistance was observed. The material is protected by EU patent awarded in several countries. The research was appreciated by publishing the results in annual report 2019 of the Ministry of Health SR marked as Excellent biomedical spot. Several public presentations were broadcasted in Slovak TV. Currently, there are discussions with industrial partners interested in commercial production. The cooperation under Horizon approved project will be performed in 2022-2025.

Kinetics of radical polymerization

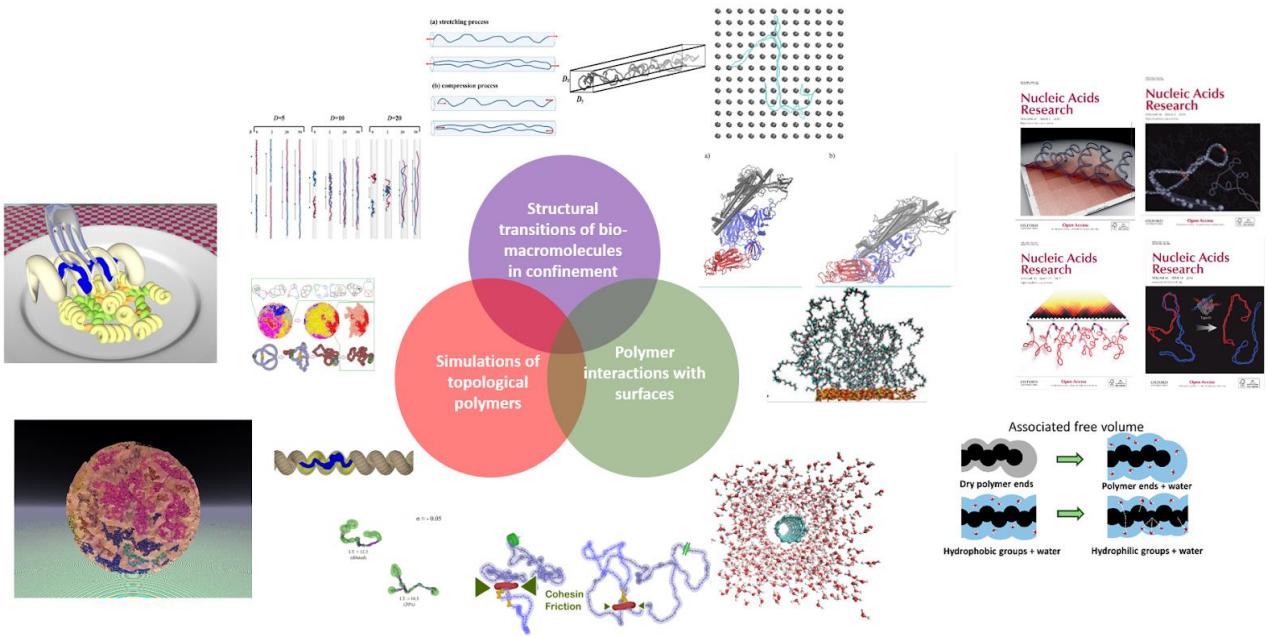
PI SAS holds a significant position globally in the field of radical polymerization kinetics and the mechanism of water-soluble monomers. This is reflected in a number of publications on this topic (target journals Macromolecules, Polymer Chemistry, Polymer), in contract cooperation with BASF SE in Germany (Dr. I. Lacík as PI), in cooperation with universities in Kingston (Canada), Goettingen (Germany), and with the Russian Academy of Sciences, and with the Polymer Division IUPAC (Dr. I. Lacík currently acts as a vice-president). PI SAS contributed to the knowledge on radical polymerization of acrylate and methacrylate families of water-soluble monomers polymerized predominantly in aqueous solutions, complemented by polymerizations in bulk and/or organic solvents, and mixtures of organic solvents with water. This knowledge is based on individual propagation rate coefficients, k_p, obtained by pulsed-laser polymerization combined with size-exclusion chromatography, followed by obtaining termination and transfer rate coefficients, by implementation of these rate coefficients to the mechanistic model and, ultimately, by comparison of experimental data with the model outcomes. The studies into mechanisms behind the solvent effects for polymerization of non-ionized monomers in aqueous solutions were finalized by the work devoted to polymerization of acrylamide. Other contributions in this field include the postulation of mechanisms responsible for k_p for self-associating monomers in different solvents, the first ever determined k_p for acrylic acid polymerized in bulk showing the role of formation of dimeric, the hybrid

solvent effect described for k_p of zwitterionic monomers, the effect of solvent composition on k_p values for both fully and sparingly water-soluble monomers polymerized in water, mixtures of water and alcohols, and alcohols, and revealing the dominating role of counterions on k_p values for fully ionized cationic methacrylate monomers.

Development of photochemically induced atom transfer radical polymerization.

When discussing the atom transfer radical polymerization (ATRP), main drawbacks are the high catalyst concentration leading to side products and product contamination, sensitivity of catalyst to oxidation in the presence of air leading to catalyst handling problems and need of system deaeration. Within the previous evaluation period, a new variation of ATRP technique was developed at the PI SAS, which enables the *in situ* (re)generation of catalyst by photochemical (λ > 350 nm) reduction of the higher oxidation state of the catalytic complex. The developed photoATRP has both economic and environmental impact since it enables synthesis of well-defined polymers at ambient temperature with low concentration of catalyst (50 – 100 ppm), in significantly shorter polymerization time. Despite the high competition of top synthetic teams, which have gradually started to actively address this topic, the researchers from the PI SAS are still succeeding in contributing to the advancement of this area of research. Continuous research during the current evaluation period showed that photoATRP of (meth)acrylates can be performed without the need of air removal from the system without the loss of control, which is a significant step toward applicability of ATRP for industrial production of polymers. It was found that the induction period during which the oxygen in the system is consumed, before the polymerization process starts, can be significantly reduced by addition of a catalytic amount of cheap tertiary amines and/or by increasing the light intensity. The system was optimized also for emulsion polymerization, flow polymerization, polymerization in the presence of carbon nanofillers as well as polymerization initiated from various surfaces, for example Si-wafer or cotton fabrics. In the latter case cotton fabrics with antibacterial or anti-inflammatory properties, depending on the monomer structure, were prepared using the developed polymerization system. This proves the wide applicability of the “oxygen tolerant” photoATRP technique.

Computer molecular simulations of polymers with focus on confined systems.



The conformation of naturally occurring polymers, which is crucial for their biological and biophysical properties and activity, is dictated by geometrical or topological confinement. In order to study the behavior of geometrically constrained polymers, the polymer chains are constrained in the space of size smaller than the size of a free polymer chain. The DNA molecules confined in nanochannels or arrays of nanoposts are considered as geometrically confined systems. These confinements represent the nanofluidic devices, interior of viral capsids or intracellular environment. Thus, the novelty of the research performed consists in the investigations of topological confinement resulting from generation of knots within DNA molecules in combination with geometrical confinement. Simulations of this behavior represent yet unexplored area with practical consequences for biology

of the cell, development of nanotechnological devices for single-molecule experiments, and material engineering.

Due to the difficulty to synthesize well-defined knotted polymer chains, the computer simulations play main role in study of such polymers. The simulations reveal a complex interplay between the strength of confinement, compressing force, and topology of the polymers. Interplay between geometry of the confinement and topology of polymer knots has been also studied and show, that specially designed helical channels could be used for separation of chiral forms of knots. The polymer chains grafted on surface experience lateral crowding which determines their conformation. Protection of surfaces against undesired protein adsorption through coating of surfaces with a polymer layer is important in biomedicine or biotechnology. The conformation of grafted chains is responsible for their repulsive or attractive interactions with proteins. As an example, the computer simulations of the spike protein of SARS-CoV-2 virus adsorbtion on graphene surface can be offered. This process can be considered as two-dimensional confinement, revealing that the secondary structure of receptor binding domain is the most rigid fragment, which does not undergo significant changes during the adsorption.

2. Partial indicators of main activities:

2.1. Research output

2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (in percentage)

All our research activities impact the global research community.

- Basic vs applied research (in %): 80 / 20
- International vs regional research (in %): 100 / 0

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications should not exceed the number of average FTE researchers per year. The principal research outputs (max. 10% of the total number of selected publications, including Digital Object Identifier – DOI if available) should be underlined. Authors from the evaluated organizations should be underlined.

1. BENKOVÁ, Zuzana** - NÁMER, Pavol - CIFRA, Peter. Comparison of a stripe and slab confinement for ring and linear macromolecules in nanochannel. In *Soft Matter*, 2016, vol. 12, no. 40, p. 8425-8439. (2015: 3.798 - IF, Q1 - JCR, 1.634 - SJR, Q1 - SJR, CCC). (2016 - Current Contents). ISSN 1744-683X. Available on https://doi.org/10.1039/c6sm01507g

2. **BENKOVÁ, Zuzana** - CORDEIRO, M.N.D.S. Structural behavior of monomer of SARS-CoV-2 spike protein during initial stage of adsorption on graphene. In *Materials Today Chemistry*, 2021, vol. 22, art. no. 100572, [12] p. (2020: 8.301 - IF, Q1 - JCR, 1.521 - SJR, Q1 - SJR, CCC). (2021 - Current Contents). ISSN 2468-5194. Available on https://doi.org/10.1016/j.mtchem.2021.100572**

3. BONDAREV, Dmitrij - BORSKÁ, Katarína - ŠORAL, Michal - MORAVČÍKOVÁ, Daniela - MOSNÁČEK, Jaroslav**. Simple tertiary amines as promotors in oxygen tolerant photochemically induced ATRP of acrylates. In *Polymer: The International Journal for the Science and Technology of Polymers*, 2019, vol. 161, p. 122-127. (2018: 3.771 - IF, Q1 - JCR, 1.039 - SJR, Q1 - SJR, CCC). (2019 - Current Contents). ISSN 0032-3861. Available on https://doi.org/10.1016/j.polymer.2018.12.009

4. BORSKÁ, Katarína - MORAVČÍKOVÁ, Daniela - MOSNÁČEK, Jaroslav**. Photochemically induced ATRP of (meth)acrylates in the presence of air: The effect of light intensity, ligand, and oxygen concentration. In *Macromolecular Rapid Communications*, 2017, vol. 38, iss. 13, art. no. 1600639. (2016: 4.265 - IF, Q1 - JCR, 1.711 - SJR, Q1 - SJR, CCC). (2017 - Current Contents). ISSN 1022-1336. Available on https://doi.org/10.1002/marc.201600639

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2.1.3 List of monographs/books published abroad

CAPEK, Ignác. *Nanocomposite Structures and Dispersions : Second Edition*. Elsevier, 2019. 458 p. Dostupné na: https://doi.org/10.1016/C2015-0-00616-5. ISBN 978-0-444-63748-2

2.1.4. List of monographs/books published in Slovakia

GRENČÍKOVÁ, Anna - ŠKULCOVÁ, Andrea - BONDAREV, Dmitrij - RYBA, Jozef - MACKUĽAK, Tomáš. *Mikroplasty?!: Od výroby po náš tanier*. 1. vyd. Bratislava: Spektrum STU, 2019. 214 s. ISBN 978-80-227-4974-9

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items for institute with less than 50 average FTE researchers per year, 20 for institutes with 50 – 100 average FTE researchers per year and so on

1. **Macro plastic waste in and along the Danube.** The results, including collected data of a polution and protocols, of the PlasticFreeDanube project in a compact form are available for download in German, Slovak and English on the digital communication and information platform https://plasticfreeconnected.com/

2. **Polymer nanocomposites based on hydrophobic carbon quantum dots and their antibacterial properties**, result selected as representative for the entire SAS, the results are presented in the Annual report of SAS for 2019 https://www.sav.sk/?lang=sk&doc=docs-annual-sas

3. **A multifunctional graphene oxide platform for cancer targeting**, result selected as representative for the entire SAS, the results are presented in the Annual report of SAS for 2019 https://www.sav.sk/?lang=sk&doc=docs-annual-sas

4. **Synthesis of hybrid graphene oxide-based nanoparticles as active fillers for novel functional polymeric materials**, result selected as representative for the entire SAS, the results are presented in the Annual report of SAS for 2020 https://www.sav.sk/?lang=sk&doc=docs-annual-sas

5. **Surface initiated polymerizations as a tool for preparation of materials with functional surfaces toward targeted properties**, result selected as representative for the entire SAS, the results are presented in the Annual report of SAS for 2021 https://www.sav.sk/?lang=sk&doc=docs-annual-sas

6. **The research of antibacterial CQD/polymer composites** was marked in annual report of the Ministry of Health SR as Excellent biomedical spot in 2019

7. **Photochemically induced copper-mediated atom transfer radical polymerization**. Excellence in Science, 2021, the publication of the RDRP agency presents a selection of the most successful completed and subsequently evaluated projects from general call 2015 in all sectors of Slovak science and technology. https://www.apvv.sk/buxus/docs/agentura/publikacie/publikacia-2021-en-A4.pdf

8. **Effects of nanoencapsulated simvastatin on cardiovascular system in experimental metabolic syndrome**. Excellence in Science, 2020, the publication of the RDRP agency presents a selection of the most successful completed and subsequently evaluated projects from general call 2014 in all sectors of Slovak science and technology. https://www.apvv.sk/buxus/docs/agentura/publikacie/publikacia-2020-en-A4.pdf

9. **Eco-bioplastics broadcasted** on 24 September 2016, complete video 26 minutes Broadcasted on 24 September 2016 https://vedanadosah.cvtisr.sk/priroda/chemia/eko-bio-plasty/

2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad

1. BIOLOGICALLY DEGRADABLE POLYMERIC COMPOSITION WITH HIGH DEFORMABILITY
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Patent No.: 10-1651319; Country: Korea
   Patent No.: 2605592; Country: Russia
   Patent No.: 194040; Country: Singapur
   Patent No.: CN 103459498 (B); Country: Canada
   Patent No.: EP 2710076; Country: Europe

2. MANUFACTURE METHOD OF NANOMATERIAL WITH ANTIBACTERIAL PROPERTIES, THE MATERIAL THEREOF, AND ITS USE
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Patent No.: EP3589682B1; Country: Europe

PCT international applications

1. A METHOD FOR ALTERING THE FUNCTIONAL STATUS OF MRNA ALLOWING ITS SELECTIVE AND SPECIFIC RECOGNITION
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia (to 12/2018)
   Owner: RÁZGA Filip; NÉMETHOVÁ Veronika (from 1/2019)
   Application No.: PCT/SK2016/0600022.

2. MANUFACTURE METHOD OF NANOMATERIAL WITH ANTIBACTERIAL PROPERTIES, THE MATERIAL THEREOF, AND ITS USE
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No.: PCT/SK2018/050004

Inputs to national / regional phases

1. MANUFACTURE METHOD OF NANOMATERIAL WITH ANTIBACTERIAL PROPERTIES, THE MATERIAL THEREOF, AND ITS USE
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No.: EP 18719324.8 Country: Europe
   Application No.: US 16490439 Country: USA

Valid / pending (application except 2016-2021)

1. BIOLOGICALLY DEGRADABLE POLYMERIC COMPOSITION WITH HIGH DEFORMABILITY
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No.: JP 5830163 (B) Country: Japan
   Application No.: IN1978/MUMNP/2013 Country: India

2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia

Patents applications

1. SPÔSOB PRÍPRAVY VODNEJ DISPERZIE STRIEBORNÝCH MIKROČASTÍC
   (METHOD OF PREPARATION OF AQUATIC DISPERSION OF SILVER MICROPARTICLES)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No.: PP 50011-2016
   Responsible person: Ignác Capek

2. KOMÔRKA NA ŠTÚDIUM FOTOPOLYMERIZÁCIE METÓDOU POZITRÓNOVEJ ANIHILÁCIE
   (CHAMBER FOR THE STUDY OF PHOTOPOLYMERIZATION BY THE POSITRONE ANIHILATION METHOD)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: PP 117-2017
   Responsible person: Švajdlenková Helena

3. SPÔSOB VÝROBY NANOKOMPOZITNÉHO MATERIÁLU S ANTIBAKTERIÁLNYMI VLASTNOSŤAMI, TAKÝTO MATERIÁL A JEHO POUŽITIE
   (METHOD OF PRODUCTION OF NANO-COMPOSITE MATERIAL WITH ANTIBACTERIAL PROPERTIES, SUCH MATERIAL AND ITS USE)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: PP 50017-201
   Responsible person: Špitálsky Zdenko

4. ZARIADENIE NA ROVNOMERNÉ OPRACOVANIE POVRCHU SYPKÝCH MATERIÁLOV V PLAZME
   (EQUIPMENT FOR UNIFORM PLASMA SURFACE TREATMENT OF MEALY MATERIALS)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: 50071-2018
   Responsible person: Novák Igor

5. SPÔSOB PRÍPRAVY ADITÍVA PRE ZVÝŠENIE POLARITY TAVNÝCH LEPIDIEL
   (METHOD OF PREPARING AN ADDITIVE TO INCREASE THE POLARITY OF MELTING ADHESIVES)

Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 50034-2019
Responsible persons: Chodák Ivan, Pavlinec Juraj, Novák Igor, Rychlý Jozef

6. SPÔSOB SIEŤOVANIA POLYSTYRÉNU (POLYSTYRENE NETWORKING METHOD)
Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 50057-2019
Responsible persons: Lukáč Ivan, Danko Martin, Mosnáček Jaroslav, Chmela Štefan

Patents

1. SPÔSOB SIEŤOVANIA FILMOV POLYMÉROV (POLYMER FILM NETWORKING METHOD)
Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 288328
Responsible persons: Lukáč Ivan, Husár Branislav, Kósa Csaba, Faryová Janka

2. SPÔSOB VÝROBY NANOPÓROVITÉHO VLÁKNITÉHO UHLÍKA Z CELULÓZOVÝCH PREKURZOROV
(METHOD OF PRODUCTION OF NANOPOROUS FIBER CARBON FROM CELLULOSE PRECURSORS)
Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 288507
Responsible persons: Novák Ivan, Berek Dušan

3. SPÔSOB PRÍPRAVY STRIEBORNÝCH NANOČASTÍC VO VODNEJ POLYAKRYLAMIDOVEJ DISPERZII
(METHOD OF PREPARATION OF SILVER PLANTS IN AQUATIC POLYACRYLAMIDE DISPERSION)
Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 288548
Responsible persons: Capek Ignác

4. SPÔSOB PRÍPRAVY KOMPOZITNÉHO SORBENTU NA ODSTRAŇOVANIE KONTAMINANTOV Z VÔD
(METHOD OF PREPARING A COMPOSITE SORBENT FOR REMOVAL OF CONTAMINANTS FROM WATERS)
Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 288563
Responsible persons: Novák Ivan, Berek Dušan

5. ZARIADENIE NA ROVNOMERNÉ OPRACOVANIE POVRCHU SYPKÝCH MATERIÁLOV V PLAZME
(EQUIPMENT FOR UNIFORM PLASMA SURFACE TREATMENT OF MEALY MATERIALS)
Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 288857
Responsible person: Novák Igor

6. SPÔSOB VÝROBY NANOKOMPOZITNÉHO MATERIÁLU S ANTIBAKTERIÁLNYMI VLASTNOSŤAMI, TAKÝTO MATERIÁL A JEHO POUŽITIE
(METHOD OF PRODUCTION OF NANO-COMPOSITE MATERIAL WITH ANTIBACTERIAL PROPERTIES, SUCH MATERIAL AND ITS USE)

Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
Application No: 288876Responsible persons: Špitálsky Zdenko, Kováčová Mária

7. KOMÔRKA NA ŠTÚDIUM FOTOPOLYMERIZÁCIE METÓDOU POZITRÓNOVEJ ANIHILÁCIE (CHAMBER FOR THE STUDY OF PHOTOPOLYMERIZATION BY THE POSITRONE ANIHILATION METHOD)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: 288901
   Responsible person: Švajdlenková Helena

European patents for the Slovak Republic

1. BIOLOGICALLY DEGRADABLE POLYMERIC COMPOSITION WITH HIGH DEFORMABILITY
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: 28300 (EP 2710076)
   Responsible person: Chodák Ivan

Utility models

1. POLYMÉRNE KOMPOZITY PRE 3D TLAČ (POLYMER COMPOSITES FOR 3D PRINTING)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: 255-2017
   Responsible persons: Špitálsky Zdenko, Kováčová Mária

2. SKÚŠOBNÉ TELIESKO NA STANOVENIE ADHÉZNEJ PEVNOSTI TAVNÉHO LEPIDLA K SUBSTRÁTU V TRHACOM STROJI
   (TEST SPECIMEN FOR DETERMINING THE ADHESIVE STRENGTH OF THE MELTING ADHESIVE TO THE SUBSTRATE IN THE BREAKING MACHINE)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: 96-2019
   Responsible persons: Chodák Ivan, Novák Igor, Pavlinec Juraj, Rychlý Jozef

Valid / pending (application except 2016-2021)

1. BIOLOGICKY DEGRADOVATEĽNÁ POLYMÉRNA KOMPOZÍCIA SO ZLEPŠENÝMI VLASTNOSŤAMI
   (BIOLOGICALLY DEGRADABLE POLYMENER COMPOSITION WITH IMPROVED PROPERTIES)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Application No: 7317
   Responsible person: Chodák Ivan

2.1.8. Narrative on the most important research outputs of the institute – especially focused on their importance for society (3-5 pages)

Interactions of SARS-CoV-2 spike protein monomer and RBD trimer with graphene.

Atomistic molecular dynamics simulations were used to study the structural changes of the monomer as well as the glycosylated trimer of the RBD unit of the spike protein of the SARS-CoV-2 virus induced by their interactions with the graphene as a material with potential protective activity. Apart from the adsorption of the virus onto the graphene, the structural modification of the spike protein, particularly its RBD unit, may reduce or suppress the infectivity of the SARS-CoV-2 virus. Both systems render more or less identical structural changes in the RBD unit which indicates that the secondary structure of the spike protein monomer is not influenced by the presence of the remaining two monomers present in the spike protein trimer. Since the glycosylated residues are oriented toward the water medium they do not affect the adsorption of the RBD unit. One α-helix disappears and 2 α-helices as well as β-sheets in the RBD unit are stabilized during the adsorption. New hydrogen bonds are formed within the protein whereas the hydrogen bonds between protein and water are destroyed upon protein adsorption.

- Benková et al. Mater. Today Chem. https://doi.org/10.1016/j.mtchem.2021.100572 .

Superabsorbent hydrogels based on renewable monomer

Renewable monomer alpha-methylene-gamma-butyrolactone, known also as a Tulipalin A, was copolymerized in its hydrolyzed form with acrylamide in the presence of small amount of crosslinker to provide superabsorbent hydrogels. The hydrogels possessed significantly higher absorption capacity compared to commonly commercially used superabsorbents based on copolymers of acrylic acid with acrylamide, while the handling of the hydrogel in its swollen state was possible due to good mechanical properties. Both the mechanical properties as well as swelling capacity could be tuned by hydrogel composition and crosslinking density. Hydrogels were noncytotoxic with potential use in a wide range of applications including for hygiene products, cell culturing and suppression of erosion or increasing the efficiency of irrigation in agriculture. For agricultural purposes, the phytotoxic properties of hydrogels were tested and compared with conventional and commonly used hydrogels. Among tested materials, MBL based hydrogels were found to be non-toxic with even a slightly positive effect on growth of control plants. In addition, effect of various stimuli was investigated to prove stimuli responsive behavior of the hydrogels.

- Kollar at al. Macromolecules, https://doi.org/10.1021/acs.macromol.6b00467; Luk et al. Polym. Chem., https://doi.org/10.1039/C7PY01397C; Rychter et al. Adv. Polym. Technol., https://doi.org/10.1155/2019/2947152; Kollar et al. Eur. Polym. J., https://doi.org/10.1016/j.eurpolymj.2019.03.012.

Revealing the spatial distribution of polymers in alginate-based microspheres

Alginate-based microspheres are the most frequent biomaterials used for immunoprotection of insulin-producing cells after transplantation to a diabetic recipient. This principle is considered as the next generation diabetes treatment since it provides long-term normoglycemia without the need for administration of external insulin and in the absence of immunosuppression. Alginate-based microspheres have been tested clinically, however, a number of questions remain to be answered. Specifically, the key treatment success is given by the microsphere structure, i.e. the spatial distribution of the polymeric components within the microsphere volume that determines stability, permeability, diffusion properties, and cell microenvironment. These microspheres are stabilized by electrostatic interactions that are susceptible to destabilization and re-arrangement, especially in vivo. PI SAS introduced, for the first time in this field, confocal Raman microscopy imaging as a powerful non-invasive tool for visualizing structural changes of alginate-based microspheres from preparation to in vivo environment. It was qualitatively and quantitatively shown that spatial distribution of alginate in alginate beads is changing from heterogeneous to homogeneous after preparation and after explantation from mice, respectively, whereas the structural heterogeneity of the polyelectrolyte complex-based microcapsules is conserved. Thus, this method offers the

encapsulation community the tool to understand the mechanisms of microsphere formation, dynamics and stability, and enables to move this therapy towards its clinical use.

- Kroneková et al. Sci. Rep., https://doi.org/10.1038/s41598-018-20022-y.

A Multifunctional Graphene Oxide Platform for Targeting Cancer

Diagnosis of oncological diseases remains at the forefront of the current medical research. With a multidisciplinary approach this problem can be much easier solved. Carbon-based nanoparticles have attracted a great amount of attention due to their interesting surface properties and ability to act as a platform for modification with various substances, drugs and ligands. CA IX (Carbonic Anhydrase IX) is a cell surface hypoxia-inducible enzyme functionally involved in adaptation to acidosis that is expressed in aggressive tumors; hence, it can be used as a tumor biomarker. The main goal of the research with PI SAS input was the development and preparation of a new type of graphene-oxide multifunctional nanoplatform for the detection of tumor cells. Graphene oxide (GO) nanolayers were prepared at PI SAS and functionalized with magnetic nanoparticles and a monoclonal antibody (MAb) specific for CA IX marker. Confocal Raman imaging was used for monitoring the living cells in an aqueous medium in real-time using an immersion objective. The study aimed to follow the endocytosis of GO nanoplatform bioconjugated to M75 in living tumor cells expressing CAIX. We succeeded to image the very stage of GO internalization through the cell membrane. The increased affinity of the prepared GO M75 molecular complexes validates the use of two-dimensional materials for future strategies of targeted cancer treatment.

- Bugarova et al., https://doi.org/10.3390/cancers11060753; Bugarova et al. Nanomed.-Nanotechnol. Biol. Med. https://doi.org/10.1016/j.nano.2020.102280.

Manufacture method of nanomaterial with antibacterial properties, the material thereof, and its use

The COVID- 19 global pandemic highlighted an underlying risk in our current urban style of living: The transmission of infectious diseases can rapidly reach the exponential phase, causing catastrophic and long-term impacts on the healthcare system, in turn affecting a significant portion of daily and economic activities. Many bacteria (and viruses) which are carried by the bodily fluids (saliva, nasal fluids, skin secretions, faeces) can be easily transferred by an infected individual to inanimate surfaces, “fomites” (glass, metals, ceramics, polymers and textiles), where the bacteria and viruses still have the capacity to infect. Therefore the team of PISAS developed new carbon material with antibacterial properties – carbon quantum dots (CQDs) whose antibacterial effect is activated just a visible light (this effect is called photodynamic therapy) and incorporated them into polymer matrices to obtain antibacterial CQD/polymer composites with antimicrobial effect. That composites can serve as the surface coating for different surfaces (flooring, roofing, wall coverings, window coverings (e.g. in hospitals), coated fabrics, flexible films for food packages, foils and sheets for antibacterial catheters, fibres for antibacterial sutures on the body surface and other applications where antibacterial activity is needed, mainly in medical applications and in industries such as food production and pharmaceutical production.)

- PCT/SK2018/050004, EP 18719324.8, US 16490439; Markovic et al., https://doi.org/10.1021/acssuschemeng.0c06260

New polymeric composites for 3D printing

Based on the collaboration with local industrial partners in area of 3D printing, our research focused on new materials / polymer composites – filaments for 3D printing based on Fused filament fabrication (FFF), also known as fused deposition modeling (with the trademarked acronym FDM). One of the outputs is also new filament based on recycled polymer matrix. As the reinforcing filler, expanded graphite, carbon fibers, and combinations thereof were used in various ratios up to 10 %. The composites from cheaper recycled PETG (polyethylene terephthalate glycol) have comparable properties to virgin PETG composites, what is of economic and ecological importance. From the obtained results it is evident that all the composite materials have higher values of the mechanical properties than the pure polymer matrix. The obtained polymer composites have excellent processing properties on a 3D printer with FFF technology. New hybrid filaments bring benefits from an economic point of view (cheaper recycled PETG, lower nozzle wear) as well as from an

environmental point of view (recycled materials, partial replacing CF by graphite). One of the hybrid composites is currently offered as a commercial product available at the market of 3D filaments.

- Špitalský et al. Polymer composites for 3D printing, utility model 8207 Slovakia, 2018; Kováčová et al.. Appl Sci-Basel, https://doi.org/10.3390/app10093062.

Macro plastic waste in and along the Danube

In search of a solution and a way to remove plastics and create enlightenment about this environmental problem and highly actual topics, an international project "PlasticFreeDanube" was created. Project focused on macroplastic waste in and along the Danube. The overall goal of the project was to establish a database of scientifically based information as well as a methodological approach to plastic waste in and along the river in terms of entry points, quantities, transport patterns and environmental hazards. The area of interest of this project includes the territory of the Danube and its coastal parts from the metropolitan areas of Vienna and Bratislava to the Gabčíkovo hydroelectric power plant (SK). The composition of the plastics was examined by PISAS scientists, and the risks to humans and the environment were subsequently identified. Based on the information obtained, a database was set up and an action plan for plastic waste management was developed.
The main goals were achieved as follows: 1. Providing methodology, data and manual for assessment and monitoring of plastic pollution in river systems; 2. Development of an action plan for the management of plastic waste and implementation of pilot measures against plastic pollution in the Danube; 3. Raising awareness of the general public and stakeholders about plastic waste pollution in the river.
The results of the PlasticFreeDanube project in a compact form are available for download in German, Slovak and English on the digital communication and information platform https://plasticfreeconnected.com/.

- Mičušík et al. Toxicol Rep, https://doi.org/10.1016/j.toxrep.2021.11.006.

“Oxygen tolerant” photochemically induced copper-mediated atom transfer radical polymerization

PhotoATRP, developed at PI SAS in the previous evaluation period, was here optimized for the possibility to perform polymerization of methacrylates without the need to remove oxygen (air) from the polymerization mixture. Optimization of the conditions was achieved in the case of photoATRP of acrylates as well as for the renewable vinyl monomer α-methylene-γ-butyrolactone, which increased the ecological significance of the project results. High fidelity of the terminal functional groups during developed photoATRP performed in the presence of a limited amount of air was confirmed by preparation of block copolymers of (meth)acrylates. Thus, it was confirmed that the initial presence of the oxygen in the polymerization mixture has no or minimal effect on the initiation process and irreversible reactions between macroradicals and oxygen during the polymerization process are absent or negligible. PhotoATRP of acrylates was also applied in the presence of carbon nanotubes, setting a concentration limit for nanotubes, above which the polymerization is not applicable. The advantage of photoATRP in the presence of nanotubes compared to another type of ATRP, using a reducing agent for catalyst recovery, has been clearly demonstrated. In addition, photoATRP of (meth)acrylates was optimized for more environmentally friendly conditions, i.e. emulsion polymerization, which allows the use of water instead of an organic solvent. The methodologies developed at PI SAS significantly contributed to solving the problem of high sensitivity of the catalyst to the presence of air and thus may contribute to making this technique more economically and environmentally profitable in the near future and being used industrially for a wide range of applications.

- Borska et al. Macromol. Rapid Commun. https://doi.org/10.1002/marc.201600639; Bondarev et al. Polymer, https://doi.org/10.1016/j.polymer.2018.12.009; Zain et al. ChemPhotoChem, https://doi.org/10.1002/cptc.201900151; Zain et al. Polym. Chem., https://doi.org/10.1039/D1PY01322J.

Functional polymers for immunotherapies

Poly(2-isopropenyl-2-oxazoline) represents a functional polymer with high potential for drug delivery, tissue engineering, and immunotherapy. This type of polymer is considered as non-cytotoxic with specific immunomodulatory properties. A new method for preparation of well-defined poly(2-isopropenyl-2-oxazolines) with respect of molar mass and architecture was developed by using an atom-transfer radical polymerization in aqueous-phase. Polymers with the molar mass up to 40 000 g/mol and narrow dispersity were prepared. It was also shown that the *in vitro* performance of poly(2-isopropenyl-2-oxazoline) strongly depends on molar mass and dispersity. Moreover, the pendant 2-oxazoline ring enables conjugation of a high amount of different hydrophobic drug molecules. We demonstrated that poly(2-isopropenyl-2-oxazoline) stimulates different immunocompetent cells by accelerating the cell-specific immune response. Depending on the immune cells used for sensitization, a different polarization of immune response can be achieved such as Th1-supported cellular immunity, Th17-promoting antimicrobial immunity, and Treg indicating anti-inflammatory immune response. These results confirm that this polymer is a proper candidate for immunomodulation of immune cells in different immunotherapies.

- Raus et al. Macromolecules, https://doi.org/10.1021/acs.macromol.9b02662; Paulovičová et al. Materials, https://doi.org/10.3390/ma14061371.

Preparation and characterization of biodegradable polymers.

As a contribution to the solution of the problem with non-degradable plastics we investigated PLA/PHB blends plasticized with acetyl tributyl citrate and loaded with various amounts of Keratin as a cheap bio-based additive. Excellent mechanical properties of the neat blend are decreased with Keratin loading (elongation at break from 300% to 140% for 20 wt.% Keratin), it nevertheless acquires a significant acceleration of hydrolytic degradation. Microbial tests confirmed free accommodation and proliferation of adhered microorganisms on the Keratin composites.
Previously we showed efficient photo-transformation of diketone to benzoyl peroxide, when it is doped in solid polymer matrices. Subsequent photo- or thermal decomposition of the synthesized benzoyl-peroxide structures in matrix leads to hydrogen abstraction of acyloxy radicals from polymer backbone causing macroradical formation and leading to main chain scission (mainly in PLA matrix) or macroradicals disproportionation.
A biodegradable PLA/PHB blends with 3 wt% of carbon black were also tested as mulching foils used in agriculture. The results after UV irradiation showed a significant stabilizing effect of the carbon black, which was reflected in the increased stability of the mechanical properties. In the case of mulching, only a slight deterioration in mechanical properties was observed after 30 days of application. However, after 90 days, the values of elongation at break were below 10 %, but the material was still compact without visible cracks. No significant effect of physical aging on the mechanical properties of the studied films was observed.

- Mosnáčková et al. Chem. Pap., https://doi.org/10.1515/chempap-2016-0043; Mosnáčková et al. RSC Adv., https://doi.org/10.1039/c7ra08869h; Jeszeová et al. World J. Microbiol. Biot., https://doi.org/10.1007/s11274-018-2483-y; Borská et al. Polym. Test., https://doi.org/10.1016/j.polymertesting.2020.106821; Mosnáčková et al. Int. J. Mol. Sci., https://doi.org/10.3390/ijms21249678; Danko et al. Polymers, https://doi.org/10.3390/polym13162693.

Development of protective masks from plastic waste

The global pandemic of coronavirus disease 2019 (COVID-19) impacted the worldwide community and increased the demand for personal protective equipment such as face masks, half-masks, or respirators, which would make people safer against viruses and bacteria. In our study Poly(ethylene terephthalate) (PET) from domestic plastic waste was processed by electrospinning from solution hexafluoro-2-propanol/dichloromethane. The nanofibrous membrane with an average diameter of 95 ± 37 nm was prepared and filtration efficiency was tested. It was shown that the recycled PET (r-PET) nanofibrous membrane retained the particles with a size of around 120 nm with more than 98% efficiency. Moreover, users' comfort characteristics such as vapor permeability and breathability were tested. Herein, it is shown that 94% of water vapor permeation is achieved. Breathability 39 $mm.s^{-1}$ is in the lower limit of the comfortable range; despite this unfavorable result, the r-PET

membrane could be used as a filtration media for personal protection because this disadvantage can be mitigated by the area and shape of the filter.

- Opálková Šišková et al. Mater. Lett., https://doi.org/10.1016/j.matlet.2020.128426.

PALS as a tool for gel microstructure study

In the study of micro-structure of dimethacrylates used as dental materials there were found out the key microstructural factors in dimethacrylates regulated by the chain transfer reagent such as structural homogeneity, reduced free volume and void fractions which could be responsible for improved material properties. Pilot in situ study of nanostructural changes of dimethacrylates during networking process, combining PALS and real time photorheology, allowed to look deeper into the mechanism regarding homogeneity of network formation via evolution of distributions, which can help at tuning of photopolymerization. As a result of this study there is a patent application of Chamber for the study of photopolymerization by the positron annihilation method (No. 288901). In addition, a microstructural study of epoxides prepared by the frontal polymerization, using PALS, showed more reduced free volume in the nanostructure compared to thermally cured epoxides which may be one of the factors increasing toughness. In addition, the new procedure was proposed to monitor the propagation of frontal polymerization from the final cured samples.

- Švajdlenková et al. In J. Polym. Sci. Pol. Phys., https://doi.org/10.1002/polb.24240; Švajdlenková et al. Macromol. Chem. Phys., https://doi.org/10.1002/macp.201800119; Švajdlenková et al. RSC Adv., https://doi.org/10.1039/c8ra07578f; Švajdlenková et al. RSC Adv., https://doi.org/10.1039/d0ra08298h.

Interactions of confined water and polymer.

The work published in ACS Macromolecules changes the classical paradigm established by Flory-Fox theory according to which ends of polymer chains do act like impurities that increase free volume. By using computer simulations, we have explored the site-specific free volume around polymers containing hydrophilic and hydrophobic groups. The simulations show that the free volume along the polymer chain changes based on the local concentration of hydrogen bonding with molecules of plasticizer - water. PVME (poly vinyl methyl ether) is frequently used as a simplified model system for studying water interactions around biological molecules like proteins or DNA. The work also addresses the current problem of confined water that does not freeze towards temperatures 240 K well below the freezing point of water in the bulk.

- Capponi et al. Macromolecules, https://doi.org/10.1021/acs.macromol.0c00472 .

Coarse-grained simulations of DNA .

Compression and extension of single dsDNA molecules confined in cylindrical channels were studied by means of Monte Carlo simulations. The elastic response is largely affected by the size of the channel. The external stretching of confined DNA results in a characteristic pattern of f-R functions involving their shift to larger extensions due to the channel-induced pre-stretching ΔRD. A smooth end-chain compression into loop-like conformations observed in moderately confined DNA can be accounted for by the relationship for a Gaussian chain in bulk. In narrow channels, the considerably pre-stretched DNA molecules abruptly buckle into hairpins. Secondly, the piston compression of DNA is characterized by a reduction of the chain span S and by smooth f-S.
It is now generally accepted that looped structures occurring in the intermediate range of ordering of chromatin are formed by a loop extrusion mechanism involving specialized proteins (structural maintenance complexes or SMCs). These mechanisms account for transcriptionally driven loop extrusion or entropically driven loop extrusion by osmotic pressure. In the current work, we use coarse grained molecular simulation to further explore the extrusion driven by supercoiling while employing much lower levels of supercoiling. As such, the work addresses current problems in molecular biology and employs advanced methods and original solutions in the study.

- Bleha et al. J. Phys. Chem. B, https://doi.org/10.1021/acs.jpcb.9b11602; Rusková et al. Biology-Basel, https://doi.org/10.3390/biology10020130.

2.1.9. Table of research outputs

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately

Scientific publications	2016			2017			2018			2019			2020			2021			total			
	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. /1 million total salary budget	number	averaged number per year	av. No. / FTE researches	av. No. / one million total salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	1	0,028	0,850	0	0,000	0,000	0	0,000	0,000	**1**	**0,167**	**0,004**	**0,139**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	1	0,028	0,850	0	0,000	0,000	0	0,000	0,000	**1**	**0,167**	**0,004**	**0,139**
Chapters in scientific monographs published abroad *(ABC)*	4	0,082	4,044	3	0,071	2,778	**3**	0,077	1,983	2	0,056	1,701	0	0,000	0,000	2	0,048	1,626	**14**	**2,333**	**0,057**	**1,949**
Chapters in scientific monographs published in Slovakia *(ABD)*	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	**0**	**0,000**	**0,000**	**0,000**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	74	1,525	74,823	71	1,675	65,741	80	2,061	52,875	65	1,836	55,272	67	1,635	56,067	82	1,988	66,667	**439**	**73,167**	**1,775**	**61,117**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS not listed above *(ADMA, ADMB, ADNA, ADNB)*	7	0,144	7,078	7	0,165	6,481	18	0,464	11,897	10	0,282	8,503	10	0,244	8,368	4	0,097	3,252	**56**	**9,333**	**0,226**	**7,796**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	4	0,082	4,044	1	0,024	0,926	1	0,026	0,661	4	0,113	3,401	0	0,000	0,000	1	0,024	0,813	**11**	**1,833**	**0,044**	**1,531**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	**0**	**0,000**	**0,000**	**0,000**
Scientific papers published in foreign peer-reviewed proceedings *(AECA)*	1	0,021	1,011	0	0,000	0,000	0	0,000	0,000	2	0,056	1,701	0	0,000	0,000	3	0,073	2,439	**6**	**1,000**	**0,024**	**0,835**
Scientific papers published in domestic peer-reviewed proceedings *(AEDA)*	1	0,021	1,011	0	0,000	0,000	10	0,258	6,609	0	0,000	0,000	0	0,000	0,000	0	0,000	0,000	**11**	**1,833**	**0,044**	**1,531**
Published papers (full text) from foreign scientific conferences *(AFA, AFC)*	13	0,268	13,145	6	0,142	5,556	0	0,000	0,000	2	0,056	1,701	0	0,000	0,000	1	0,024	0,813	**22**	**3,667**	**0,089**	**3,063**
Published papers (full text) from domestic scientific conferences *(AFB, AFD)*	3	0,062	3,033	7	0,165	6,481	6	0,155	3,966	3	0,085	2,551	9	0,220	7,531	0	0	0	**28**	**5**	**0**	**4**

2.2. Measures of research outputs (citations, etc.)

2.2.1. Table with citations per annum (without self-citations)

Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) are listed separately

Citations, reviews	2015		2016		2017		2018		2019		2020		total		
	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	averaged number per year	av. No. / FTE researchers
Citations in Web of Science Core Collection (1.1, 2.1)	2 061	42,48	2 339	55,17	2 463	63,46	2 636	74,44	2 732	66,68	2 917	70,73	**15 148**	**2 524,67**	**61,24**
Citations in SCOPUS (1.2, 2.2) if not listed above	173	3,57	296	6,98	220	5,67	244	6,89	235	5,74	221	5,36	**1 389**	**231,50**	**5,62**
Citations in other citation indexes and databases (not listed above) (3.2,4.2)	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	**0**	**0,00**	**0,00**
Other citations (not listed above) (3.1, 4.1)	3	0,06	2	0,05	0	0,00	9	0,25	9	0,22	2	0,05	**25**	**4,17**	**0,10**
Reviews (5,6)	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	**0**	**0,00**	**0,00**

2.2.2. List of 10 most-cited publications published any time with the address of the institute, with number of citations, without self-citations, in the assessment period (2015 – 2020)

1. **MIERTUŠ, Stanislav** - SCROCCO, E. - TOMASI, J. Electrostatic interaction of a solute with a continuum. A direct utilization of ab initio molecular potentials for the prevision of solvent effects. In *Chemical Physics*, 1981, vol. 55, iss. 1, p. 117-129. ISSN 0301-0104. Available on https://doi.org/10.1016/0301-0104(81)85090-2 – number of citations **2283**
2. **ŠPITÁLSKY, Zdenko** - TASIS, Dimitrios - PAPAGELIS, Konstantinos - GALIOTIS, Costas. Carbon nanotube-polymer composites: Chemistry, processing, mechanical and electrical properties. In *Progress in Polymer Science: an International Review Journal*, 2010, vol. 35, p. 357 - 401. (2009: 23.753 - IF, 11.539 - SJR, Q1 - SJR, CCC). (2010 - Current Contents). ISSN 0079-6700. Available on https://doi.org/10.1016/j.progpolymsci.2009.09.003 - number of citations **1380**
3. **MIERTUŠ, Stanislav**** - TOMASI, J. Approximate evaluations of the electrostatic free-energy and internal energy changes in solution processes. In *Chemical Physics*, 1982, vol. 65, iss. 2, p. 239-245. ISSN 0301-0104. Available on https://doi.org/10.1016/0301-0104(82)85072-6 – number of citations **548**
4. VEISEH, Omid - DOLOFF, Joshua C. - MA, Minglin - VEGAS, Arthuro J. - TAM, Hok Hei - BADER, Andrew R. - LI, Jie - LANGAN, Erin - WYCKOFF, Jeffrey - LOO, Whitnney S. - JHUNJHUNWALA, Siddharth - CHIU, Alan - SIEBERT, Sean - TANG, Katherine - HOLLISTER-LOCK, Jennifer - ARESTA-DASILVA, Stephanie - BOCHENEK, Matthew - MENDOZA-ELIAS, Joshua - WANG, Yong - QI, Merigeng - LAVIN, Danya M. - CHEN, Michael - DHOLAKIA, Nimit - THAKRAR, Raj - **LACÍK, Igor -** WEIR, Gordon C. - OBERHOLZER, Jose - GREINER, Dale L. - LANGER, Robert - ANDERSON, Daniel G. Size- and shape-dependent foreign body immune response to materials implanted in rodents and non-human primates. In *Nature Materials*, 2015, vol. 14, p. 643-651. (2014: 36.503 - IF, Q1 - JCR, 14.956 - SJR, Q1 - SJR, CCC). (2015 - Current Contents). ISSN 1476-1122. Available on https://doi.org/10.1038/NMAT4290 - number of citations **313**
5. LIGON, Samuel Clark - **HUSÁR, Branislav** - WUTZEL, Harald - HOLMAN, Richard - LISKA, Robert. Strategies to reduce oxygen inhibition in photoinduced polymerization. In *Chemical Reviews*, 2014, vol. 114, p. 557 - 589. (2013: 45.661 - IF, Q1 - JCR, 22.299 - SJR, Q1 - SJR, CCC). (2014 - Current Contents). ISSN 0009-2665. Available on https://doi.org/10.1021/cr3005197 - number of citations **270**
6. **OMASTOVÁ, Mária** - TRCHOVÁ, M. - KOVÁŘOVÁ, J. - STEJSKAL, J. Synthesis and structural study of polypyrroles prepared in the presence of surfactants. In *Synthetic Metals*, 2003, vol. 138, no. 3, p. 447 - 455. (2002: 1.187 - IF, CCC). (2003 - Current Contents). ISSN 0379-6779. Available on https://doi.org/10.1016/S0379-6779(02)00498-8 – number of citations **200**
7. **CAPEK, Ignác**. Preparation of metal nanoparticles in water-in-oil (w/o) microemulsions. In *Advances in colloid and interface science*, 2004, vol. 110, no.1 - 2, p. 49 - 74. (2003: 4.057 - IF). ISSN 0001-8686. Available on https://doi.org/10.1016/j.cis.2004.02.003 - number of citations **199**
8. ORIVE, G. - HERNANDEZ, R.M. - GASCON, A.R. - CALAFIORE, R. - CHANG, T.S.M. - DE VOS, P. - HORTELAO, G. - HUNKELER, D. - **LACÍK, Igor** - SHAPIRO, A.M.I. - PEDRAZ, J.L. Cell encapsulation: promise and progress. In *Nature medicine*, 2003, vol. 9, no. 1, p. 104 - 107. ISSN 1078-8956. Available on https://doi.org/10.1038/nm0103-104 - number of citations **148**
9. BLINOVA, Natalia V. - STEJSKAL, Jaroslav - TRCHOVÁ, Miroslava - PROKEŠ, Jan - **OMASTOVÁ, Mária**. Polyaniline and polypyrrole: a comparative study of the preparation. In *European Polymer Journal*, 2007, vol. 43, p. 2331 - 2341. (2006: 2.113 - IF, Q1 - JCR, 1.095 - SJR, Q1 - SJR, CCC). (2007 - Current Contents). ISSN 0014-3057. Available on https://doi.org/10.1016/j.eurpolymj.2007.03.045 - number of citations **118**
10. **MOSNÁČEK, Jaroslav - ILČÍKOVÁ, Markéta.** Photochemically mediated atom transfer radical polymerization of methyl methacrylate using ppm amounts of catalyst. In *Macromolecules*, 2012, vol. 45, no. 15, p. 5859 - 5865. (2011: 5.167 - IF, Q1 - JCR, 2.556 - SJR, Q1 - SJR, CCC). (2012 - Current Contents). ISSN 0024-9297. Available on https://doi.org/10.1021/ma300773t - number of citations **114**

2.2.3. List of 10 most-cited publications published any time with the address of the institute, with number of citations, without self-citations, obtained until 2020

1. **MIERTUŠ, Stanislav** - SCROCCO, E. - TOMASI, J. Electrostatic interaction of a solute with a continuum. A direct utilization of ab initio molecular potentials for the prevision of solvent effects. In *Chemical Physics*, 1981, vol. 55, iss. 1, p. 117-129. ISSN 0301-0104. Available on https://doi.org/10.1016/0301-0104(81)85090-2 – **5611 (only SCOPUS)**
2. **ŠPITÁLSKY, Zdenko** - TASIS, Dimitrios - PAPAGELIS, Konstantinos - GALIOTIS, Costas. Carbon nanotube-polymer composites: Chemistry, processing, mechanical and electrical properties. In *Progress in Polymer Science: an International Review Journal*, 2010, vol. 35, p. 357 - 401. (2009: 23.753 - IF, 11.539 - SJR, Q1 - SJR, CCC). (2010 - Current Contents). ISSN 0079-6700. Available on https://doi.org/10.1016/j.progpolymsci.2009.09.003 - number of citations **2187**
3. **MIERTUŠ, Stanislav**** - TOMASI, J. Approximate evaluations of the electrostatic free-energy and internal energy changes in solution processes. In *Chemical Physics*, 1982, vol. 65, iss. 2, p. 239-245. ISSN 0301-0104. Available on https://doi.org/10.1016/0301-0104(82)85072-6 – number of citations **1589 (only SCOPUS)**
4. **CAPEK, Ignác**. Preparation of metal nanoparticles in water-in-oil (w/o) microemulsions. In *Advances in colloid and interface science*, 2004, vol. 110, no.1 - 2, p. 49 - 74. (2003: 4.057 - IF). ISSN 0001-8686. Available on https://doi.org/10.1016/j.cis.2004.02.003 - number of citations **553**
5. **OMASTOVÁ, Mária** - TRCHOVÁ, M. - KOVÁŘOVÁ, J. - STEJSKAL, J. Synthesis and structural study of polypyrroles prepared in the presence of surfactants. In *Synthetic Metals*, 2003, vol. 138, no. 3, p. 447 - 455. (2002: 1.187 - IF, CCC). (2003 - Current Contents). ISSN 0379-6779. Available on https://doi.org/10.1016/S0379-6779(02)00498-8 – number of citations **434**
6. ORIVE, G. - HERNANDEZ, R.M. - GASCON, A.R. - CALAFIORE, R. - CHANG, T.S.M. - DE VOS, P. - HORTELAO, G. - HUNKELER, D. - **LACÍK, Igor** - SHAPIRO, A.M.I. - PEDRAZ, J.L. Cell encapsulation: promise and progress. In *Nature medicine*, 2003, vol. 9, no. 1, p. 104 - 107. ISSN 1078-8956. Available on https://doi.org/10.1038/nm0103-104 - number of citations **390**
7. VEISEH, Omid - DOLOFF, Joshua C. - MA, Minglin - VEGAS, Arthuro J. - TAM, Hok Hei - BADER, Andrew R. - LI, Jie - LANGAN, Erin - WYCKOFF, Jeffrey - LOO, Whitnney S. - JHUNJHUNWALA, Siddharth - CHIU, Alan - SIEBERT, Sean - TANG, Katherine - HOLLISTER-LOCK, Jennifer - ARESTA-DASILVA, Stephanie - BOCHENEK, Matthew - MENDOZA-ELIAS, Joshua - WANG, Yong - QI, Merigeng - LAVIN, Danya M. - CHEN, Michael - DHOLAKIA, Nimit - THAKRAR, Raj - **LACÍK, Igor -** WEIR, Gordon C. - OBERHOLZER, Jose - GREINER, Dale L. - LANGER, Robert - ANDERSON, Daniel G. Size- and shape-dependent foreign body immune response to materials implanted in rodents and non-human primates. In *Nature Materials*, 2015, vol. 14, p. 643-651. (2014: 36.503 - IF, Q1 - JCR, 14.956 - SJR, Q1 - SJR, CCC). (2015 - Current Contents). ISSN 1476-1122. Available on https://doi.org/10.1038/NMAT4290 - number of citations **313**
8. LIGON, Samuel Clark - **HUSÁR, Branislav** - WUTZEL, Harald - HOLMAN, Richard - LISKA, Robert. Strategies to reduce oxygen inhibition in photoinduced polymerization. In *Chemical Reviews*, 2014, vol. 114, p. 557 - 589. (2013: 45.661 - IF, Q1 - JCR, 22.299 - SJR, Q1 - SJR, CCC). (2014 - Current Contents). ISSN 0009-2665. Available on https://doi.org/10.1021/cr3005197 - number of citations **270**
9. ORIVE, G. - HERNANDEZ, R.M. - GASCON, A.R. - CALAFIORE, R. - CHANG, T.M.S. - DE VOS, P. - HORTELANO, G. - HUNKELER, D. - **LACÍK, Igor** - PEDRAZ, J.L. History, challenges and perspectives of cell microencapsulation. In *Trends in Biotechnology*, 2004, vol. 22, no. 2, p. 87-92. ISSN 0167-7799. Available on https://doi.org/10.1016/j.tibtech.2003.11.004 - number of citations **258**
10. BLINOVA, Natalia V. - STEJSKAL, Jaroslav - TRCHOVÁ, Miroslava - PROKEŠ, Jan - **OMASTOVÁ, Mária.** Polyaniline and polypyrrole: a comparative study of the preparation. In *European Polymer Journal*, 2007, vol. 43, p. 2331 - 2341. (2006: 2.113 - IF, Q1 - JCR, 1.095 - SJR, Q1 - SJR, CCC). (2007 - Current Contents). ISSN 0014-3057. Available on https://doi.org/10.1016/j.eurpolymj.2007.03.045 - number of citations **233**

2.2.4. List of 10 most-cited publications published during the evaluation period (2016-2021) with the address of the Institute, with number of citations, without self-citations, obtained until 2021

1. HRONEC, M. - FULAJTÁROVÁ, K. - VÁVRA, Ivo - SOTÁK, T. - DOBROČKA, Edmund - **MIČUŠÍK, Matej**. Carbon supported Pd-Cu catalysts for highly selective rearrangement of furfural to cyclopentanone. In *Applied Catalysis B: Environmental*, 2016, vol. 181, p. 210-219. (2015: 8.328 - IF, Q1 - JCR, 2.326 - SJR, Q1 - SJR, CCC). (2016 - Current Contents). ISSN 0926-3373. Available on https://doi.org/10.1016/j.apcatb.2015.07.046 - number of citations **122**

2. BOCHENEK, Matthew A.* - VEISEH, Omid* - VEGAS, Arturo J. - MCGARRIGLE, James J. - QI, Meirigeng - MARCHESE, Enza - OMAMI, Mustafa - DOLOFF, Joshua C. - MENDOZA-ELIAS, Joshua - NOURMOHAMMADZADEH, Mohammad - KHAN, Arshad - YEH, Chuh-Chieh - XING, Yuan - ISA, Douglas - GHANI, Sofia - LI, Jie - LANDRY, Casey - BADER, Andrew R. - OLEJNIK, Karsten - CHEN, Michael - HOLLISTER-LOCK, Jennifer - WANG, Yong - GREINER, Dale L. - WEIR, Gordon C. - STRAND, Berit Lokensgard - ROKSTAD, Anne Mari A. - **LACÍK, Igor** - LANGER, Robert - ANDERSON, Daniel G. - OBERHOLZER, Jose**. Alginate encapsulation as long-term immune protection of allogeneic pancreatic islet cell transplanted into the omental bursa of macaques. In *Nature biomedical engineering*, 2018, vol. 2, no. 11, p. 810-821. (2017: Q4 - JCR). ISSN 2157-846X. Available on https://doi.org/10.1038/s41551-018-0275-1 - number of citations **112**

3. CHUBAR, Natalia - GILMOUR, Robert - GERDA, Vasyl - **MIČUŠÍK, Matej - OMASTOVÁ, Mária** - HEISTER, Katja - MAN, Pascal - FRAISSARD, Jacques - ZAITSEV, Vladimir. Layered double hydroxides as the next generation inorganic anion exchangers: Synthetic methods versus applicability. In *Advances in colloid and interface science*, 2017, vol. 245, p. 62-80. (2016: 7.223 - IF, Q1 - JCR, 2.155 - SJR, Q1 - SJR, CCC). (2017 - Current Contents). ISSN 0001-8686. Available on https://doi.org/10.1016/j.cis.2017.04.013 - number of citations **94**

4. GHOSAL, Kajal** - AGATEMOR, Christian - **ŠPITÁLSKY, Zdenko** - THOMAS, Sabu - KNY, Erich. Electrospinning tissue engineering and wound dressing scaffolds from polymer-titanium dioxide nanocomposites. In *Chemical Engineering Journal*, 2019, vol. 358, p. 1262-1278. (2018: 8.355 - IF, Q1 - JCR, 2.066 - SJR, Q1 - SJR, CCC). (2019 - Current Contents). ISSN 1385-8947. Available on https://doi.org/10.1016/j.cej.2018.10.117 - number of citations **73**

5. EVGIN, Tuba - KOCA, Halil Dogacan - HORNY, Nicolas - TURGUT, Alpaslan - TAVMAN, Ismail Hakki - CHIRTOC, Mihai - **OMASTOVÁ, Mária - NOVÁK, Igor**. Effect of aspect ratio on thermal conductivity of high density polyethylene/multi-walled carbon nanotubes nanocomposites. In *Composites Part A: Applied Science and Manufacturing*, 2016, vol. 82, p. 208-213. (2015: 3.719 - IF, Q1 - JCR, 1.532 - SJR, Q1 - SJR, CCC). (2016 - Current Contents). ISSN 1359-835X. Available on https://doi.org/10.1016/j.compositesa.2015.12.013 - number of citations **60**

6. CVEK, Martin - MRLÍK, Miroslav - **ILČÍKOVÁ, Markéta - MOSNÁČEK, Jaroslav** - MUNSTER, Lukáš - PAVLÍNEK, Vladimír. Synthesis of silicone elastomers containing silyl-based polymer-grafted carbonyl iron particles: An efficient way to improve magnetorheological, damping, and sensing performances. In *Macromolecules*, 2017, vol. 50, no. 5, p. 2189-2200. (2016: 5.835 - IF, Q1 - JCR, 2.564 - SJR, Q1 - SJR, CCC). (2017 - Current Contents). ISSN 0024-9297. Available on https://doi.org/10.1021/acs.macromol.6b02041 - number of citations **52**

7. KOZMA, Erika - MRÓZ, Wojciech - VILLAFIORITA-MONTELEONE, Francesca - GALEOTTI, Francesco - **ECKSTEIN ANDICSOVÁ, Anita** - CATELLANI, Marinella - BOTTA, Chiara. Perylene diimide derivatives as red and deep red-emitters for fully solution processable OLEDs. In *RSC Advances*, 2016, vol. 6, iss. 66, p. 61175-61179. (2015: 3.289 - IF, Q2 - JCR, 0.947 - SJR, Q1 - SJR, CCC). (2016 - Current Contents). ISSN 2046-2069. Available on https://doi.org/10.1039/c6ra10467c - number of citations **49**

8. **CAPEK, Ignác**. Polymer decorated gold nanoparticles in nanomedicine conjugates. In *Advances in colloid and interface science*, 2017, vol. 249, p. 386-399. (2016: 7.223 - IF, Q1 - JCR, 2.155 - SJR, Q1 - SJR, CCC). (2017 - Current Contents). ISSN 0001-8686. Available on https://doi.org/10.1016/j.cis.2017.01.007 - number of citations **47**

9. RYCHTER, Piotr - KOT, Marta - BAJER, Krzysztof - ROGACZ, Diana - **OPÁLKOVÁ ŠIŠKOVÁ, Alena** - KAPUŠNIAK, Janusz. Utilization of starch films plasticized with urea as fertilizer for improvement of plant growth. In *Carbohydrate Polymers*, 2016, vol. 137, p. 127-138. (2015: 4.219 - IF, Q1 - JCR, 1.440 - SJR, Q1 - SJR, CCC). (2016 - Current Contents). ISSN 0144-8617. Available on https://doi.org/10.1016/j.carbpol.2015.10.051 - number of citations **45**
10. **SEDNIČKOVÁ, Michaela** - PEKAŘOVÁ, Silvie - KUCHARCZYK, Pavel - BOČKAJ, Ján - **JANIGOVÁ, Ivica - KLEINOVÁ, Angela - JOCHEC MOŠKOVÁ, Daniela** - OMANÍKOVÁ, Leona - PERDOCHOVÁ, Dagmar - KOUTNÝ, Marek - SEDLAŘÍK, Vladimír - ALEXY, Pavol - **CHODÁK, Ivan**.** Changes of physical properties of PLA-based blends during early stage of biodegradation in compost. In *International Journal of Biological Macromolecules*, 2018, vol. 113, p. 434-442. (2017: 3.909 - IF, Q1 - JCR, 0.917 - SJR, Q1 - SJR, CCC). (2018 - Current Contents, WOS, SCOPUS). ISSN 0141-8130. Available on https://doi.org/10.1016/j.ijbiomac.2018.02.078 - number of citations **43**

2.2.5. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations, without self-citations, in the assessment period (2015– 2020). The cited papers must bear the address of the institute

Omastová Mária, DSc. number of citations: **2379**
Špitalský Zdenko, PhD. number of citations: **2091**
Lacík Igor, DSc. number of citations: **1951**
Mičušík Matej, PhD. number of citations: **1608**

2.2.6. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations, without self-citations, obtained until 2020. The cited papers must bear the address of the Institute,

Omastová Mária, DSc. number of citations: **4007**
Lacík Igor, DSc. number of citations: **3582**
Špitalský Zdenko, PhD. number of citations: **3071**
Prof. Capek Ignác, DSc. number of citations: **2132**

2.2.7. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations, without self-citations, obtained until 2021 of their papers published during the evaluation period (2016– 2021). The cited papers must bear the address of the Institute

Mičušík Matej, PhD. number of citations: **832**
Omastová Mária, DSc. number of citations: **519**
Špitalský Zdenko, PhD. number of citations: **490**
Lacík Igor, DSc. number of citations: **351**

2.3. Research status of the institute in international and national context

- **International/European position of the institute**

2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items for institute with less than 50 average FTE researchers per year, max. 20 for institutes with 50 – 100 average FTE researchers per year and so on

Research activities of the institute at the international/European level are based on cooperation with foreign research institutes and universities through international research projects, bilateral projects and sometimes without a formal project covering. Similarly, the Institute has wide cooperation with foreign companies through the project schemes or based on the contracts.
Below is the list of the most important international research activities:

1. Immobilization of pancreatic cells for diabetes treatment

Design of polyelectrolyte complex-based multicomponent microcapsules and alginate microbeads aimed at encapsulation of insulin-producing cells for diabetes treatment. This work has been performed within a broad international cooperation that involves Juvenile Diabetes Research Foundation, JDRF (NY, USA), The Chicago Diabetes Project (Chicago, USA), contract cooperation with companies working in this field (USA, Japan, Belgium, Israel), and research institutions and universities (USA, Norway, Czechia).

- Multicomponent microcapsules for allogeneic islet transplantation in a comprehensive, preclinical non-human primate model; registration number: JDRF 2-SRA-2014-288-Q-R; duration of the project: 11.2014-10.2017; Lacík Igor – principal investigator from the Polymer Institute of SAS; coordinator: University of Illinois, Chicago, USA
- New generation PMCG multicomponent microcapsule with tailored biointerface to avoid immune response after transplantation; registration number: JDRF 2-SRA-2018-521-S-B; duration of the project: 09.2017-08.2021; Lacík Igor – principal investigator
- Testing of multicomponent PMCG microcapsules in the NHP pre-clinical model; The Chicago Diabetes Project, duration of the project: 01.2018 – 08.2019; Lacík Igor – principal investigator
- Contract research with Otsuka Pharmaceutical Factory, Inc, Japan – 12 individual contracts on various topics in the field of microcapsule design in the period 2016 – 2021
- Transnational Call 2013 M2Neural: Multifunctional Materials for advanced Neural interfaces; project number: Project M-ERA.Net; duration of the project: 11.2014-10.2017; Lacík Igor – principal investigator from the PIS SAS; coordinator: Scuola Superiore Sant'Anna, Italy

2. Kinetics of radical polymerization

Radical polymerization of monomers with functional groups such as carboxylic acid and amide moieties yields materials of significant technical importance. Polymerizations are mostly carried out in aqueous phase, which is a specific solvent providing strong interactions via hydrogen bonds resulting in large effects on the rate coefficients. We systematically entered this topic in year 2000 and applied the pulsed-laser-initiation techniques from determination of propagation rate coefficients to modelling of polymerization process and molar mass distributions for methacrylate, acrylate and N-vinylamide monomer families. This research has been supported by the research contracts with BASF SE Ludwigshafen in Germany that involved the cooperation with Goettingen University in Germany (Prof. M. Buback), Queen's University in Canada (Prof. R. Hutchinson) and activities within the Polymer Division IUPAC.

- Kinetic coefficients and models for existing and future polymerization processes and systems at BASF; BASF R&D contract, duration of the project: 09.2015-08.2018; Lacík Igor – principal investigator
- Kinetic coefficients and models for polymerization processes: co- and terpolymerization studies in water, alcohols and their mixtures. BASF R&D contract, duration of the project: 04.2019-04.2022; Lacík Igor – principal investigator

3. ERA-Net activities in material research

PI SAS is involved in several projects with industrial partners, e.g., with the Czech company SYNPO a.s., Pardubice, two MEra-Net projects are running. Within the MERA-Net project "MERF", the characterization of flame retardants for epoxy resins are studied, using unique infrastructure as a cone calorimeter. The European Partnership for Improved Composites (EPIC) project focuses on research and development of new hybrid composite materials based on epoxies and carbon fibers of combined special structured molecules and / or carbon and inorganic nanostructures. SYNPO, a.s. Pardubice is also an industrial partner in the Horizon Nano2Day project.
Together with the Polish company STO Warsaw (building materials supplier), we are dealing with the use of phase change materials as a segment in panels for thermal insulation of buildings in building insulation (ERA-Net ActivETICS project). More details are described in the project results section.

- Multifunctional polymer composites doped with novel 2D nanoparticles for advanced applications (Acronym: Nano2Day); project number: Call: H2020-MSCA-RISE-2017, Proposal number: 777810; Work Programme Part: Marie Skłodowska-Curie Actions; duration of the project: 05/2018 – 04/2023; Mária Omastová – principal investigator
- Advanced polymer composites filled with novel 2D nanoparticles (NANO2COM); project number: M-ERA.NET Call 2017; duration of the project: 09/2018 – 11/2021; Mária Omastová – principal investigator for PI SAS; cooperating countries: Latvia, Lituania
- European Partnership for Improved Composites (EPIC); project number: M-ERA.NET Call 2018; duration of the project: 09/2019 – 08/2022; Matej Mičušík – principal investigator for PI SAS; cooperating countries: Czech Republic, both academic and private sector
- Energy Activated External Thermal Insulation Composite System - integration of thermal storage and photovoltaics for energy-efficient buildings (En-ActivETICS); project number: M-ERA.NET Call 2018; duration of the project: 10/2019 – 09/2022; Ivan Chodák – principal investigator for PI SAS; cooperating countries: Poland, Estonia
- Matrix for carbon reinforced epoxy laminates with reduced flammability (MERF); project number: M-ERA.NET Call 2019; duration of the project: 05/2020 – 04/2023; Zdeno Špitalský – principal investigator for PI SAS; cooperating countries: Czech Republic, Latvia
- Li-ion BAttery-SupErcapacitor Hybrid Device (LiBASED); project number: M-ERA.NET2/2019/966 /LiBASED; duration of the project: 09/2020-08/2023; Mária Omastová – principal investigator for PI SAS; cooperating countries: Czech Republic, Turkey

4. Contract research related to polymeric materials

We also have achieved several successes in this area, an example is the cooperation with the Spanish company AIMPLAST Valencia. This company won the DOTMASK regional project this year, where personal protective equipment with improved antimicrobial properties is developed. A study of the photodynamic effects of hydrophobic quantum dots developed at PI SAS is also included in this research.

5. Preparation of biodegradable polyesters

Preparation of biodegradable polyesters is still being intensively studied thanks to known (dilactide) or new lactone monomers available from renewable resources. Ftheluorescent probe, such as pyrene was bound to the chain-ends and used for real-time monitoring of stereocomplexation of PLLA a PDLA polylactide enantiomers. In addition, a five-membered Tulipaline A (α-methylene-γ-butyrolactone, α-MBL), which contain exo-cyclic methylene double bond suitable for further functionalization was copolymerized with ε-caprolactone. It confirmed the possibility to synthesize linear and star-shaped copolyesters with molar content of MBL 3-25 % and low dispersity ($Đ$ = 1.15-1.30). Subsequent reaction on a pendant double bond employing tiolene reaction under mild conditions with photoinitiation and is also studied for preparation of vitrimers. The studies are realized within the SAS-PAS bilateral projects with Center of Molecular and Macromolecular studies in Lodz, Poland, as well as 2 Taiwan universities within the SAS-MOST research project.

6. Photoactive derivatives

Long-term cooperation between PI SAS and SCITEC-CNR in Italy is focused on the preparation, characterization and application of photoactive derivatives (thiazolothiazole, perylene, naphthaleneimide). In our laboratories, the derivatives were synthesized and physico-chemically characterized. Electrochemistry and incorporation into model electrical equipment was carried out at a partner institute. The result of this cooperation was high-quality performances in peer-reviewed journals and at national or international conferences. The prepared new materials were focused on optical devices such as OLED, sensor. The cooperation is realized within the SAS-CNR bilateral projects.

7. Novel bioactive materials for packaging

Long-term cooperation between Polymer Institute and Centre of Polymer and Carbon Materials of Polish Academy of Sciences in Zabrze (Poland) resulted in the bilateral project “Predictive study under composting conditions of bioactive materials obtained by electrospinning”. The aim of the project is to characterize selected bioactive materials that are suitable as packaging materials. Characterization includes the composting process and products after composting. This objective was chosen because, in the case of the use of the investigated materials as packaging in the food or pharmaceutical industry, these cannot be recycled by typical options such as: material recycling or regeneration of monomers, due to contamination or residues of packaged products. The use of biodegradable polymers and composting of waste after packaging seems to be a good alternative. Therefore, it is necessary to study the composting process in case residues of pharmaceuticals and other organic compounds enter the process. In addition, within this cooperation, several model materials such as PCL membranes, PCL / diclofenac (pharmaceuticals), PCL / nisin but also PLA and rPET (food packaging) were prepared and comprehensively characterized. The membranes were then sent to study various types of degradation, both in compost, in seawater, and in enzymatic media. Due to the pandemic situation, it was not possible to fully implement all the planned procedures and the results are still only partial. The cooperation is realized within the SAS-PAS bilateral projects.

8. Computer simulations within international collaborations

Computer simulations became an indispensable approach merging classical theory and experiments. The molecular simulations can provide unprecedented information in terms of high-resolution details on molecular structure, dynamics and thermodynamics that is not accessible by classical approaches. The computer simulations and modeling require an integrative approach combining ideas from different schools of computer and classical experimentalists and theorists, that allow addressing problems in emerging fields of nanotechnology, such as nanofluidics, chiral nanotechnology, knot factories, sequencing and single molecule experiments, such as magnetic and optical tweezers, AFM, furthermore, molecular biology, DNA function and organization, molecular topology, interaction with surfaces and others. The integrative approach is also connected with demands on various computational infrastructure. This is achieved by developing collaborations within international networks and bilateral cooperations. Within the evaluation period the such collaborations involved institutes in Porto (Zuzana Benková – principal investigator from the PI SAS, project numbers: SFRH/BPD/90265/2012; INT/PORTUGAL/P-05/2013; NORTE-01-0145-FEDER-000011; LAQV@REQUIMTE) and Lausanne (Dušan Račko – STSM 44913), Trento (COST 17139), Vienna (SK-AT-20-0011).

2.3.2. List of international conferences (co)organised by the institute

1. BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP - BYPOS 2016; Hotel Bachledka, Ždiar, Slovak Republic; March 14 -18, 2016; responsible person: **Podhradská Silvia;** number of participants: 46
2. NEW TRENDS IN SOLAR CELLS AND WG AND MC MEETING OF COST MP 1307; Lindner Hotel Bratislava, Slovak Republic; April 19 – 22, 2016; responsible person: **Omastová Mária;** number of participants: 75
3. 22nd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2016, Hotel Holiday Inn, Bratislava, Slovak Republic, September 06 – 09, 2016; responsible person: **Jaroslav Mosnáček**; number of participants: 60
4. 2nd MEETING OF ABIOG PROJECT PARTNERS & WORKSHOP, Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic, November 15 – 16, 2016 responsible Person: **Alena Šišková**; number of participants: 30
5. 7th INTERNATIONAL CONFERENCE POLYMERIC MATERIALS IN AUTOMOTIVE PMA 2017, Conference Center of Lindner Hotel Gallery Central in Bratislava, Slovak Republic, May 29 – 31, 2017; responsible person: **Ivan Chodák**; number of participants: 98
6. BYPOS 2017- 7th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Glamour, Zemplínska Šírava, Slovak Republic, June 12 – 16, 2017; responsible person: **Alena Šišková**; number of participants: 32
7. 69th CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 11 – 15, 2017; responsible person: **Mária Omastová;** number of participants: 340
8. WORKSHOP SOFT SKILLS - FIRST INTERNATIONAL WORKSHOP FOR YOUNG POLYMER RESEARCHERS**;** Polymer Institute SAS, Bratislava, Slovak Republic; October 2017; responsible person: Anna Zahoranová number of participants: 24
9. BYPOS 2019- 8th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Marlene, Oščadnica, Slovak Republic, March 25 – 28, 2019; responsible person: **Alena Šišková**; number of participants: 40
10. 23rd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2019**;** Hotel Falkensteiner Bratislava, Slovak Republic; June 30 – 03, 2019; responsible person: **Zuzana Benková**; number of participants: 35
11. 8TH INTERNATIONAL CONFERENCE POLYMERIC MATERIALS IN AUTOMOTIVE AND 24th SLOVAK RUBBER CONFERENCE PMA AND SRC 2020, Conference Center of Lindner Hotel Gallery Central in Bratislava, Slovak Republic; September 16 – 18, 2020; responsible person: **Ivan Chodák**; number of participants: 64

2.3.3. List of edited proceedings from international scientific conferences

1. *BYPOS 2016: 6th Bratislava Young Polymer Scientists Workshop: March 13th-18th, 2016: High Tatras, Slovakia: workshop book*. Bratislava: Young Scientists Council of Polymer Institute of SAS, 2016. 120 p. ISBN 978-80-970923-8-2
2. *New Trends in Solar Cells: book of abstracts*. Bratislava: Polymer Institute of SAS, 2016. 128 p. ISBN 978-80-970923-9-9
3. *Polyméry 2016: IX. Slovensko - Česká konferencia: program a zborník príspevkov*. Bratislava: Ústav polymérov SAV, 2016. 116 S. ISBN 978-80-89841-00-4 (Polyméry 2016)
4. *BIMac 2016: XXII. Bratislava Conference on Macromolecules: Polymers with Tailored Architecture and Properties: programme book and book of abstracts*. Bratislava: Ústav polymérov SAV, 2016. 78 P. Dostupné na internete: <http://polymer.sav.sk/bimac>. ISBN 978-80-89841-01-1
5. *PMA 2017 & SRC 2017: International Conference on Polymeric Materials in Automotive: 23rd Slovak Rubber Conference: book of proceedings*. Techn.red. D. Jochec-Mošková. Bratislava,

Slovakia: Slovak University of Technology, Faculty of Chemical and Food Technology & Polymer Institute of SAS, 2017. 208 p. ISBN 978-80-89841-04-2 (PMA 2017 & SRC 2017: International Conference on Polymeric Materials in Automotive: Slovak Rubber Conference)

6. *Bypos: 7th Bratislava Young Polymer Scientists Workshop: workshop book*. Bratislava: Young Scientist Council of Polymer Institute SAS, 2017. ISBN 978-80-89841-05-9
7. *"V. Labudove dni". Abstract book* = "V. Labuda´s days". Abstract book. Eds.: Špitálska Eva, Špitalský Zdenko, Štefanidesová Katarína, Kazimírová Mária. Bratislava: Institute of Virology, Biomedical Research Center, Slovak Academy of Sciences, 2018. 78 s. ISBN 978-80-972111-3-4
8. *BYPoS: conference book*. Bratislava: Young Scientist Council of Polymer Institute SAS, 2019. 82 p. ISBN 978-80-89841-09-7 (BYPoS 2019: Bratislava Young Polymer Scientists conference)
9. *PMA 2020 & SRC 2020: International Conference on Polymeric Materials in Automotive & 24th Slovak Rubber Conference: book of proceedings*. Bratislava: Faculty of Chemical and Food Technology, Slovak University of Technology, 2020. 300 p. ISBN 978-80-89841-13-4 (International Conference on Polymeric Materials in Automotive & 24th Slovak Rubber Conference: PMA 2020 & SRC 2020)
10. *Polyméry 2020: XI. Slovensko - Česká konferencia: kniha príspevkov a program*. Bratislava: Ústav polymérov SAV, 2020. 100 s. Dostupné na internete: <http://polymer.sav.sk/polymery2020/documents/Kniha%20prispevkov_Polymery2020.pdf>. ISBN 978-80-89841-14-1 (Polyméry 2020: Slovensko-Česká konferencia)

2.3.4. List of journals edited/published by the institute and information on their indexing in WOS, SCOPUS, other databases or no databases, incl. impact factor and other metrics of journals in each year of the assessment period

No such items

- **National position of the institute**

2.3.5. List of selected activities of national importance

At the national level, the institute activities are not focused only to research cooperation with other research institutes, universities and companies but also to educational activities through supervising students and presentations at universities as well as to wide popularization activities:

1. Interdisciplinary research

In 2017 the PI SAS participated together with other 5 research institutes (Biomedicine Center SAS, the Centre for Advanced Materials Application SAS, the Institute of Electrical Engineering SAS, the Institute of Physics SAS, the Institute of Inorganic Chemistry SAS, the Institute of Materials and Machine Mechanics SAS) on creation of new institute Centre for Advanced Materials Application SAS within the Structural Funds project Centre of Excellence for Advanced Materials Application. The aim was to create a new center to share expertise for interdisciplinary research in the area of interfaces and surface engineering. Currently the research is focused on the surface engineering for two main directions – biomedicine and batteries.

There are other numerous cooperations with various research institutions in Slovakia within the research running at PI SAS. Just to mention a few of them:

- graphene-based nanoplatform for detection of cancer, combination of chemistry, physics, biomedicine, and nano- and bio-engineering, in cooperation with the Institute of Virology SAS, the Institute of Physics SAS, and the Institute of Experimental Physics SAS

- Pb-free perovskite solar cells with long-term stability, combination of nanomaterial chemistry, nanotechnology, polymer chemistry, chemical engineering, and physics, in cooperation with the Institute of Physics SAS
- polymer composites based on carbon quantum dots for antibacterial application, combination of polymer chemistry, nanomaterial chemistry, physics, microbiology, in cooperation with the Institute of Physics SAS (together with the Centre of Polymer Systems Tomas Bata University in Zlín, Czech Republic)
- nanoparticles based on montmorillonite and their surface modification by organocations and cationic polymers enabling better intercalation / exfoliation of the nanofillers, combination of polymer chemistry, inorganic chemistry, physical chemistry, in cooperation with the Institute of Inorganic Chemistry SAS
- characterization of polymeric microcapsules, hydrogels and cells by confocal Raman microscopy, combination of polymer chemistry and physics, in cooperation with the Institute of Physics SAS
- design and characterization of hydrogel microcapsules for immobilization of whole cells and enzymes for various biotechnological processes, combination of polymer chemistry, organic chemistry, and physical chemistry, in cooperation with the Institute of Chemistry SAS
- mechanism and kinetics of polymerization of charged monomers and characterization of polyelectrolytes, combination of polymer chemistry and physics, in cooperation with the Institute of Experimental Physics SAS
- restoration of the painting canvas by available techniques, combination of polymer chemistry, material chemistry, and biotechnology, in cooperation with the Institute of Molecular Biology SAS
- gene and drug delivery for treatment of neurodegenerative and mental diseases, combination of polymer chemistry, molecular biology, neurology, and pharmacology, in cooperation with the Centre for Biosciences SAS
- immunomodulation studies of poly(2-alkyl-2-oxazoline) polymers, combination of polymer chemistry, molecular biology, and immunology, in cooperation with the Institute of Chemistry SAS

2. Research cooperation with Slovak universities

- biodegradable polymers, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava
- spectral characterization of organic molecules in solutions and polymer matrices for applications in photonics and sensorics, Faculty of Natural Sciences, Comenius University
- analysis of adhesive materials, Faculty of Materials Science and Technology, Slovak University of Technology, Trnava
- analysis of surface properties of wooden materials, Faculty of Wood Sciences and Technology, Technical University, Zvolen
- connection of nano- and textile technologies with an abstract art, Academy of Fine Arts and Design, Bratislava
- new generation of targeted drug delivery vehicles as a selective cancer treatment, Faculty of Science, Pavol Jozef Šafárik University, Košice
- preparation and characterization of the structure and properties of biodegradable multiphase modified-starch-based polymeric materials, Technical University of Košice
- influence of supramolecular structure on ultimate properties of blends of biodegradable polymers with thermoplastic starch, Technical University of Košice
- polymeric materials in protection of cultural heritage, Slovak Technical University, Faculty of Chemical and Food Technology, Bratislava

3. Research cooperation with Slovak companies

- polymer composites for 3D printing, MYMEDIA s.r.o. Bratislava
- application research of 2D fillers in elastomeric composites, VIPO a.s. Partizánske
- innovation of packaging materials based on biodegradable polymers, Novplasta s.r.o. Šenkvice
- design of biodegradable polymers with improved properties, PANARA s.r.o. Nitra

- characterization of regenerate and preparation of model rubber compounds based on natural rubber, Resumo s.r.o. Banská Bystrica
- chemical and physical characterization of process in rubber for special use during long-term heating, Continental a.s. Púchov, Asseco CEIT a.s. Žilina
- bonding of ultrasonic converters to a stainless steel substrate, ECOSON s.r.o. Nové Mesto nad Váhom
- preparation of adhesive materials, SOS electronic s.r.o. Košice, Matador Industries a.s. Bratislava
- hydrogel scaffolds for cartilage regeneration prepared by 3D bioprinting, National Institute of Rheumatic Diseases, Piešťany
- chemical characterization of fibers for CHT Switzerland AG, Slovakia.
- chemical characterization of glass fabrics for DIPEX s.r.o., Slovakia.
- mechanical properties and chemical characterization of polymer blends and composites (TPO, PP-PE) for Faurecia Automotive Slovakia s.r.o.
- chemical characterization of packaging foils for CHEMOSVIT FOLIE, s.r.o., Slovakia.
- chemical characterization of elastomer products for ELASTORSA SLOVAKIA s.r.o., Slovakia.
- chemical characterization of samples for SISECAM Science and Technology Center, Turkey.
- chemical characterization of various sediments and contaminants for Nafta a.s., Slovakia.
- chemical characterization of foils for Essity Slovakia s.r.o., Slovakia.
- chemical characterization of various electronic parts for Semikron s.r.o., Slovakia.
- chemical characterization of painted polymer composites for SPPP Slovakia s.r.o., Slovakia.
- chemical characterization of PVC profiles for Partizánske Building Components - SK, s.r.o., Slovakia.

4. Invited lectures in Slovak universities and scientific research institutions

- Macromolecular chemistry, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava
- New trends in synthesis of polymers, Faculty of Natural Sciences, Comenius University, Bratislava
- Microcapsules for diabetes treatment, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava
- Organic chemistry as a basis for new polymer materials, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava
- Bonding of polymeric and metallic materials, Surface properties of polymeric and metallic materials, Faculty of Materials Science and Technology, Slovak University of Technology, Trnava
- Electrically conductive polymer composites, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava
- Polymer physics for PhD students, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava
- Basic macromolecular chemistry (preparation of high school students for the International Chemistry Olympiad), Faculty of Natural Sciences, Comenius University, Bratislava
- Physics of macromolecular substances, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava

5. Pedagogical activities

Apart from invited lectures, the researchers of PI SAS take part in regular pedagogical activities at the Faculty of Natural Sciences, Comenius University, Bratislava and Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava where they teach students of the 2nd and 3rd degree of the university studies, respectively. The annual lecture activities are summarized in Table 2.5.4.

6. Supervision activities

Researchers at PI SAS also extensively provide students with supervision of their diploma and bachelor theses and guide the experimental work of students in the laboratories of the Institute. The numbers of diploma and bachelor theses in individual years are presented in Table 2.5.4.

7. Activities of researchers in national commissions

- Joint Expert Commissions for Doctoral Studies (Faculty of Natural Sciences, Comenius University and Faculty of Chemical and Food Technology, Slovak University of Technology)
- DrSc defence commissions
- PhD defence commissions
- SAS Commission for Evaluation of International Projects
- SAS Commission for Intellectual Property, Innovation and Technology Transfer (member)
- SAS Program Center of Excellence
- SAS Commission for Economic Affairs
- SAS Commission for International Scientific and Technical Cooperation
- SAS Commission for Infrastructure and Structural Funds
- SAS Accreditation Commission
- SAS Commission for Communication and Media
- Jury for Awarding the International Prize of the SAS
- VEGA Commission for Chemical Sciences, Chemical Engineering and Biotechnologies
- Scientific College for Chemical Sciences
- Commissions in inaugural or habilitation proceedings at universities
- Slovak Accreditation Agency
- Slovak Commission for Scientific Degrees: chemical sciences
- Working Group on Biomedicine and Biotechnology for Scientific and Research Capacities RIS3 SK
- Working Group for the Further Direction of the Smart Specialization Strategy for Slovakia
- Scientific Board of the Ministry of Health of the Slovak Republic
- APVV Council for Natural Sciences
- APVV Council for International Scientific and Technical Cooperation

8. Popularization and propagation activities

PI SAS regularly organizes or participates in various popularization and propagation activities such as Open Day, SAS Open Day, European Research Night, Find a Scientist in Yourself, Spring Camp for children, Daily Children's Camp. Another form for propagation of the research conducted at PI SAS is through media. In addition to the organization of international conferences, PI SAS also (co)organizes the Slovak-Czech conferences together with the Institute of Macromolecular Chemistry AS CR in Prague, Czechia. Details on popularization and propagation activities are listed in part 2.7.

2.3.6. List of journals (published only in the Slovak language) edited/published by the institute and information on their indexing in WOS, SCOPUS, other database or no database, incl. impact factor and other metrics of journals in each year of the assessment period

No such items

- **Position of individual researchers in the international context**

2.3.7. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter

1. BENKOVÁ, Zuzana - NÁMER, Pavol - **CIFRA, Peter**. Simulation of linear and ring DNA in nanochannels. In ARUZ-Workshop 2016 : Dedicated parallel machines - a breakthrough in computation : December 1-3, 2016 - Lodz, Poland (2.12. 2016)
2. **BEREK, Dušan**. SEC/GPC - A standard but still ommature method of molecular characterization of synthetic polymers. International Conference and Exhibition on Advances in HPLC& Chromatography Techniques : March 14-15, 2016 - London UK (15.3. 2016)
3. **BEREK, Dušan** - NOVÁK, Ivan. Functional composites based on microporous carbon fibers made from cellulosics. International Conference on Advanced Materials & Technology : (ICMAT-16) : May, 26-28, 2016 - Karnataka, India (28.5. 2016)
4. **BEREK, Dušan** - NOVÁK, Ivan - MUNKA, K. Composite sorbents on the base of nanoporous carbon fibers prepared by carbonization of cellulose. 2016 Engii Conferences January Series : Materials & Mathematics Conference : January 14-16, 2016 - Bangkok, Thailand (15.1. 2016)
5. **BEREK, Dušan.** Molecular characterization of constituents of complex polymer systems. POLYCHAR : The 24th Annual World Forum on Advanced Materials : May 9-13, 2016 - Poznań, Poland (9.5. 2016)
6. **BEREK, Dušan.** Liquid chromatography of block copolymers. 2th International Conference and Expo on Separation Techniques : September 26-28, 2016 - Valencia, Spain (26.9. 2016)
7. **BEREK, Dušan**. Comprehensive molecular characterization of multi/component synthetic polymers with liquid chromatography. World Congress on Chromatography : September 21-23, 2016 - Amsterdam, Netherlands (22.9. 2016)
8. **BEREK, Dušan.** Recent progress in liquid chromatography of synthetic polymers. In EuAsC2S-14 : 14th Eurasia Conference on Chemical Sciences : December 15-18, 2016 - Karachi, Pakistan (18.12. 2016)
9. **BEREK, Dušan.** Molecular characterization of block copolymers by liquid chromatography. In ExTech 2016 & ISSN 2016 : 18th International Symposium on Advances in Extraction Technologies & 22nd International Symposium on Separation Sciences : July 3-6, 2016 - Toruń, Poland (6.7. 2016)
10. **LACÍK, Igor** - STACH, Marek - CHORVÁT, Dušan Jr. - SOBOLČIAK, Patrik - KASÁK, Peter. Propagation kinetics for zwitterionic sulfobetaine monomers. 12th International Workshop on Polymer Reaction Engineering : May 14-17, 2016 - Frankfurt am Mein, Germany (20.5. 2016)
11. **MOSNÁČEK, Jaroslav** - ILČÍKOVÁ, Markéta - BORSKÁ, Katarína - ECKSTEIN ANDICSOVÁ, Anita - KUNDYS, Anna - MORAVČÍKOVÁ, Daniela. Photochemically induced atom transfer radical polymerization. LPP 16 : World Congress on Living Polymerizations and Polymers : 29 May - 3 June, 2016 - Budapest, Hungary (3.6. 2016)
12. **NOVÁK, Igor** - SEDLIAČIK, Ján - KRUPA, Igor - CHODÁK, Ivan - ŽIGO, Ondrej - NÓGELLOVÁ, Zuzana. Investigation of behaviour of plastic/wood-based composites. Wood - Material of the XXI-st Century : November 15-16, 2016 - Rogow, Poland (15.11. 2016)
13. **NOVÁK, Igor** - LEHOCKÝ, Marián - CHODÁK, Ivan - KARBASSI, Elika - ASADINEZHAD, Ahmad - PRACHÁR, Jozef. Antibacterial assessment of polyethylene treated by alginic acid using cold plasma. Wood - Material of the XXI-st Century : November 15-16, 2016 - Rogow, Poland (16.11. 2016)

14. **RAČKO, Dušan** - BENEDETTI, F. - DORIER, J. - BURNIER, Y. - STASIAK, A. Generation of Supercoils in Nicked and Gapped DNA Drives DNA Unknotting and Postreplicative Decatenation. Workshop on Knots and Links in Biological and Soft Matter Systems: September 19-24, 2016 - Trieste, Italy (29.9. 2016)
15. **KRONEK, Juraj.** Functional poly(2-oxazoline)s as building blocks for biomedical materials. BYPOS 2016: 6th Bratislava Young Polymer Scientists Workshop : March 13-18, 2016 - High Tatras, Slovakia (18.3. 2016)
16. **BEREK, Dušan.** Recent progress in liquid chromatography of synthetic polymers. The 5th International Conference on Catalysis : August 23-25, 2017 - Guilin, China (24.8. 2017)
17. **BEREK, Dušan** - NOVÁK, Ivan. Functional composites based on microporous carbon fibers with deposited nanoparticles. 25th POLYCHAR 2017 : World Forum on Advanced Materials : October 9-13, 2017 - Kuala Lumpur, Malaysia (12.10. 2017)
18. **BEREK, Dušan.** Evaluation of high-performance liquid chromatography columns retentivity with the help of macromolecular probes. 4th World Congress on Chromatography : August 7-9, 2017 – Rome, Italy (7.8. 2017)
19. **BEREK, Dušan.** Retention mechanisms in liquid chromatography of non-charged synthetic polymers. 23rd International Symposium on Separation Sciences : ISSS 2017 : September 19-22, 2017 - Vienna, Austria (20.9. 2017)
20. **BEREK, Dušan.** Molecular characterization of block copolymers by liquid chromatography. 3rd International Conference and Exhibition on Advances in Chromatography & HPLC Techniques : July 13-14, 2017 – Berlin, Germany (13.7. 2017)
21. **MIČUŠÍK, Matej** - KULIČEK, Jaroslav - GEMEINER, P. - MIKULA, M. - KIM, S.Y. - OMASTOVÁ, Mária. Polypyrrole based composites for solar cell application. 81st Prague Meeting on Macromolecules : Polymers and Organic Materials for Electronics and Photonics: Science for Applications : September 10-14, 2017 - Prague, Czech Republic (12.9. 2017)
22. **OMASTOVÁ, Mária** - BUGÁROVÁ, Nikola - ŠPITÁLSKY, Zdenko - KONERACKÁ, Martina - ZAŤOVIČOVÁ, Miriam - ŠIFFALOVIČ, Peter. Modified graphene oxide in biosensor application. ICAE 2017 : The 4th International Conference on Advanced Electromaterials : November 21-24, 2017- Jeju, Korea (21.11. 2017)
23. **MARKOVIĆ, Zoran M.** Biomedical applications of carbon and graphene quantum dots. Graphene-based components and flexible electronic/sensing devices. March 3, 2017 - Novi Sad, Serbia (3.3. 2017)
24. TREĽOVÁ, Dušana - RÁZGA, Filip - KRONEKOVÁ, Zuzana - NÉMETHOVÁ, Veronika - UHELSKÁ, Lucia - RAUS, Vladimír - MAZANCOVÁ, Petra - FRAŇO, Milan - HEYDARI, Abolfazl - KLEŠČÍKOVÁ, Lucia - ROKSTAD, Anne Mari - MARCHESE, Enza - MCGARRIGLE, James - OBERHOLZER, José - **LACÍK, Igor.** Polyelectrolyte microcapsules: A bridge to improved diabetes treatment. In DVSPM 2017 : Danube Vltava Sava Polymer Meeting : September 5-8, 2017 - Vienna, Austria (6.9. 2017)
25. **MARKOVIĆ, Zoran M**. Biomedical application of carbon nanomaterials and graphene/polymer nanocomposites. Bypos : 7th Bratislava Young Polymer Scientists Workshop : June 12-16, 2017 – Zemplínska Šírava, Slovakia (14.6. 2017)
26. **MOSNÁČEK, Jaroslav** - ILČÍKOVÁ, Markéta - KUNDYS, Anna - ECKSTEIN ANDICSOVÁ, Anita - BORSKÁ, Katarína - MORAVČÍKOVÁ, Daniela. Copper mediated photochemically induced ATRP. Bypos : 7th Bratislava Young Polymer Scientists Workshop : June 12-16, 2017 – Zemplínska Šírava, Slovakia (15.6. 2017)
27. **MIČUŠÍK, Matej** - CHATZIMANOLIS, Christos - TABAČIAROVÁ, Jana - KOLLÁR, Jozef - KYRITSIS, Apostolos - PISSIS, Polycarpos - PIONTECK, Jurgen - OMASTOVÁ, Mária. Gas sensors based on elastomer/carbon nanotubes composites. PMA 2017 & SRC 2017 : International Conference on Polymeric Materials in Automotive : 23rd Slovak Rubber Conference : May 29-31, 2017 - Bratislava, Slovakia (30.5. 2017)
28. **BEREK, Dušan.** Liquid chromatography of synthetic polymers. Global Summit on Stem Cell & Tissue Engineering and World Conference on Analytical & Bioanalytical Chemistry : July 23-24, 2018 - Barcelona, Spain (24.7. 2018)

29. **BEREK, Dušan**. Molecular characterization of synthetic polymers with help of liquid chromatography. 18th International Conference on World Analytical Chemistry & Mass Spectrosmetry & World HPLC, Separation Techniques & Pharmacovigilance : August 29-30, 2018 – Toronto, Canada (29.8. 2018)
30. **BEREK, Dušan**. Polymer liquid chromatography. In Polychar 26 : World Forum on Advanced Materials: September 10-13, 2018 – Tbilisi, Georgia (10.9. 2018)
31. **BEREK, Dušan** - NOVÁK, Ivan. Carbon fibers: Removal of heavy metals, color and radioactivity. Building Your Water Market : September 18-21, 2018 - Geneva & Montreux, Switzerland (20.9. 2018)
32. **CHODÁK, Ivan.** Effect of biodegradation on physical properties of PLA-based blends. International Conference on Materials Science and Engineering : July 23-25, 2018 – Moscow, Russia (24.7. 2018)
33. **LACÍK, Igor.** Pulsed-laser initiated polymerization in aqueous solution. In PULS-2018 with RKCM´2018 : September 2-7, 2018 - Lodz, Poland (6.9. 2018)
34. **LACÍK, Igor.** Hydrogel microspheres for cell encapsulation in next generation diabetes treatment. ISPCS ´18 : XXI International Seminar on Physics and Chemistry of Solids and advanced materials : June 10-13, 2018 - Czestochowa, Poland (10.6. 2018)
35. MIČUŠÍK, Matej - ČÍKOVÁ, Eliška - **OMASTOVÁ, Mária**. Smart electrically conductive polymeric nanocomposites. In Nanostruc 2018 : International Conference on Structural Nano Composites : May 23-24, 2018 - Berlin, Deutschland (23.5. 2018)
36. **OMASTOVÁ, Mária.** Elastomeric nanocomposite for advanced spplication. SEPM 2018 : Science and Engineering of Polymeric Materials : March 18-21, 2018 - Sousse, Tunisia (19.3. 2018)
37. **OMASTOVÁ, Mária**. Polymeric nanocomposites with advanced properties. In Polymers - Site of Advanced Horizons and Ambits : May 2-4, 2018 - Zlín : Czech Republic (2.5. 2018)
38. **PEPTU, Cristian**. Nanostructured electrospun mats based on novel cyclodextrin-oligoester derivatives. ICPAM-12 : 12th International Conference on Physics of Advanced Mateials : September 22-28, 2018 – Heraclion, Crete (22.9. 2018)
39. **NOVÁK, Igor** - SEDLIAČIK, Ján - KLEINOVÁ, Angela - MATYAŠOVSKÝ, Ján - JURKOVIČ, Peter. Oak wood pre-treated by cold plasma. Wood Material of the XXI-st Century : XXXII International Scientific Conference : November 20-21, 2018 – Rogow, Poland (20.11. 2018)
40. **NOVÁK, Igor** - SEDLIAČIK, Ján - KLEINOVÁ, Angela - MATYAŠOVSKÝ, Ján - JURKOVIČ, Peter. Discharge plasma treatment of wood surfaces. Wood Material of the XXI-st Century : XXXII International Scientific Conference : November 20-21, 2018 – Rogow, Poland (21.11. 2018)
41. **BEREK, Dušan**. Molecular characterization of synthetic macromolecules by liquid chromatography. 24th International Symposium on Separation Sciences (ISSS 2018), 21st International Conference Analytical Methods and Human Health (AMHH 2018) : June 17-20, 2018 - Jasná, Slovakia. (19.6. 2018)
42. **BEREK, Dušan**. Separation of parent homopolymers from diblock copolymers by liquid chromatography under limiting conditions of desorption. Block copolymers with highly adsorptive blocks. 9th International Conference on Chemistry science and Technology & 11th International Conference & EXPO on Chromatography Technioques : April 22-24, 2019 - Dublin, Ireland (22.4. 2019)
43. **BEREK, Dušan**. Evaluation of high-performance liquid chromatography columns retentivity with help of macromolecular probes. In ISSS 2019 : 25th International Symposium on Separation Science : September 15-18, 2019 - Lódz, Poland (15.9. 2019)
44. **BEREK, Dušan.** Separation and characterization of parent homopolymers in block copolymers with help of liquid chromatography. In POLYCHAR 27 : World Forum on Advanced Materials : October 14-17, 2019 - Naples, Italy (14.10. 2019)
45. DATTA, S. - PETRENČÍKOVÁ, Nadežda - ŠRÁMKOVÁ, Petra - KRONEKOVÁ, Zuzana - JUTKOVÁ, A. - JANCURA, D. - **KRONEK, Juraj**. Gradient copolymers from aliphatic and

aromatic 2-oxazolines for drug delivery. 257th ACS National Meeting : March 31 – April 4, 2019 - Orlando, US

46. **KRONEK, Juraj** - JEONG, Jiwon - KRONEKOVÁ, Zuzana - DATTA, Shuhashis - JANCURA, Daniel - SOHN, Daewon. Synthesis of gradient copolymers based on one-pot cationic copolymerization of aliphatic and aromatic 2-oxzolines. Annual Fall Meeting of the Polymer Society of Korea : Oktober 10-11, 2019 Jeju, Korea (10.10. 2019)
47. **LACÍK, Igor.** Multicomponent alginate-based microcapsule design for immunoprotection of transplanted pancreatic islets in diabetes treatment. In 1st International Conference PSPM : Precisely Structured Polymer Materials : October 27-30, 2019 - Lodz, Poland (28.10. 2019)
48. **LACÍK, Igor.** Characterization of Biomaterials. The Chicago Diabetes Project : Global Collaboration for a Faster Cure: May 10-11, 2019, Charlottesville, US (11.5. 2019)
49. **MIČUŠÍK, Matej** - BODIK, Michal - BUGÁROVÁ, Nikola - ŠIFFALOVIČ, Peter - OMASTOVÁ, Mária. MS-IN-1769 2D nanoplatforms for cancer detection. In Microscopy 2019 : Imaging Principles of Life 2019: May 15-16, 2019 - Lednice na Moravě : Czech Republic (13.5. 2019)
50. **OMASTOVÁ, Mária.** Polymeric composite nanofibers prepared by electrospinning for advanced application. In 7th International Seminar on Modern Polymeric Materials for Environmental Applications including Special Session Recent Advances in Polymer Nanocomposites and Hybrid Materials : May 15-17, 2019 - Kraków, Poland (16.5. 2019)
51. **OMASTOVÁ, Mária** - MIČUŠÍK, Matej - BUGÁROVÁ, Nikola - SOYKA, Yaryna - ANISKIEVICH, A. - ZELENIAKIENE, D. Two-dimensional nanomaterials: research and applications. The 4th International Conference on Nanomaterials: Fundamentals and Applications : November 10-11, 2020 - Košice, Slovakia online (11.11. 2020)
52. **BEREK, Dušan:**Molecular characterization of synthetic polymers by liquid chromatography. POLY-CHAR: International Polymer Characterization Conference: April 12-14, 2021 - Venice, Italy online (12.4. 2021)
53. **LACÍK, Igor:** Pulsed-laser initiated polymerization: A tool to understand the polymerization in aqueous solitions. VESPS 2021: Virtual European Symposium of Photopolymer Science dedicated to Ewa Andrzejewska: June 15-17, 2021 - Austria online (15.6. 2021)
54. **LACÍK, Igor:** Impact of counterions on the propagation rate coefficient in radical polymerization of ionized monomers. Polymer Meeting 14 : August 30 - September 2, 2021 - Graz, Austria (1.9. 2021)
55. **LACÍK, Igor.** Alginate-based microcapsules for encapsulation of pancreatic islets in diabetes treatment. Emerging and Enabling Materials E-Conference: November 22 - 24, 2021 - Qatar online (23.11. 2021)
56. **KOVÁČOVÁ, Mária.** How can we achieve the antibacterial effect of polymer nanocomposites using light? International Seminar: Antimicrobial Agents: Market, Trends and Opportunities: June 29, 2021- Valencia, Spain (29.6. 2021)
57. **MOSNÁČEK, Jaroslav –** KOLLÁR, Jozef – BONDAREV, Dmitrij – HOLOŠ, Ana – ZAIN, Gamal – KARIM, Rubina – ECKSTEIN, Anita – BORSKÁ, Katarína – MORAVČÍKOVÁ, Daniela: Oxygen tolerant copper mediated photo-ATRP under specific polymerization conditions. VESPS 2021: Virtual European Symposium of Photopolymer Science dedicated to Ewa Andrzejewska : June 15-17, 2021 - Austria 2021 online (15.6. 2021)
58. **OMASTOVÁ, Mária:** Polymeric composites with novel 2D nanofillers Mxenes. IMMC 2021: 20th International Metallurgy and Materials Congress: June 10-12,2021 – Istanbul, Turkey online (12.6. 2021)
59. **RAČKO, Dušan** - RUSKOVÁ, Renáta. Towards loop extrusion with pseudo-topologically and non-topologically bound SMC´s. Eutopia 3 : Third Meeting of the European Topology Interdisciplinary Initiative : February 15-17, 2021 - Lisbon, Portugal online (15.2.2021)
60. **OPÁLKOVÁ ŠIŠKOVÁ, Alena** - FRAJOVÁ, Jaroslava - HRŮZA, Jakub - OPÁLEK, Andrej - BUČKOVÁ, Mária - KOZICS, Katarína - GALEOTTI, Francesco - ECKSTEIN ANDICSOVÁ, Anita. Membranes from post-consumer poly(ethyleneterephthalate)/silk fibroin mixture for filtration. 3-rd E-Meeting on Polymer Science & Biomaterials : November 8-9, 2021 - Greenville, US online (8.11. 2021) – poster

61. **ECKSTEIN ANDICSOVÁ, Anita** - OPÁLKOVÁ ŠIŠKOVÁ, Alena - BUČKOVÁ, Mária - KRONEKOVÁ, Zuzana - OPÁLEK, Andrej - KOZMA, Erika. Diclofenac loaded electrospun poly(ε-caprolactone) mats for therapeutic application. 3-rd E-Meeting on Polymer Science & Biomaterials : November 8-9, 2021 - Greenville, US online (8.11. 2021) – poster

2.3.8. List of researchers who served as members of the organising and/or programme committees

Benková Zuzana

- chairperson of the 23RD BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2019**;** Hotel Falkensteiner Bratislava, Slovak Republic; June 30 – 03, 2019

Berek Dušan

- member of the permanent programme committees of the conference POLYCHAR, Denton, Texas, USA

Csomorová Katarína

- secretary of the organizing committee of the conference PMA & SRC 2017 – 7th international conference „Polymeric Materials in Automotive – PMA 2017 & 23rd Slovak Rubber Conference SRC 2017, Bratislava, Slovak Republic

Čakánek Peter

- member of the organizing committee of the 23RD BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2019**;** Hotel Falkensteiner Bratislava, Slovak Republic; June 30 – 03, 2019

Eckstein Anita

- member of programme and organizing committee of the 2nd MEETING OF ABIOG PROJECT PARTNERS & WORKSHOP, Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic, November 15 – 16, 2016

Hloušková Zuzana

- member of the organizing committee of the conference PMA & SRC 2017 – 7th international conference „Polymeric Materials in Automotive – PMA 2017 & 23rd Slovak Rubber Conference SRC 2017, Bratislava, Slovak Republic

Chodák Ivan

- chairperson of the programme committees of the conference PMA & SRC 2017 – 7th international conference „Polymeric Materials in Automotive – PMA 2017 & 23rd Slovak Rubber Conference SRC 2017, Bratislava, Slovak Republic
- member of the International Scientific Committee of the 3rd Int. Conference on Bio-based Polymers and Composites. Szeged, Aug 30- Sept- 3, 2016.
- member of the International Scientific Committee of the 2nd Annual Conference and Expo on Biomaterials, Madrid, May 201.
- member of the International Scientific Committee of EUROFILLERS 2017, 23 – 27 April 2017, Heraklion Crete, Greece.
- member of the International Scientific Committee of 4TH INT. CONFERENCE ON BIO-BASED POLYMERS AND COMPOSITES. Balatonfured Sept- 2-6, 2018.
- member of the International scientific committee of the International Conference on Materials Science and Engineering: Moscow, Russia, 23. - 25. July, 2018.
- member of the International Organizing Committee of the EUROFILLERS 2019, April 2019, Palermo, Italy.
- member of the scientific committee of the ESBP 2019 10th European Symposium on Biopolymers, Straubing, Germany 25 – 27 Sept 2019.
- chairperson of the programme committee of the 8TH INTERNATIONAL CONFERENCE POLYMERIC MATERIALS IN AUTOMOTIVE AND 24TH SLOVAK RUBBER CONFERENCE PMA AND SRC 2020, Conference Center of Lindner Hotel Gallery Central in Bratislava, Slovak Republic; September 16 – 18, 2020

Jochec Mošková Daniela

- member of the programme and organizing committee of THE 6TH BRATISLAVA YOUNG SCIENTISTS WORKSHOP – BYPoS 2016, March 2016, Hotel Bachledka High Tatras, Slovak Republic
- member of organizing committee of the NEW TRENDS IN SOLAR CELLS and WG and MC meeting of COST MP 1307, April 2016, Bratislava, Slovak Republic
- member of the organizing committee of the conference PMA & SRC 2017 – 7TH INTERNATIONAL CONFERENCE „POLYMERIC MATERIALS IN AUTOMOTIVE – PMA 2017 & 23rd Slovak Rubber Conference SRC 2017, Bratislava, Slovak Republic
- member of the organizing committee of the BYPOS 2017- 7th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Glamour, Zemplínska Šírava, Slovak Republic, June 12 – 16, 2017

Kollár Jozef

- member oF THE PROGRAMME AND ORGANIZING COMMITTEE OF THE 6TH BRATISLAVA YOUNG SCIENTISTS WORKSHOP – BYPoS 2016, March 2016, Hotel Bachledka High Tatras, Slovak Republic

Kroneková Zuzana

- chairperson of the 2nd MEETING OF ABIOG PROJECT PARTNERS & WORKSHOP, Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic, November 15 – 16, 2016

Mosnáček Jaroslav

- chairperson of the 22nd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2016, Hotel Holiday Inn, Bratislava, Slovak Republic, September 06 – 09, 2016

Omastová Mária

- member of International Scientific Committee of the EUROFILLERS 2017, 23 – 27 April 2017, Heraklion Crete, Greece.
- member of International Scientific Committee of EUPOC 2018 Como, 20-24 May 2018, Italy
- member of International Organizing Committee of EUROFILLERS 2019, April 2019, Palermo, Italy.
- member of International Scientific Committee of EUPOC Electrospinning techniques, 12-16 May 2019, Como, Italy
- member of the International International Advisory Board of EPF 2019 June 9-14, 2019, Hersonissos Heraklion Crete, Greece.
- chairperson of the NEW TRENDS IN SOLAR CELLS and WG and MC meeting of COST MP 1307, April 2016, Bratislava, Slovak Republic

Opálková Šišková Alena

- chairperson of the conference 6TH BRATISLAVA YOUNG SCIENTISTS WORKSHOP – BYPoS 2016, March 2016, Hotel Bachledka High Tatras, Slovak Republic
- member of organizing committee the 2nd MEETING OF ABIOG PROJECT PARTNERS & WORKSHOP, Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic, November 15 – 16, 2016
- chairperson of the BYPOS 2017- 7th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Glamour, Zemplínska Šírava, Slovak Republic, June 12 – 16, 2017
- chairperson of the BYPOS 2019- 8th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Marlene, Oščadnica, Slovak Republic, March 25 – 28, 2019
- member of the organizing committee of the conference BIMAc 2019 – 23RD BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES, September 2016, Bratislava, Slovak Republic
- member of organizing committee of the 23RD BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2019**;** Hotel Falkensteiner Bratislava, Slovak Republic; June 30 – 03, 2019

Podhradská Silvia

- member of the programme and organizing committee of the 6th BRATISLAVA YOUNG SCIENTISTS WORKSHOP – BYPoS 2016, March 2016, Hotel Bachledka High Tatras, Slovak Republic
- member of organizing committee of the NEW TRENDS IN SOLAR CELLS and WG and MC meeting of COST MP 1307, April 2016, Bratislava, Slovak Republic
- member of the organizing committee of the 22nd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2016, Hotel Holiday Inn, Bratislava, Slovak Republic, September 06 – 09, 2016
- member of the organizing and programme committee of the BYPOS 2017- 7th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Glamour, Zemplínska Šírava, Slovak Republic, June 12 – 16, 2017
- member of the organizing committee of the conference PMA & SRC 2017 – 7th INTERNATIONAL CONFERENCE „POLYMERIC MATERIALS IN AUTOMOTIVE – PMA 2017 & 23rd Slovak Rubber Conference SRC 2017, Bratislava, Slovak Republic
- member of organizing and programme committee of the BYPOS 2019- 8th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Marlene, Oščadnica, Slovak Republic, March 25 – 28, 2019
- member of the organizing committee of the conference BIMAc 2019 – 23rd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES, Bratislava, Slovak Republic
- member of organizing committee of the 23rd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2019**;** Hotel Falkensteiner Bratislava, Slovak Republic; June 30 – 03, 2019
- member of organizing committee and secretary of the 8th INTERNATIONAL CONFERENCE POLYMERIC MATERIALS IN AUTOMOTIVE AND 24th SLOVAK RUBBER CONFERENCE PMA AND SRC 2020, Conference Center of Lindner Hotel Gallery Central in Bratislava, Slovak Republic; September 16 – 18, 2020

Račko Dušan

- member of programme committee of the 23rd BRATISLAVA INTERNATIONAL CONFERENCE ON MACROMOLECULES - BIMAC 2019**;** Hotel Falkensteiner Bratislava, Slovak Republic; June 30 – 03, 2019

Zahoranová Anna

- member of organizing and programme committee of the BYPOS 2019- 8th BRATISLAVA YOUNG POLYMER SCIENTISTS WORKSHOP, Hotel Marlene, Oščadnica, Slovak Republic, March 25 – 28, 2019

2.3.9. List of researchers who received an international scientific award

Berek Dušan

- Certificate of Achievement; awarded by: Organizing Committee of 18th International Conference on World HPLC & Activities report of the SAS organization 47 Separation Techniques Toronto, Canada; Description: For phenomenal and worthy oral presentation, 2018
- Certificate of Recognition Oceňovateľ: WBCABC-2018 Organizing Committee Members Barcelona, Spain Description: For phenomenal and worthy plenary presentation at World Conference on Analytical & Bioanalytical Chemistry Barcelona, Spain
- Certificate of Recognition Oceňovateľ: WCABC-2018 Organizing Committee Members Barcelona, Spain Opis: For phenomenal and worthy oral presentation at World Conference on Analytical & Bioanalytical Chemistry Barcelona, Spain
- Medal of contribution Valuator: Committee of Analytical Chemistry Polish Academy of Sciences; Description: Recognition for merit in the field of analytical chemistry, 2018

Habánková Eva

- Prize for the best student lecture awarded by scientific committee of the conference; Description: Prize awarded at the 10th Czech-Slovak Conference Polymers 2018, Třešť, Czech Republic

Ilčíková Markéta

- Best Poster Award of 4th International Conference on Rheology and Modeling of Materials, 7.-11.10. 2019, Miskolc, Hungary; Authors: M. Ilčíková, M. Maslowski, M. Zygo, M. Mrlik, J. Mosnáček, J. Pietrasik: PMMA/SAN blends with graphene oxide polymer hybrids: Investigation of compatibility by melt rheology

Majerčíková Monika

- Online Short Talk Student Award given by: IUPAC MACRO 2020+ Jeju, Korea Description: diploma for poster presentation, 2021

Omastová Mária

- Honorary membership in the Czech Chemical Society; awarded by: Czech Chemical Society; Description: Honorary membership in the Czech Chemical Society granted at the 68th Congress of Chemical Companies, Prague, September 2016
- Best poster award; given by: Organizing committee of International Conference Baltic Polymer Symposium 2018

Rusková Renáta

- Price per poster; awarded by: ESI Conference, CECAM-AT / ESI-TU Wien; Description: 1st prize for a poster presentation, 2021

Špitálsky Zdenko

- Publication included in the Editors collection: RSC Advances in the categories Photodynamic Therapy and Graphene; awarded by: Royal Society of Chemistry; Description: Publication of the author's team: Z.M. Markovic, S.P. Jovanovic, P.Z. Mašković, M. Danko, M. Mičušík, V.B. Pavlović, D.D. Milivojrvić, A. Kleinová, Z. Špitalský, B.M. Todorovic Markovic, RSC Adv, 2018, 8, 22876-22886

- **Position of individual researchers in the national context**

2.3.10. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

1. **LACÍK, Igor**; Blood glucose control by transplanted encapsulated islets: current situation.; 6. - 8.10. 2016: 1. Congress of the Slovak Transplantological Society with international participation; Košice (7.10. 2016)
2. **LACÍK, Igor**; Microcapsules for encapsulation of pancreatic islets.; 8. - 10.3. 2016: Scientific seminar on the occasion of the opening of the CELIM PF UPJŠ Košice center; (Microcapsules for encapsulation pancreatic islets)
3. **CHODÁK, Ivan** - OMASTOVÁ, Mária; Research focused on potential applications at the Polymer Institute of SAS.; 27. - 28.9. 2017: 7th year of seminars from the series Trends in the Plastics Industry. Veľká Lomnica, High Tatras
4. **MARKOVIĆ, Zoran M.**; Biomedical application of carbon quantum dots.; 69. Congress of chemists: 11.-15. 9. 2017; High Tatras (12.9. 2017)
5. **ECKSTEIN, Anita**; Polymers in present; 1st Slovak Lach:ner conference; Bratislava, (25.10. 2018)
6. **KOVÁČOVÁ, Mária** – MARKOVIĆ, Zoran - ŠPITALSKÝ, Zdenko; Photodynamic therapy, quantum dots and their use; 1st Slovak Lach:ner conference; Bratislava, (25.10. 2018)
7. **LACÍK, Igor;** Pancreatic islet transplantation: the possibility of improving sugar control by encapsulated cell transplantation; 18. - 20.10. 2018: 2nd Congress of the Slovak Transplant Society SLS with international participation; Bratislava, (19.10. 2018)

8. **LACÍK, Igor.** Encapsulated pancreatic islets: the possibility to improve sugar control; Expert workshop: Innovative ways of educating parents and children with diabetes mellitus, type I; Faculty of Health, University of Prešov, Prešov. (12.10. 2018)
9. **LACÍK, Igor.** Innovative islet transplantation: present to future. Biomedicine Life Science Innovation Day, Bratislava (29.5. 2018)
10. **ŠPITALSKÝ, Zdenko** – KOVÁČOVÁ, Mária – SVOBODA, Peter.; 3D printing of polymer composites; 1st Slovak Lach:ner conference; Bratislava, (25.10. 2018)
11. **LACÍK, Igor;** Polymeric biomaterials for immunoprotection of pancreatic islets in diabetes treatment. Biomedicine Life Science Innovation Day, Bratislava, (22.5. 2019)
12. **LACÍK, Igor;** Treatment of diabetes encapsulated in the pancreatic islets. Medical Dialogues: Innovations in Medicine; Boehringer Ingelheim RCV GmbH & Co. KG.; Bratislava, (13.8.2020)
13. **ŠPITALSKÝ, Zdenko**; Nanocomposites – a new antibacterial polymeric material. EXTRATEX Virtual ClusterXchange: Intersectoral Cooperation (10.3. 2021)
14. **ŠPITALSKÝ, Zdenko;** Polymer Institute SAS; Possibilities of application of basic research results. 10th professional seminar Trends in the plastics industry 2021. Innovation day, online (4.11. 2021)

2.3.11. List of researchers who served as members of organising and programme committees of national conferences

Cifra Peter
- member of programme committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016

Csomorová Katarína
- member of organizing committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016

Danko Martin
- member of programme committee of the 69th CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 11 – 15, 2017
- member of programme committee of the 71st CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 09 – 13, 2019
- chairperson of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Eckstein Anita
- member of the organizing committee of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Hloušková Zuzana
- member of organizing committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016
- member of programme and organizing committee of the 69th CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 11 – 15, 2017

Jochec Mošková Daniela
- member of organizing committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016

Kronek Juraj
- member of programme committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016

Lacík Igor

- member of programme committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016
- member of the programme committee of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Mičušík Matej

- member of programme committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016

Mosnáček Jaroslav

- member of programme committee of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Omastová Mária

- member of programme committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016
- chairperson of the 69th CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 11 – 15, 2017
- chairperson of the 71st CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 09 – 13, 2019
- member of programme committee of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Opálková Šišková Alena

- member of organizing committee of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Podhradská Silvia

- member of organizing committee of the IX. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2016; Hotel Academia – KC Stará Lesná; Slovak Republic; June 08 – 10, 2016

Procházka Michal

- member of organizing committee of the 69th CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 11 – 15, 2017
- member of organizing committee of the 71st CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 09 – 13, 2019
- 73st CONGRESS OF CHEMICAL SOCIETIES; Starý Smokovec, High Tatras, Slovak Republic; September 06 – 10, 2021

Račko Dušan

- member of the programme committee of the XI. SLOVAK – CZECH CONFERENCE - POLYMÉRY 2020; Polymer Institute of the Slovak Academy of Sciences, Bratislava, Slovak Republic; October 06 – 07, 2020

Špitálsky Zdenko

- member of organizing committee of "V. LABUDA´S DAYS", September 14 – 14, 2018, Congress Center Smolenice, Slovak Republic

2.3.12. List of researchers who received a national scientific award

Balogh Róbert

- Competition for the best presentation at the BYPoS workshop, awarded by committee of the conference BYPoS 2017, Description: 3rd place in the competition for the best presentation at the BYPoS workshop, Zemplínska Šírava, June 2017
- Award at the Interactive Conference of Young Scientists of the Preveda civic association, Appraiser: Preveda civic association
- Diploma for excellent contribution in the section Organic, Bioorganic, Pharmaceutical Chemistry, Pharmacology and Toxicology; Appraiser: Preveda, o.z.; Description: The award was given as part of the award ceremony on the occasion of the 10th Interactive Conference of Young Scientists in Bratislava, 2018

Borsig Eberhard

- Gold Medal of the Slovak Academy of Sciences; awarded by Presidium of the Slovak Academy of Sciences; Description: Award given to the appointed person on October 19, 2016 by the Slovak Academy of Sciences for many years of scientific work in the field of polymer science.

Bugárová Nikola

- Award for the best publication for scientists under 35; 1st place; given by: Scientific Board of PI SAS, 2019
- Award for the best publication for scientists under 35; 2nd place; given by: Scientific Board of PI SAS, 2020

Capek Ignác

- Literary Fund Award for Scientific and Professional Literature in 2015; Appraiser: Literary Fund; Description: Award for Scientific and Professional Literature in 2015 in the category of natural and technical sciences for the work DNA Engineered Noble Metal Nanoparticles: Fundamentals and State-of-the-Art of, 2016

Dušička Eva

- Award for the best publication for scientists under 35; Description: 1st place; Awarder: Scientific Board of PI SAS, 2020
- Student personality of Slovakia for academic year 2019/2020; Description: nomination, 2020

Eckstein Anita

- Prize for the best lecture at the All-Slovak Student Scientific Conference Applied Natural Sciences 2019; Description: Prize for the lecture P. Maxiánová, Z. Tokárová, A. Eckstein: Preparation of potential photochemically active initiators for polymerization reactions

Chodák Ivan

- winner of the Prize for Science and Technology in 2017, Awarded by Ministry of Education, Science, Research and Sport, Description: in the Lifelong Merit in Science and Technology category - awarded by the Minister of Education, Science, Research and Sport as part of the Slovak Science and Technology Week 2017

Kleinová Angela

- SCHS diploma for the best poster presentation at the 71st Congress of Chemists, 9.9.-13.9. 2019, Vysoké Tatry; Appraiser: SCHS; Description: Poster of the author's team M. Mičušík, A. Kleinová, M. Procházka, S. Podhradská, A. Rabayová, G. Bodor, M. Omastová. Chemical analysis of plastic waste using FTIR and XPS from a collection carried out along the Danube in Bratislava

Kováčová Mária

- Award for the best publication for scientists under 35, 2nd place; Awarder: Scientific Board of PI SAS, 2019

- SAS Award for the results of scientific research work of young researchers up to 35 years of age and doctoral students; Appraiser: Presidium of the SAS; Description: 3rd prize in the 2nd Department of Sciences of the SAS, 2020
- Award for the best publication for scientists under 35, 3rd place Awarder: Scientific Board of PI SAS, 2021
- Eset Science Award 2021 finalist, Outstanding Young Scientist under 35 category; Awarder: ESET Foundation

Kroneková Zuzana

- Honorable mention L´OREAL - UNESCO for women in science Appraiser: UNESCO Description: Prize for the project Polymer systems for combined immunotherapy, 2018

Lazar Milan

- Gold Medal of the Slovak Academy of Sciences; Appraiser: Presidium of the SAS; Description: Award for lifetime contribution in the field of chemistry and polymers, 2018

Lacík Igor

- Laureate of the 19th year of the Crystal Wing in the category Medicine and Science in 2015; Appraiser: Agency Krištáľové krídlo; Description: Award in the category of Medicine and Science for 2015, Slovak National Theater, 24.01.2016
- Finalist of the ESET Science Award competition, Outstanding personality of Slovak science 2019
- Personality of science and technology of Slovak Republic (award by the Ministry of education SR), 2018

Majerčíková Monika

- Marta Sališová Award Competition Appraiser: Conference 73rd Congress of Chemists 2021; Description: finalist of the competition
- Competition for the best publication for scientists under 35 years of age; Appraiser: Scientific Board of PI SAS; Description: 3rd place, 2021

Némethová Veronika

- Student Personality of the Year of Slovakia for the academic year 2015/2016; awarded by: Junior Chamber International – Slovakia; Description: Absolute winner of the twelfth year of the national competition Student Personality of the Year of Slovakia for the academic year 2015/2016, organized by Junior Chamber International - Slovakia. The project is carried out under the auspices of the President of the Slovak Republic and its guarantors are the Rectors' Conference Of Slovakia And The Slovak Academy Of Sciences.

Novák Igor

- Significant personality of the Slovak Academy of Sciences; Appraiser: Slovak Academy of Sciences 2021

Omastová Mária

- Award of the Literary Fund for the three-year scientific citations in the category Technical sciences, 2016
- Award Scientist of the Year 2016
- Pribina's Cross I. class, awarded by the President of the Slovak Republic. 2019
- ESET Science Award; given by: ESET Foundation; Description: From the all candidates for the ESET Science Award, Ing. Mária Omastová, DrSc. was one of the final fifteen scientific and pedagogical personalities who represent Slovakia in the international scientific community, innovate the higher education process, popularize their fields or represent young talents are nominated for this award, 2020

Opálková Šišková Alena

- Prize of the Slovak Academy of Sciences for Popularization of Science; Appraiser: Presidency of the SAS; Description: The prize was awarded for the project Find a Scientist in Yourself 3.7. 2018 in Smolenice
- SAS Award for Popularization Appraiser: SAS Description: nomination, 2020

Peidayesh Hamed

- The best publication competition for scientists under 35 years of age; Appraiser: Scientific Board of PI SAS; Description: 2nd place, 2021

Podhradská Silvia

- Prize of the Slovak Academy of Sciences for Popularization of Science; Appraiser: Presidency of the SAS; Description: The prize was awarded for the project Find a Scientist in Yourself 3.7. 2018 in Smolenice

Rusková Renáta

- Doktogrant Project Quality Certificate; Appraiser: Slovak Academy of Sciences, 2021

Rychlá Lýdia

- Medal of the Slovak Academy of Sciences for the support of science; Appraiser: Presidency of the SAS; Description: Award for science support and creation of a school on polymer chemiluminescence, 2018

Špitálsky Zdenko

- Award of the Literary Fund for an outstanding scientific response to one publication in the 2014 and 2018 for paper in Progress in Polymer Science 2010, the IF> 20 (currently over 2700 SCOPUS citations)
- Dean's award for excellent bachelor's thesis; Appraiser: Dean of FCFT; Description: Bachelor work of T. Lacenová, supervisor: Z. Špitalský
- Innovative act of the year 2017; Evaluator: Ministry of Economy of the Slovak Republic Description: Company MYMEDIA s.r.o. in cooperation with Polymer Institute developed the material awarded at the International Engineering Fair in Nitra 22.5.2018
- 2018 Prize of Presidium SAS for publication with high number of citations
- Excellent biomedical spot, Appraiser: Annual Report of the Ministry of Health of the Slovak Republic for 2018 in the field of science, research and innovation, Description: Research of antibacterial polymer composites based on carbon quantum dots, 2019
- The most attractive eco-poster; Appraiser: CVTI Bratislava Description: Conference with international participation Technology transfer in Slovakia and abroad, authors Z. Špitalský, M. Kováčová, V. Ďuriš, M. Vysopal, P. Svoboda

Zain Gamal

- Award for the best presentation at the BYPoS conference, 25.3.-28.3. 2019 Oščadnica, 3rd place; Valuator: Young Scientists Council of PI SAS; Description: Poster price G. Zain, J. Mosnáček: Photochemically induced atom transfer radical polymerization of Tulipalin A.
- Award for the best publication for scientists under 35; Description: 3rd place; Awarder: Scientific Board of PI SAS, 2019
- Competition for the best publication for scientists under 35 years of age Appraiser: Scientific Board of PI SAS Description: 1st place, 2021

2.4. Research grants and other funding resources

(List type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator "C", work package leader "W", investigator "I". Add information on the projects which are interdisciplinary, and also on the joint projects with several participating SAS institutes)

- **International projects**

  2.4.1. List of major projects of Framework Programmes of the EU (which pilar), NATO, COST, etc. Add information on your activities in international networks

Projects HORIZONT 2020

1. Title: *Multifunctional polymer composites doped with novel 2D nanoparticles for advanced applications*
   Grant No.: H2020-MSCA-RISE-2017; duration: 5/2018 – 4/2023; funding: 25 547.00 €, national sources: €11 779.00 €; responsible person: **Mária Omastová**; status in the project: I
   Activities in international networks:
   The overall goal of the project is to provide new materials and technologies with higher performance, efficiency, quality and cost savings in various applications for end users. The concept explored in the project is to identify and expand the application potential of advanced MXene-doped polymers and to assess their effectiveness in comparison with well-known carbon-based particles such as graphene. Stable and highly conductive composites with PMMA and epoxy matrix were prepared at PI SAS containing MXenes and also hybrid MXenes and carbon nanotubes.

2. Title: *Confined n-Propanol by ESR and LF-BDS. Confined n-Propanol by ESR and HF-BDs*
   Grant No.: EUSMI E180300076; duration: 1/2018 – 12/2018; funding: 4 480.00 €; rResponsible person: **Josef Bartoš**; status in the project: I
   Activities in international networks:
   Actual topic of the confined systems (medium in porous material) is the study of amorphous state of medium and the mutual interaction between medium and the pore surface which are the key factors for control-release of the drug. Different porous materials with medium were prepared and monitored humidity and filling factor.

3. Title: *External factors in silica confined n-propanol*
   grant No.: EUSMI E181200215; duration: 1/2019 – 12/2019; funding: 3 797.00 €; responsible person: **Josef Bartoš**; status in the project: I

   Activities in international networks:
   The study of the model system: polar alkanol in polar matrix MCM-41 by means of dielectric spectroscopy revealed the factor of drying procedure of MCM-41 and the filling factor. It was confirmed that drying procedure of MCM-41 has low effect on the medium. However, the filling factor (saturated and overfilled state) revealed the appearance of two phases of propanol, i.e. close to the pore surface and in the area of the pore core. It requires further study.

4. Title: *Dynamics and phase behaviors of confined oligomeric and polymeric PDMS in AAO matrices*
   grant No.: EUSMI E200400406; duration: 1/2020 – 12/2021; funding: 7 458.00 €; responsible person: **Josef Bartoš**; status in the project: I

   Activities in international networks:
   Dynamics and phase behaviors of confined oligomeric and polymeric PDMS in AAO matrices. Confined system of monomers, oligomers in the porous material may greatly help to understand the impact of restriction on the polymer structure. This specific problem was solved on a model system of *poly(dimethyl siloxane)* (*PDMS*) confined in inorganic matrix of *alumina oxide* (*AAO*) with pore diameter D_{pore}=200 Å using dielectric spectroscopy (BDS).It was found that the

restriction of PDMS in AAO matrix leads to the amorphous state which is independent of the thermal treatment and results in dramatic reduction of the phase transition.

ERDF Project - INTERREG V-A SK-AT

1. Title: *Macro plastic waste in and along the Danube*
   Grant No.: 305021S022; duration: 09/2017 – 09/2020 prolonged to 03/2021; funding: ERDF: 127 618.00 €, national sources: 13 412.00 €; responsible person: **Mária Omastová**; status in the project: I
   Activities in international networks:
   Within Interreg project PlasticFreeDanube following reports were prepared at PI SAS or with PI SAS input: Report on types of plastic waste, its additives and adsorbed substances; Analysis of fragmentation and abrasion resistance of macroplastics in a river system; Report on fragmentation and abrasion resistance of macro-plastics in the river system; Evaluation of the impact of macro-plastics on the river system; Report on the possible impact of macro-plastic pollution in and along the Danube, Sampling strategy and construction recommendations for macroplastic in large rivers, Sampling Protocol, and Sorting Protocol.

COST Projects

1. Title: *Multi-Functional NanoCarbon Composite Materials Network (MultiComp): two main problems to be solved for composite materials: (1) adequate dispersion of the nano-carbon reinforcement material, and (2) strong enough interfacial bonding between the nano- c*
   Grant No.: CA15107; duration: 04/2016 – 04/2020; funding: 15 199.00 €; responsible person: **Matej Mičušík**; status in the project: I
   Activities in international networks:
   MultiComp is a COST Action designed to bring together theorists, experimentalists and industrialists in the field of nano-carbon materials technology. Although carbon nanotubes, graphene and few-layer graphene have been used to improve the properties of composite materials, two main problems remain to be solved before these composite materials can realize their full potential: (1) adequate dispersion of the nano-carbon reinforcement material, and (2) strong enough interfacial bonding between the nano-carbon reinforcement elements and the composite matrix.

2. Title*: Sustainable flame retardancy for textiles and related materials based on nanoparticles substituting conventional chemicals*
   Grant No.: MP1105; duration: 05/2012 – 05/2016; funding: 1 458.00 €; responsible person: **Mária Omastová**; status in the project: I
   Activities in international networks:
   A conductive surface layer was applied to the fabric at the same time as the anti-combustible layer. Obtained results showed that if the last step is application of an anti-combustible layer, the electrical conductivity of the fabric was significantly reduced. The results of on a conical calorimeter measurement showed that parameters such as ignition time, heat release rate, and total oxygen consumption were significantly reduced, i.e. the flammability of the material was suppressed.

3. Title: *European network to connect research and innovation efforts on advanced Smart textiles*
   Grant No.: CA17107; duration: 10/2017 – 10/2022; funding: 10 740.00 €; responsible person: **Anita Eckstein**; status in the project: I
   Activities in international networks:
   The consortium aims is to create a functional textile material that actively affects its environment. It focuses on various industries, especially the healthcare, automotive and aerospace industries, protective equipment, sports and wearable items, the construction industry, and interior design. As part of this project, we worked with members of the consortium to use plastic waste for applications such as filtration and medicine. As part of this project, doctoral student Gamal Zain received a travel grant to Northern Macedonia, where he had the opportunity to test his materials for flammability.

4. Title: *European Topology Interdisciplinary Action*
   Grant No.: CA17139; duration: 6/2018 – 12/2022; funding: 3 700.00 €; responsible person: **Dušan Račko**; status in the project: I
   Activities in international networks:
   The goal of the COST action EUTOPIA is to establish a collaborative platform to approach problems in the study of biological and soft matter that feature topological characteristics. In doing this, it creates a pan-European, synergistic network of researchers from different fields that will overcome geographical, economical and societal barriers, as well as those naturally surrounding traditional academic communities. The activities are organized within 5 workgroups with a specialized focus on theory of topological entanglements in polymers and fibers, new topological polymeric and fibrous materials, entanglement in proteins, entanglements in DNA, chromosomes and other biological material, and topological complex fluids. The outcomes of the research carried out thanks to the EUTOPIA Action will push forward the boundaries of our current understanding of key systems, and foster the knowledge transfer of scientific findings to industry and, ultimately, to society as a whole.

5. Title: *European Network of multidisciplinary research to Improve the Urinary Stents*
   Grant No.: CA16217; duration: 6/2018 – 9/2021; funding: 5 593.00 €; responsible person: **Zdenko Špitálsky**; status in the project: I
   Activities in international networks:
   As a member of large scientific and industrial community with focus on urinal stents we offered and led discussions about usage of CQDs as antibacterial material for surface treatment of urinal stents or catheters. Due to the positive response from community we performed several experiments on catheters and that results were presented comunity of COST action.

6. Title: *European network of furan based chemicals and materials for Sustainable development.*
   Grant No.: CA18220; duration: 11/2019 – 11/2023; funding: 6 883.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: I
   Activities in international networks:
   FUR4Sus Cost project is network focused on design of inovative approach toward new chemicals and polymeric materials from renewable 2,5-furandicarboxylic acid (FDCA) starting from laboratory research through industial development to final products. PI SAS contributes in synthesis of new functional monomers and polymers from FDCA in order to synthesize new drug delivery systems and vitrimers.

7. Title: *European Forum for Advanced Practices*
   Grant No.: CA18136; duration: 4/2019 – 3/2023; funding: 8 965.00 €; responsible person: **Silvia Podhradská**; status in the project: I
   Activities in international networks:
   In our approach, we are planning to link science – art – environment - education. In the frame of our projects, we will use modern technologies for self-expression of artists via applied art. We see as the suitable input material the plastic waste from landfills or from the European rivers. The formed objects will be coming from the workshops of artists and scientists. The applied art and resulting objects will be used for environmental, technical and material education for the general public, particularly for pupils at the elementary schools and high schools. In the frame of the COST action, we are planning to organize further NANO-Art exhibitions, workshops, competitions, conferences and festivals. We would like to extend our cooperation with young designers and young technologists, and to support them in creating the start-ups in Slovakia and other European Countries

8. Title: *Advanced Engineering and Research of aeroGels for Environment and Life Sciences*
   Grant No.: CA18125; duration: 4/2020 – 4/2023; funding: 8 030.00 €; responsible person: **Igor Lacík**; status in the project: I
   Activities in international networks:
   AERoGELS COST project is focused on networking between scientific and technological expertise delivered by academic, industrial and regulatory institutions in the European research space. Aerogels are a specific category of mesoporous materials with high porosity and tailored physico-chemical properties. This COST project specifically deals with utilization of aerogels for

environmental and life sciences. New knowledge is obtained with respect to material characteristics as well as the impact on health and environment. PI SAS contributes to Working groups on Pharmaceutical and biomedical application of aerogels and Design and characterization of aerogels.

9. Title: *High-performance Carbon-based Composites with Smart Properties for Advanced Sensing Applications*
   Grant No.: CA 19118; duration: 10/2020 – 9/2024; funding: 3 588.00 €; responsible person: **Mária Omastová**; status in the project: I
   Activities in international networks:
   We have been involved in the activity Preparation of advanced composite materials. Our intention was to examine graphene nanoplatelets of different sizes. We did the basic characteristics, measured their XPS spectra and SEM characterization. These 2D materials together with carbon nanotubes have been used for preparation of new types of elastomer composites.

- **National projects, incl. international projects with only national funding**

2.4.2. List of ERA-NET projects funded from SAS budget

1. Title: *M2Neural: Multifunctional Materials for advanced Neural interfaces*
   Grant No.: -; duration: 11/2014 – 08/2017; funding: 41 706.00 €; responsible person: **Igor Lacík**; status in the project: I

2. *Title: Advanced polymer composites filled with novel 2D nanoparticles*
   Grant No.: M-ERA.NET-18-414-Nano2Com; duration: 9/2018 – 8/2021; funding: : 74 951.00 €; responsible person: **Mária Omastová**; status in the project: I

3. *Title: Energy Activated External Thermal Insulation Composite System - integration of thermal storage and photovoltaics for energy efficient buildings*
   Grant No.: M-ERA.NET Call 2018; duration: 10/2019 – 9/2022; funding: 56 025.00 €; responsible person: **Ivan Chodák**; status in the project: I

4. *Title: European Partnership for Improved Composites*
   Grant No.: M-ERA.NET Call 2018; duration: 9/2019 – 8/2022; funding: 58 325.00 €; responsible person: **Matej Mičušík**; status in the project: I

5. *Title: Li-ion BAttery-SupErcapacitor Hybrid Device*
   Grant No.: M-ERA.NET-2/2019/966/LiBASED; duration: 9/2020 – 8/2023; funding: 33 324.00 €; responsible person: **Mária Omastová**; status in the project: I

6. *Title: Matrix for carbon reinforced epoxy laminates with reduced flammability*
   Grant No.: M-ERA.NET Call 2019; duration: 5/2020 – 4/2023; funding: 41 665.00; responsible person: **Zdenko Špitálsky**; status in the project: I

2.4.3. List of projects of the Slovak Research and Development Agency, APVV

APVV Scientific projects

1. Title: *Immobilized recombinant microorganisms for the biotechnological production of chemical specialties using biocatalytic cascade reactions*
   grant No.: APVV-15–0227; duration: 7/2016 – 6/2020; funding: 37 350.00 €; responsible person: **Igor Lacík**; status in the project: I

2. *Title: Structural transitions of (bio)macromolecules in nanochannels*
   grant No.: APVV-15-0323; duration: 7/2016 – 6/2020; funding: 113 986.00 €; responsible person: **Peter Cifra**; status in the project: C

3. Title: *Silicon carbide thin film technologies: Research and development of silicon carbide thin film technologies for application in solar cells and thin film devices*
   grant No.: APVV-0443-12; duration: 10/2013 – 12/2016; funding: 3 740.00 €; responsible person: **Angela Kleinová**; status in the project: I

4. Title: *Modified polymers from renewable resources and their degradation*
   grant No.: APVV-15-0528; duration: 7/2016 – 6/2020; funding: 146 083.00 €; responsible person: **Štefan Chmela**; status in the project: C

5. Title: *Rubber compounds with new types of fillers for special applications*
   grant No.: APVV-0694-12; duration: 10/2013 – 9/2016; funding: 12 200.00 €; responsible person: **Ivan Chodák**; status in the project: I

6. Title: *Unreactive melt adhesives based on metallocene polymers for industrial applications*
   grant No.: APVV-14-0566; duration: 7/2015 – 6/2019; funding: 84 915.00 €; responsible person: **Ivan Chodák**; status in the project: C

7. Title: *Nanoparticles-based sensors of gaseous biomarkers of diseases*
   grant No.: APVV-14-0891; duration: 7/2015 – 6/2019; funding: 72 980.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: I

8. Title: *Biochips and biosenzors for glycorecognition, their development, preparation and application in cancer research*
   grant No.: APVV-14-0753; duration: 7/2015 – 6/2019; funding: 20 875.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: I

9. Title: *MEDERIT: Materials and processes for functional encapsulation of pancreatic islets in diabetes treatment*
   grant No.: APVV-14-0858; duration: 7/2015 – 6/2019; funding: 155 214.00 €; responsible person: **Igor Lacík**; status in the project: C

10. Title: *Graphene-based nanoplatform for detection of cancer*
    grant No.: APVV-14-0120; duration: 7/2015 – 6/2019; funding: 77 418.00 €; responsible person: **Mária Omastová**; status in the project: C

11. Title: *Effects of nanoencapsulated simvastatin on cardiovascular system in experimental metabolic syndrome*
    grant No.: APVV-14-0932; duration: 7/2015 – 6/2019; funding: 36 060.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: I

12. Title: *Research of the impact of low temperature PLASma on increase the surface treatment permanence of TEXtile materials using NANOsols*
    grant No.: APVV-14-0518; duration: 7/2015 – 6/2019; funding: 90 000.00 €; responsible person: **Zdenko Špitálský**; status in the project: C

13. Title: *Nanocomposite materials based on organo-phosphonium smectites and polymers*
    grant No.: APVV-15-0741; duration: 7/2016 – 6/2020; funding: 98 092.00 €; responsible person: **Ivan Chodák**; status in the project: I

14. Title: *Towards highly selective cancer treatment: Endogenous lipoprotein-DARPin complexes as a new generation of targeted drug delivery vehicles*
    grant No.: APVV-15-0485; duration: 7/2016 – 6/2020; funding: 59 083.00 €; responsible person: **Juraj Kronek**; status in the project: I

15. Title: *Photochemically induced copper-mediated atom transfer radical polymerization*
grant No.: APVV-15-0545; duration: 7/2016 – 6/2020; funding: 214 670.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: C

16. Title: *Lignin as composite component for phenol-formaldehyde resins and wood-plastic composite*
grant No.: APVV-15-0201; duration: 7/2016 – 6/2020; funding: 9 000.00 €; responsible person: **Michal Procházka**; status in the project: I

17. Title: *Multivalent morpholino-based antisense system for CML*
grant No.: APVV-15-0215; duration: 7/2016 – 6/2020; funding: 73 550.00 €; responsible person: **Filip Rázga**; status in the project: C

18. Title: *Potential risk of metal and metal oxide nanoparticles used for biomedical aplications: focus on reproductive and immune systems and brain*
grant No.: APVV-15-0296; duration: 7/2016 – 6/2020; funding: 32 000.00 €; responsible person: **Jozef Kollár**; status in the project: I
19. Title: *Smart MoS2 platform for cancer diagnosis and targeted treatment*
grant No.: APVV-15-0641; duration: 7/2016 – 6/2020; funding: 43 000.00 €; responsible person: **Jozef Kollár**; status in the project: I

20. Title: *Physical properties of organic compounds and water confined in mesopores of inorganic matrices*
grant No.: APVV 16-0369; duration: 7/2016 – 6/2021; funding: 83 163.00 €; responsible person: **Josef Bartoš**; status in the project: I

21. Title: *Real-time grow studies of hybrid van der Waals heterostructures*
grant No.: APVV-17-0352; duration: 10/2018 – 6/2022; funding: 19 879.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: I

22. Title: *Glycan bionanosensors and bioanalytical devices - their construction, validation and application for cancer diagnostics*
grant No.: APVV-17-0300; duration: 10/2018 – 6/2022; funding: 19 859.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: I

23. Title: *Biotechnological preparation of bioplastics based on PHA with programmable releasing of biopolymer and application possibilities*
grant No.: APVV-18-0420; duration: 7/2019 – 6/2023; funding: 69 438.00 €; responsible person: **Martin Danko**; status in the project: C

24. Title: *Rational design of hydrogel microcapsules for immunoprotection of transplanted pancreatic islets in diabetes treatment*
grant No.: APVV-18-0480; duration: 7/2019 – 6/2023; funding: 98 755.00 €; responsible person: **Igor Lacík**; status in the project: C

25. Title: *The occurrence of microplastics and selected micropollutants in surface and drinking waters of Slovakia and their effective removal by progressive processes*
grant No.: APVV-19-0250; duration: 7/2020 – 5/2024; funding: 18 023.00 €; responsible person: **Dmitrij Bondarev**; status in the project: I

26. Title: *Bionanocomposites based on organic polycations and layered silicates*
grant No.: APVV-19-0487; duration: 7/2020 – 5/2024; funding: 32 779.00 €; responsible person: **Juraj Kronek**; status in the project: I

27. Title: *Advanced Oxygen Tolerant Photochemically Induced Atom Transfer Radical Polymerization*
grant No.: APVV-19-0338; duration: 7/2020 – 6/2024; funding: 45 739.00 €; responsible person: **Jaroslav Mosnáček**; status in the project: C

28. Title: *Hybrid Low Dimensional Layered Materials with new Functionalities*
grant No.: APVV-19-0465; duration: 7/2020 – 12/2023; funding: 42 042.00 €; responsible person: **Mária Omastová**; status in the project: C

29. Title: *Carbon-silicon based composite anodes for Li-ion batteries*
grant No.: APVV-19-0461; duration: 7/2020 -6/2024; funding: 9 820.00 €; responsible person: **Matej Mičušík**; status in the project: I

30. Title: *Immobilization and co-immobilization of viable whole-cell biocatalysts with enzyme cascades for production of chemical specialties, development of methods for their characterization and bioreactor engineering*
grant No.: APVV-20-0272; duration: 7/2021 – 6/2026; funding: 4 874.00 €; responsible person: **Igor Lacík**; status in the project: I

31. Title: *Activation of the VGF/BDNF/TrkB pathway by synthetic mRNA encapsulated in polyplex nanoparticles: effects on neural excitability, neuroplasticity and animal behavior*
grant No.: APVV-20-0202; duration: 7/2021 – 6/2025; funding: 8 911.00 €; responsible person: **Juraj Kronek**; status in the project: I

32. Title: *Nanocomposites based on elastomeric blends with improved resistance to diffusion of gasses including hydrogen*
grant No.: APVV-20-0593; duration: 7/2021 – 12/2023; funding: 26 000.00 €; responsible person: **Ivan Chodák**; status in the project: C

APVV Mobility projects

33. Title: *New polymeric composites with MXene and carbon based nanofillers*
grant No.: APVV-SK-BY-RD-19-0011; duration: 8/2019 – 7/2022; funding: 77 583.00 €; responsible person: **Matej Mičušík**; status in the project: C

34. Title: *The design and characterization of hybrid polymeric scavengers for endotoxins*
grant No.: APVV-SK-KR-18-0011; duration: 9/2018 – 12/2019; funding: 6 341.00 €; responsible person: **Juraj Kronek**; status in the project: C

35. Title: *Transparent, electrically conductive polymeric nanocomposites on the base of nanostructured graphite*
grant No.: SK-SRB-2013-0044; duration: 1/2015 – 12/2016; funding: 24 007.00 €; responsible person: **Zdenko Špitálsky**; status in the project: C

36. Title: *Composites based on conductive polymers*
grant No.: DS-2016-0027; duration: 1/2017 – 12/2018; funding: 2 718.00 €; responsible person: **Matej Mičušík**; status in the project: C

37. Title: *Antibacterial polymeric nanocomposites on the base of carbon nanomaterials*
grant No.: DS-2016-0021; duration: 1/2017 – 12/2018; funding: 2 588.00 €; responsible person: **Zdenko Špitálsky**; status in the project: C

38. Title: *Antibacterial polymeric nanocomposites fibers based on carbon nanomaterials*
grant No.: SK-SRB-2016-0038; duration: 11/2017 – 12/2018; funding: 1 488.00 €; responsible person: **Zdenko Špitálsky**; status in the project: C

39. Title: *Transcription induced supercoiling in 4D genome organization*
grant No.: STSM 44913 / CA 17139.; duration: 11.8.2019 – 25.8.2019; funding: 2 050.00 €; responsible person: **Dušan Račko**; status in the project: C

2.4.4. List of projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education, VEGA (for funding specify only total sum obtained from all VEGA grants in a particular year)

	Project title	Type / Project number	Duration	Funding for the Institute (EUR) / all project duration	Role of the Institute Responsible person
2016	Mechanisms of gold and magnetic nanoparticle effects on renal cells	VEGA 2/0113/15	01/2015 – 12/2018	2 838.00 €	I Filip Rázga
	Characterization of complex organic compounds under meso-scale spatial restriction using external probing techniques)	VEGA 2/0030/16	01/2016 – 12/2019	23 540.00 €	C Josef Bartoš
	Interactions of surfaces modified by poly(ethylene oxide) with free polymers	VEGA 2/0098/16	01/2016 – 12/2019	21 584.00 €	C Zuzana Benková
	Composite and smart nanoparticles and nanomaterials: preparation, modification and collective properties	VEGA 2/0040/14	1/2014 - 12/2017	6 032.00 €	C Ignác Capek
	Structural transitions of confined semi-flexible macromolecules	VEGA 2/0055/16	1/2016 – 12/2019	15 378.00 €	C Peter Cifra
	Photochemically active systems and probes for polymer research	VEGA 2/0112/13	1/2013 – 12/2016	11 863.00 €	C Martin Danko
	Micro- and nanofibers from natural resources on the base of saccharides and proteins prepared by electrospinning	VEGA 2/0142/14	1/2014 - 12/2016	4 593.00 €	C Anita Eckstein
	Relaxation and time dependent effects at deformation of multiphase systems with polymeric matrix	VEGA 2/0108/14	1/2014 - 12/2017	13 371.00 €	C Ivan Chodák
	Pre-oxidation of polymers on their route to biodegradation	VEGA 1/0122/15	1/2015 - 12/2017	7 934.00 €	C Ivica Janigová
	Biodegradable polymers for agricultural applications and food packaging	VEGA 2/0167/14	1/2014 - 12/2016	5 856.00 €	C Jozef Kollár
	Polymers based on 2-oxazolines for targeted	VEGA 2/0163/15	1/2015 - 12/2017	10 843.00 €	C Juraj Kronek

	drug delivery and controlled cell adhesion				
	Biocompatibility study of polymers and polymeric materials suitable for biomedical applications. In vitro analysis of cytotoxicity and cell response at the signal transduction level	VEGA 2/0156/15	1/2015 - 12/2017	12 025.00 €	C Zuzana Kroneková
	Kinetics and bioapplications of zwitterionic polymers	VEGA 2/0198/14	1/2014 – 12/2016	13 115.00 €	C Igor Lacík
	Investigation of surface, adhesive and antibacterial properties of selected medicinal polymers modified by low-temperature plasma.	VEGA 2/0199/14	1/2014 - 12/2016	2 825.00 €	C Igor Novák
	Polymeric nanocomposites and hybrids and their applications as sensors and actuators	VEGA 2/0149/14	1/2014 – 12/2017	40 248.00 €	C Mária Omastová
	Nanostructured polymers and polymer nanostructure	VEGA 2/0068/13	1/2013 – 12/2016	701.00 €	C Dušan Račko
	Modeling and synthesis of hybrid conjugated systems for anticancer therapy	VEGA 2/0094/15	1/2015 - 12/2018	16 226.00 €	C Filip Rázga
	Oxidative and hydrolytic aging of cellulose derivatives as an important factor of flammability changes	VEGA 2/0161/14	1/2014 – 12/2016	3 583.00 €	C Jozef Rychlý
	Electrically conductive polymer nanocomposites based on the nanostructured graphite	VEGA 2/0093/16	1/2016 – 12/2019	60 246.00 €	C Zdenko Špitálský
	(Preparation of polymeric microspheres via internal gelation in emulsion and critical evaluation of their properties toward functional treatment of type I diabetes	VEGA 2/0059/16	1/2016 / 12/2018	9 018.00 €	C Dušana Treľová
2017	Development and study of polymers and polymeric materials based on renewable resources	VEGA / 2/0158/17	1/2017 – 12/2020	86 648.00 €	C Martin Danko

	New electro- and photo-active derivatives for small molecules and polymer systems	VEGA / 2/0161/17	1/2017 – 12/2020	27 436.00 €	C Anita Eckstein
	Preparation and characterization of the structure and properties of biodegradable multiphase modified-starch-based polymeric materials)	VEGA / 1/0570/17	1/2017 - 12/2020	15 272.00 €	I Ivan Chodák
	Microstructure and the sorption properties of the carbon fibres prepared by the carbonizing cellulose precursors	VEGA / 2/01271 /17	1/2017 – 12/2020	1 752.00 €	I Helena Švajdenková
2018	Combined polymer systems for cancer immunotherapy	VEGA / 2/0124/18	1/2018 – 12/2020	46 210.00 €	C Zuzana Kroneková
	Preparation and characterization of polymeric materials based on thermoplastic starch	VEGA / 2/0019/18	1/2018 – 12/2021	12 100.00 €	C Katarína Mosnáčková
	Polymeric materials for advanced application	VEGA / 2/0019/18	1/2018 – 12/2021	68 578.00 €	C Mária Omastová
2019	Preparation and study of polymer gels for protection of cultural heritage	VEGA / 1/0602/19	1/2019 – 12/2022	8 699.00 €	I Juraj Kronek
2020	Structural-dynamic properties of oligomers and polymers in the bulk and confined states of porous inorganic matrices.	VEGA / 2/0005/20	1/2020 – 12/2023	2 415.00 €	C Josef Bartoš
	Protection of surfaces against protein adsorption: poly(ethylene oxide) vs poly(2-oxazoline)	VEGA 2/0122/20	1/2020 - 12/2023	10 734.00 €	C Zuzana Benková
	Utilization of controlled polymerizations in the preparation of nano-particles and composites.	VEGA 2/0161/20	1/2020 – 12/2023	15 643.00 €	C Dmitrij Bondarev
	Microspheres based on dual non-covalently and covalently crosslinked alginates with self-healing properties for cell encapsulation	VEGA 2/0140/20	1/2020 – 12/2023	13 345.00 €	C Abolfazl Heydari

	Radical polymerization of water-soluble monomers: the effect of molecular interactions on the polymerization kinetics and mechanism	VEGA 2/0121/20	1/2020 – 12/2022	28 526.00 €	C Igor Lacík
	Molecular dynamics simulations of topologically confined and constrained polymers	VEGA 2/0102/20	1/2020 – 12/2023	12 982.00 €	C Dušan Račko
	Polymer Composites for 3D Printing	VEGA 2/0051/20	1/2020 – 12/2023	6 915.00 €	C Zdenko Špitálsky
	Influence of microstructure and dynamics on the crosslinking process and the properties of cured polymers	VEGA 2/0029/20	1/2020 – 12/2022	7 688.00 €	C Helena Švajdlenková
2021	Polymers and polymeric materials with added value from renewable resources.	VEGA 2/0168/21	1/2021 – 12/2024	22 515.00 €	C Martin Danko
	Development of immunoactive polymer carriers for photodynamic therapy.	VEGA 2/0172/21	1/2021 – 12/2023	6 612.00 €	C Zuzana Kroneková
	Influence of supramolecular structure on ultimate properties of blends of biodegradable polymers with thermoplastic starch	VEGA 1/0751/21	1/2021 - 12/2024	4 126.00 €	I Katarína Mosnáčková

2.4.5. List of projects supported by EU Structural Funds

1. Title: *Building-up Centre of Excellence for Advanced Materials Application Operational Programme: 313000 – OP Research and Innovation*; code ITMS: 313021T081; duration: 7/2019 – 6/2023; funding: 60 640 €; responsible person: **Jaroslav Mosnáček**; status in the project: I

2. Title: *Innovation of the product portfolio of the company Novplasta*
grant No.: NFP313020W110; duration: 1.8.2020 / 31.7.2023; funding: 35 910 €; responsible person: **Zdenko Špitálsky**; status in the project: I

2.4.6. List of other projects funded from national resources

Projects of 7RP - SASPRO

1. Title: *Conjugated Antisense system for Selective and Specific BCR-ABL supprEssion: An innovaTive straTegy for CML treatment*
   Grant No.: SASPRO 0057/01/02; duration: 04/2015 – 03/2018; funding: 146 658.00 € co-funded by Maria Curie Actions; responsible person: **Filip Rázga**; status in the project: C

2. Title: *ANTIbacterial GRaphene/POlymer NANOcomposite*
   Grant No.: SASPRO 1237/02/02; duration: 12/2015 – 11/2018; funding: 207 450.75 € co-funded by Maria Curie Actions; responsible person: **Zoran Marković**; status in the project: C

3. Title: *Functional Star Architectures Based On Cyclodextrin Cores And Bioinspired Synthetic Arms For Versatile Drug Delivery Systems*
   Grant No.: SASPRO 1237/02/02; duration: 01/2016 – 12/2018; funding: 183 534.06 € co-funded by Maria Curie Actions; responsible person: **Christian Peptu**; status in the project: C

Project Joint Research Program; International Visegrad Fund

1. Title: *The synthesis of well-defined new copolymers using living polymerization methods and advanced chromatographic techniques*
   grant No.: SAS-MOST Taiwan JRP 2014; duration: 1/2015 – 12/2017; funding: 25 000.00 €+ 25000 €; responsible person: **Jaroslav Mosnáček**; status in the project: C

2. Title: *Polymeric Adaptable Networks toward the Fabrication of High-performance Materials*
   grant No.: SAS-MOST JRP 2019/07; duration: 1/2020 – 12/2022; funding: 50 000.00 €; responsible person: **Martin Danko**; status in the project: I

3. Title: *Pb-free Perovskite solar cells with Long-term stability*
   grant No.: V4-Kórea Joint Research Program on Chemistry and Chemical Engineering; duration: 11/2017 – 10/2020; funding: 75 000 €; responsible person: **Mária Omastová**; status in the project: I

4. Title: *Black metals decorated with surface receptors as high potentiality materials for gas sensing*
   grant No.: V4-Japan Blacksens; duration: 11/2021 – 10/2024; funding: 3 600.00 €; responsible person: **Matej Mičušík**; status in the project: C

5. Title*: Photovoltaic and sensor properties of plasma and chemical functionalized graphene and carbon nanotubes*; grant No.: SAS - TÜBITAK JRP 2014 /2; duration: 12/2014 – 11/2017; funding: 62 837 €; responsible person: **Mária Omastová**; status in the project: C

6. Title: *Soft Skills Workshop for Young Scientists*; grant No.: 21710053; duration: 6/2017 – 11/2017; funding: 5 988 €; responsible person: **Anna Zahoranová**; status in the project: C

Project MVTS - COST

1. Title: *New materials and devices based on conducting polymers and their composites.*
   grant No.: MVTS - COST Polycon01DS15015; duration: 1/9.2015 – 1/2016; funding: 292 € from national sources; responsible person**: Mária Omastová**; status in the project: I

2. Title: *Stable Next-Generation Photovoltaics: Unraveling degradation mechanisms of Organic Solar Cells by complementary characterization techniques (StableNextSol)*
   grant No.: MVTS - COST MP 1307; duration: 2/2015 – 3/2018; funding: 3500 € from national sources; responsible person: **Mária Omastová**; status in the project: I

3. Title: *Innovative application of regenerated wood cellulose fibers*; grant No.: MVTS - COST MP 1205; duration: 5/2013 – 5/2017; funding: 3500 € from national sources; responsible person: **Alena Šišková**; status in the project: I

4. Title: *Electrospun nano-fibres for bioinspired composite materials and innovative industrial applications*; grant No.: MVTS - COST MP 1206; duration: 5/2012 – 5/2017; funding: 4 813 €; responsible person: **Mária Omastová**; status in the project: I

Project mobility

1. Title: *Andvanced LC-MSn for characterization of bio-polymers and their degradation products* grant No.: SAV-PAV MAD; duration: 1/2016 – 12/2018; funding: Mobility; responsible person: **Alena Šišková**; status in the project: C

2. Title: **Synthesis of functionalized biocompatible polyester copolymers**
grant No.: SAV-PAV MAD; duration: 1/2016 – 12/2018; funding: Mobility; responsible person: **Martin Danko**; status in the project: C

3. Title: *Molecular simulation study of the wetting behavior of polymer grafted silica surface*; grant No.: INT/PORTUGAL/P-05/2013; duration: 1/2014 – 1/2017; funding: mobility; responsible person: **Zuzana Benková**; status in the project: I

4. Title: *The Advanced Biomaterials Group (ABIOG)*; grant No.: 21620101; duration: 9/2016 – 3/2017; funding: mobility; responsible person: **Zuzana Kroneková**; status in the project: I

5. Title: *The Chicago Diabetes Project: Global collaboration for a functional cure*; grant No.: -; duration: 1.5.2007; funding: mobility; responsible person: Igor Lacík; status in the project: I

6. Title: *Dye-sensitized solar cell based on perovskite solid-state electrolyte (DOPE)*; grant No.: Projekt KONNECT Joint Call on “Resources and Sustainability”; duration: 9/2016 – 8/2018; funding: 24 887.00 € from national sources; responsible person: **Mária Omastová**; status in the project: I

7. Title: *External probe characterization of the confined organics*; grant No.: DAAD-SAV 2014-15; duration: 2/2014 – 12/2016; funding: mobility; responsible person: **Josef Bartoš**; status in the project: I

8. Title: *Safety and quality of food in nanotechnology*; grant No.: NORTE-01-0145-FEDER-000011; duration: 9/2016 – 7/2017; funding: mobility; responsible person: **Mária Omastová**; status in the project: I

9. Title: *Molecular dynamics simulations of PEO-modified surfaces immersed in a matrix of homopolymer melts or solutions*; grant No.: SFRH/BPD/90265/2012; duration: 4/2013 – 9/2016; funding: mobility; responsible person: **Zuzana Benková**; status in the project: I

10. Title: *Luminescent silk nanofibers as platforms for sensing devices*; grant No.: SAV-CNR Taliansko; duration: 1/2016 – 12/2017; funding: mobility; responsible person: **Martin Danko**; status in the project: C

11. Title: *Bio-friendly multifunctional polymers*; grant No.: SK-HU MAD; duration: 1/2016 – 12/2018; funding: mobility; responsible person: **Jaroslav Mosnáček**; status in the project: C

12. Title: *Antibacterial properties of polymers modified by low-temperature plasma*; grant No.: -; duration: 1/2014 – 12/2016; funding: mobility; responsible person: **Igor Novák**; status in the project: C

13. Title: *Study of surface and adhesive properties of polyimide and its copolymers*; grant No.: -; duration: 1/2012 – 12/2016; funding: mobility; responsible person: **Igor Novák**; status in the project: C

14. Title: *Antibacterial modification of polymers*; grant No.: -; duration: 1/2017 – 12/2017; funding: mobility; responsible person: **Igor Novák**; status in the project: C

15. Title: *Cationic poly(2-oxazolines) for gene delivery and drug delivery applications*; grant No.: MAD; duration: 1/2018 – 12/2020; funding: mobility; responsible person: **Juraj Kronek**; status in the project: C

16. Title: *Štúdium povrchových a adhéznych vlastností polyimidu a jeho kopolymérov*; grant No.: - ; duration: 1/2018 – 12/2018; funding: mobility ; responsible person: **Igor Novák** ; status in the project: I

17. Title: *Advanced Functional Polymers toward the Fabrication of High-performance Materials*; grant No.: MAD SAV - PAV; duration: 1/2019 – 12/2021; funding: mobility; responsible person: **Martin Danko**; status in the project: C

18. *Title: Well-Defined Functional Polymers; grant*; No.: MAD SK-HU; duration: 1/2019 – 12/2021; funding: mobility; responsible person: **Jaroslav Mosnáček**; status in the project: C

19. Title: *Predictive study under composting conditions of bioactive materials obtained by electrospinning*; grant No.: MAD; duration: .1/2019 – 12/2021 funding: ; responsible person: **Alena Opálková Šišková**; status in the project: C

20. Title: *Propagation kinetics of sodium acrylate monomer studied by SP–PLP–EPR*; grant No.: DAAD ; duration: 9/2019 – 12/2019; funding: mobility; responsible person: **Eva Dušička**; status in the project: C

2.4.7. List of projects funded from private funds

1. Title: *Multicomponent microcapsules for allogeneic islet transplantation in a comprehensive, preclinical non-human primate model*; JDRF, grant No.: 2-SRA-2014-288-Q-R; duration: 11/2014 – 10/2017; funding: 70 597.00 €; responsible person: **Igor Lacík**; status in the project: I

2. Title: *New generation PMCG multicomponent microcapsule with tailored biointerface to avoid immune response after transplantation*; JDRF, grant No.: 2-SRA-2018-521-S-B; duration: 09/2017 – 08/2020; funding: 94 458.00 €; responsible person: **Igor Lacík**; status in the project: C

3. Title: *Testing of multicomponent PMCG microcapsules in the NHP preclinical model*; The Chicago Diabetes Project, duration: 01.2018 – 8.2019; funding: 100 000 USD, **Igor Lacík** – status in the project: principal investigator

4. Title: *Development of modified compositions based on rubber regenerate* produced by RESUMO, Ltd..Contract research for the company RESUMO, Ltd., project duration 05, 2021 – 10.2022, total budget 4 000 €. **Ivan Chodák**, status in the project: I

2.4.8. List of projects funded from other competitive funds

SAIA projects

1. Title: *Chromophore-labeled bacterial cellulose used in sensors (ChromBakCel)*, Istituto di Scienze e Tecnologie Chimiche “Giulio Natta”, CNR, Italy, duration: 2/2020 – 3/2020, (completed 1 month out of approved 3 due to COVID-19), responsible person: **Anita Eckstein**
2. Title: *Computer molecular dynamics simulations of surfaces modified by polymer chains*, Department of Chemistry and Biochemistry, Faculty of Sciences, University of Porto, Portugal, duration: 9/2019 – 11/2019, responsible person: **Peter Čakánek**

DoktoGrant (funded by Slovak Academy of Sciences for projects of PhD students)

1. Title: Multifunctional cellulosic fiber prepared by SI-photoinduced ATRP, 2019; responsible person: **Gamal Zain**

Starting grants (funded by Polymer Institute SAS for projects of young researchers)

1. Title: Chitosan-cylodextran-based hydrogel formed by click reaction for 3D cell encapsulation, 2019; responsible person: **Abolfazl Heydari**
2. Title: Investigation of interactions of surfaces covered by polymer chains using molecular dynamics simulation, 2019, responsible person: **Peter Čakánek**
3. Title: Gene Vectors based on Tulipalin A, 2018, responsible person: **Falko Pippig**
4. Title: Preparation of partialy hydrolized chiral poly(2-oxazoline)s with chirality in the main chain and effect on the biocompatibility and formation of polyplexes with DNA, 2018, responsible person: **Marián Smolíček**

2.5. PhD studies and educational activities

2.5.1. List of accredited programmes of doctoral studies, period of validity, source of funding

Accredited study fields of doctoral studies until August 31, 2019

Study field	Code	University, Faculty
Physical Chemistry	4.1.18	Comenius University in Bratislava, Faculty of Natural Sciences
Macromolecular Chemistry	4.1.19	Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology
Technology of Macromolecular Materials	5.2.21	Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology

Accredited study fields and programmes of doctoral studies since September 1, 2019

Study field	Study programmes	Code	University / Faculty
Chemistry	Physical Chemistry	1420	Comenius University in Bratislava, Faculty of Natural Sciences Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology[a]
Chemistry	Macromolecular Chemistry[b]	1420	Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology
Chemistry	Organic Chemistry	1420	Comenius University in Bratislava, Faculty of Natural Sciences[a] Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology[a]
Chemical Engineering and Technology	Technology of Polymer Materials	2820	Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology

[a] From January 30, 2020 with the Faculty of Natural Sciences, Comenius University in Bratislava, from Month No, 2020 with the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava.

[b] as subprogramme of Physical Chemistry from the academic year 2021/2022.

2.5.2. Summary table on doctoral studies (number of internal/external PhD students at the end of the year; number of foreign PhD students, number of students who successfully completed their theses during the year, number of PhD students who quit the programme during the year*)*

PhD study	2016			2017			2018			2019			2020			2021		
Number of potential PhD supervisors	21			21			23			23			21			24		
PhD students	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted	unumber, end of yea	defended thesis	students quitted	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted
Internal total	12	1	2	13	3	0	10	4	1	13	2	1	17	1	0	15	1	4
from which foreign citizens	2	0	0	2	1	0	3	0	0	7	0	0	11	0	0	9	1	3
External	1	0	0	1	0	0	2	1	0	1	0	1	1	0	0	0	0	0
Other supervised by the research employees of the institute	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2.5.3. PhD career path – Information on the next career steps of the PhD graduates who received their degree from the institute

Name of the PhD student	PhD graduation year	Position after PhD graduation
Mgr. Anna Zahoranová, PhD.	2016	Post-doc at Vienna University of Technology, Faculty of Chemical and Food Technology, Vienna, A
Ing. Jozef Prachár, PhD	2017	Post-doc in Germany, now works in Slovakia
Mgr. Petra Šrámková, PhD.	2017	Post-doc at Masaryk University, Plasma Nanotechnologies and Bioapplications, Brno, CZ
Ing. Jaroslav Kulíček, PhD	2017	Post-doc in Czech Repubic
Ing. Anna Chovancová, PhD.	2018	Post-doc at PI SAS
Mgr. Petra Mazancová, PhD.	2018	Researcher, Selecta Biotech SE, Bratislava, SK
Mgr. Veronika Némethová, PhD.	2018	Researcher, Selecta Biotech SE, Bratislava, SK
Ing. Eliška Číková, PhD	2018	Works for international IT company
Ing. Martina Hudáková, PhD.	2018	head of the product assessment department, Fire Engineering and Expertise Institute of the Ministry of Interior
Ing. František Ivanič, PhD	2019	Works for Slovak company
Ing. Nikola Bugárová, PhD	2019	Post-doc stay in Czech Republic and Austria, currently post-doc at PI SAS
Mgr. Mária Kováčová, PhD	2020	Post-doc at PI SAS, from 2022 a Post-doc in Czech Republic
Ing. Anna Hološ, PhD.	2021	Returned to Serbia

2.5.4. Summary table on educational activities

Teaching	2016	2017	2018	2019	2020	2021
Lectures (hours/year)*	40	166	31	44	24	35
Practicum courses (hours/year)*	355	915	657	419	156	289
Supervised diploma and bachelor thesis (in total)	4	5	8	3	2	6
Members in PhD committees (in total)	10	10	7	7	7	5
Members in DrSc. committees (in total)	3	3	0	0	1	0
Members in university/faculty councils (in total)	3	5	3	6	6	5
Members in habilitation/inauguration committees (in total)	2	1	2	0	1	0

2.5.5. List of published university textbooks

No such items.

2.5.6. Number of published academic course books

No such items.

2.5.7. List of joint research laboratories/facilities with universities

No such items.

2.5.8. Supplementary information and/or comments on doctoral studies and educational activities – focused on what changes have occurred since the last evaluation in 2016

PI SAS performs doctoral studies as an external educational institution based on the contract with 2 faculties of 2 largest Slovak universities, i.e., Faculty of Chemical and Food Technology of the Slovak University of Technology (FCFT) and Faculty of Natural Sciences of the Comenius University (FNS). Till 2020, these doctoral studies could be carried out only in the Slovak language in 2 study programmes, i.e., Macromolecular Chemistry and Technology of Polymer Materials, at FCFT, and 1 study programme, i.e. Physical Chemistry, at FNS. Since 2020 the contract with the universities was extended to other study programmes, i.e. Physical Chemistry at FCFT and Organic Chemistry at both FCHPT and FNS, including the possibility to conduct doctoral studies in all study programmes also in English language. This extension enabled a broadening of the base of potential PhD candidates from both Slovakia and abroad. In addition, two employees of the institute are validated as PhD supervisors at Faculty of Technology of Tomas Bata University in Zlin, Czech Republic, in the study programme Technology of Macromolecular Substances. Based on this, there has already been communication with the Dean of the Faculty toward the possibility for PI SAS to act as an external educational institution for this University. It should be noted that as a result of these discussions, the Memorandum on the PhD study was signed in May 2022 between the Rector of Tomas Bata University and the President of the Slovak Academy of Sciences, allowing the completion of this process in the near future.

The possibility to conduct doctoral studies in the English language led to a dramatic increase in the ratio of foreign to Slovak PhD students during the last years, as can be seen from Table 2.5.2. At the same time, it also increased the number of applicants for PhD study and allowed to selection of PhD students of higher quality. Considering this fact, the management of the institute adopted a strategy to cover a few PhD students from institutional budget when the number of high-quality applicants is higher than the capacity allocated by the Slovak Academy of Sciences. However, here it has to be pointed out that selection of PhD students from many foreign applicants from various

countries, without a deeper knowledge on their study and personal history, it is rather difficult and risky to verify the quality of the student only based on online communication and provided recommendation letters. This is connected with an increased number of the PhD students who terminate their study after the 1st or 2nd year. This puts additional load on the PhD training process and institute resources without the expected outcome.

In order to ensure a high quality of the PhD study at PI SAS, apart from the lectures and examination associated with the PhD studies at the universities, the PhD students are evaluated annually by the Scientific Board of PI SAS. This evaluation is based on presentation (in English), discussion of results, overall activity, and outcomes. In 2020, new requirements, that need to be fulfilled by PhD students during their 4 years studies, were prepared by garants of doctoral study fields at PI SAS and the Scientific Board of PI SAS as a document "Internal quality assurance system for doctoral studies". This document was validated by the Committee for PhD of the Slovak Academy of Sciences. The requirements are as follows: a) minimum 2 publications and 1 submitted manuscript in Q1 or Q2 journals registered in WOS, while in at least one publication containing the results from thesis the student has to be the first author or the publication has to be published in a journal with IF > 4; b) minimum 1 active presentation at the international conference; c) at least one oral presentation at national or international conference; d) research stay at the foreign institute for at least 2 weeks; e) successful pre-defense with positive review from the internal reviewer.

The PhD quality is further assured by a) careful selection of PhD supervisors, who, in addition to their scientific quality, must be able to cover also the costs associated with the PhD student research and participation in conferences; b) evaluation of the submitted PhD topics; c) acting of PI SAS scientists as lecturers for PhD students within the courses organized by FCFT.

In addition to doctoral studies, PI SAS scientists also participate as lecturers for undergraduate (Bc) and MSc students at FNS, FCFT, Faculty of Materials Science and Technology STU in Trnava, and Faculty of Technology of Tomas Bata University in Zlin (Czech Republic). During the last years, several MSc and bachelors' theses of students from the above universities were completed at PI SAS.

Overall, it can be stated that PI SAS is having a high-quality research staff capable of lecturing various subjects at the relevant universities. Nevertheless, the interest from these universities remains to be low likely due to a low number of students and relatively high number of own lecturers. During the evaluation period, Dr. J. Mosnacek, participated in the preparation of a new textbook entitled "Syntéza a vlastnosti polymérov "(English translation: Synthesis and properties of polymers), which is going to be published by FCFT in 2022. Dr. Mosnacek contributed 2 chapters describing modern methods for polymer synthesis, namely reversible deactivation radical polymerization and ring opening polymerization techniques, which have not been included in any Slovak textbooks so far.
Regularly, there is an interest from students from Slovak as well as foreign universities and high schools to do their summer internship at the institute. In addition, students and young researchers from abroad use the Erasmus or SAIA programmes to gain practical experience and education related to the PI SAS expertise.

List of students within summer internships and employed as scientific support forces:

- Natália Szabóova from the University of Strathclyde in Glasgow, UK – preparation of nanomaterials
- Petra Maxiánova from University of Ss. Cyril and Methodius in Trnava – preparation of photoactive derivatives
- Marcela Gašparová from University of Ss. Cyril and Methodius in Trnava – preparation of photoactive derivatives
- Daniela V. Ciesarova from Faculty of Science, Charles University, Prague, Czech Republic – preparation of photoactive derivatives
- Elena Bendová from Faculty of Arts of Masaryk University, Brno, Czech Republic – preparation of electrospun nanofiber
- Mário Otočka from FNS - electrospinning
- Zuzana Holková from FNS – electrospinning

- Réka Penczinger from Pharmacology at University College London – preparation of nanomaterials
- Alexandra Mýtniková form Mercury Private High School form Bratislava – preparation of nanoparticles
- Katarína Sujová form Mercury Private High School form Bratislava – preparation of nanoparticles
- Terézia Štrbová from FCFT – furan base derivatives
- Lea Babejová from FCFT– characterisation of gels, cryogels
- Simona Ilkova from University of Ss. Cyril and Methodius in Trnava – preparation of photoactive derivatives – preparation and characterisation of pentafluorophenyl-1H-pyrrol derivatives
- Dorota Gašparíková from Warwick University, UK – electrospinning and chemical modification of electrospun membranes on the base of acetate cellulose
- Patrícia Šablicová - compulsory practice, secondary vocational school of chemistry, Bratislava – preparation of nanofibrous membranes by electrospinning from natural polymers
- Martin Országh from Gymnázium I. Lettrich in Martin
- Viktória Levkaničová, a high-school student, London, UK – contemporary topics in polymeric materials
- Veronika Brngálová, Vienna University, Austria – kinetics of radical polymerization
- Dominika Prokopová, Comenius University Bratislava - kinetics of radical polymerization and microcapsules for cell encapsulation
- Renáta Raptová, master student Faculty of Chemical and Food Technology STU in Bratislava, Preparation and study of polymeric composites with 2D nanoparticles
- Katarína Čangelová, VUT Brno, Czech Republic – synthesis of polymers from renewable monomers
- Kristína Dicová, Comenius University in Bratislava – synthesis of organocatalysts

List of foreign MSc and PhD students coming for research stay funded by Erasmus or SAIA programmes:

1. Sharmain Luk, Canada, SAIA, 5/2016 – 8/2016
2. Paulina Maczugowska, Poland, ERASMUS, 8/2016 - 9/2016
3. Krzysztof Jerczynski, Poland, ERASMUS, 10/2017 – 2/2018
4. Monika Zygo: Poland; ERASMUS, 1/2018 - 3/2018
5. Khadiga Mohammed, Egypt, SAIA, 9/2018 – 10/2018
6. Serhii Yakushchenko, Ukraine, SAIA, 11/2018 – 2/2019
7. Monika Zygo: Poland; SAIA project, 5/2019 – 6/2019
8. Elif Kaymallar: Turkey, ERASMUS, 7/2019
9. Anna MariaTryba: Poland, ERASMUS, 8/2019 – 10/2019
10. Marlena Ostrysz: Poland, ERASMUS, 9/2019 – 1/2020
11. Marijana Ponjavic: Serbia, SAIA project, 2/2020 – 5/2020

2.6. Societal impact

2.6.1. The most important case studies of the research with direct societal impact, max. 4 for institute with up to 50 average FTE researchers per year, 8 for institutes with 50 – 100 average FTE researchers per year and so on. Structure: Summary of the impact; Underpinning research; References to the research; Details of the impact; Sources to corroborate the impact. One page per one case study

1. Study of the suitability of methodology for the restoration of Miracle of Loaves and Fishes by Zanussi

Summary of the impact:

Investigation of suitability of the methodology for the restoration of Miracle of Loaves and Fishes by Zanussi using the attenuated total reflectance - Fourier transform infrared spectroscopy proved the suitability of the methodology for the restoration and preservation of cultural heritage for the next generation.

Underpinning research:

The large-format painting, Miracle of the Loaves and Fishes by Zanussi, from the seminary of st. Gorazd in Nitra (Slovakia), dated 1775, was retrieved in critical condition. Along with heavy soiling, damage caused by leaking wastewater, numerous tears, and perforations, extensive overpainting was evident. Overpainted areas loosely correspond to visible mechanical damage on the verso of the painting. The adhesive of the patches over mechanical damages caused severe deformation of the original canvas and subsequently delamination of the paint layer. Analysis of the original paint layer and overpainting revealed that Zanussi's studio used the oil-painting technique on the pigmented ground layer. An efficient and easy method was needed to remove the overpainting from the brittle original paint layer. The enzymatic treatment represents a reasonable and mild option for removing the overpainting. The efficiency of the proposed method was tested, first of all, on the designed model system. The linseed oil on the canvas was degraded and removed by the traditional approach by pure gels agar-agar, tylose, klucel G, and then by extracellular enzymatic media (EEM) and by the combination of the individual gels with the addition of EEM. The efficiency of all preparations was investigated by Attenuated total reflectance - Fourier transform infrared spectroscopy (ATR-FTIR) at the Polymer Institute of SAS. ATR-FTIR has been shown to be a suitable method for analyzing the effectiveness of restoration methodology. It was revealed that the combination of gels tylose and Klucel G with EEM is the best approach to remove overpainting. Other preparations, even EEM itself, were not effective enough. After confirming the correctness of the methodology, the parts of the painting were cleaned, and the efficiency was again monitored during cleaning by ATR-FTIR spectroscopy. It was confirmed that the painting was restored very effectively and could be returned to the seminary.

References to research:

Kisová, Z., Pavlović, J., Šefčiková, L., Bučková, M., Puškárová, A., Kraková, L., Opálková Šišková, A., Kleinová, A., Machatová, Z., Pangallo, D. Removal of overpainting from an historical painting of the XVIII century: A yeast enzymatic approach. Journal of Biotechnology, 2021, vol. 335, p. 55-64. https://doi.org/10.1016/j.jbiotec.2021.06.008

Details of Impact:

In the study of cultural heritage objects, the effectiveness of the restoration methodology has been confirmed at the Polymer Institute of SAS by ATR-FTIR spectroscopy. The restoration methodology was developed by the Institute of Molecular Biology of SAS. The procedure is based on an extracellular enzymatic mixture applied to remove the oil-based overpainting from a historical painting of the XVIII Century. Enzymatic treatment is the most delicate approach compared to traditional approaches such as chemical methods - water-based systems or organic solvents in the form of an emulsion, gel, or a pure solvent. Laser cleaning and mechanical cleaning or even microabrasion methods represent other options. However, these traditional approaches are invasive and often damage works of art. The main impact is the protection and restoration of the next generations' cultural heritage and monitoring during the restoration plays a key role.

Sources to corroborate the impact: -

2. The authenticity of documents (commercial agreement)

Summary of the impact:

Speeding up and consolidating the criminal justice system through the increased value of evidence gathered by multi-modal imaging techniques.

Underpinning research:

The authenticity of a multi-page (4 pages) printed and signed document sponsored by the Scientific Judicial Police Laboratory, Lisbon, Portugal, has been investigated. To meet the study's aims on verification of available multi-modal imaging techniques for forensic science, the round-robin testing methodology was used in different laboratories across Europe. The delivered documents, including printer toner, used paper, and pen ink used to make signatures, were investigated by Fourier transform infrared spectroscopy at the Polymer Institute of SAS.
Using FTIR, it was found that one of the pages of the official document (commercial agreement) had been falsified. This conclusion could be made by comparing the composition of the paper, showing that one of the papers in the document contained a different amount of inorganic filler than the others. Subsequently, the diverse composition of the printing ink on the paper, which was different from the others, was confirmed in the same way, as was the composition of the ink of the lips with which the contract was signed. In this case, it was explicitly a forgery of page no. 2, where the price of the contracted goods was stated. In the end, the results from all the laboratories were compared and evaluated. The sponsor confirmed our conclusion. Thanks to the FTIR, it turned out that we were among the most successful solvers of the assignment within a group of 18 laboratories across Europe participating in the testing. Thanks to a comprehensive library of model chemical compounds such as inks and dyes and historical and contemporary commercial paper, FTIR seems to be one of the most effective methods in detecting forged documents.

References to research: -

Details of Impact:

Verification of the usability of available imaging techniques for forensic science. Imaging technologies enable multiple physical and chemical information to be captured in one analysis from one specimen, with data being more easily conveyed and understood for more rapid exploitation. The 'enhanced' value of the evidence gathered will be conducive to much more informed investigations and judicial decisions, thus contributing to savings to the public purse and a speedier and more robust criminal justice system.

Sources to corroborate the impact: https://vedanadosah.cvtisr.sk/technika/ako-zlepsit-analyzy-kriminalistickych-dokazov/

3. Microcapsules for Pancreatic Islet Encapsulation and Type I Diabetes Therapy

Summary of the impact:

Microencapsulation of pancreatic islets represents a future treatment of diabetes type 1. Transplanted islets release insulin depending on the actual glucose level, thus, providing a physiological glucose control. The role of microcapsules is to protect transplanted cells from the attack by the immune system. The multicomponent microcapsule developed at PI SAS has been considered as a candidate for clinical studies based on previous animal studies in rodents and non-human primates. This microcapsule type has been extensively screened in our laboratories during the evaluating period. A new generation of microcapsules was prepared using the library of well-defined polymers that were synthesized to ensure the reproducible and sustained production of microcapsules. In parallel, the process of encapsulation was explored and microcapsules were characterized by advanced physico-chemical and biological methods. Extensive datasets were collected to establish the relationship between microcapsule characteristics and the in vivo performance of the implant since such information is insufficiently covered in the contemporary field of islets encapsulation. A significant position of PI SAS in this field is demonstrated by R&D contracts with Otsuka Pharmaceutical Factory, Ltd (Japan, ongoing contract), Beta-O_2 Technologies Ltd. (Israel), Beta Cell NV (Belgium), the projects from Juvenile Diabetes Research Foundation (New

York, USA, I. Lacík PI and co-PI of the projects) and participation in activities of The Chicago Diabetes Project (Chicago, USA). PI SAS established the non-profit foundation Cukrovka n.f. that communicates new developments and achievements in the field of diabetes treatment to the lay public.

Underpinning research:

Our previous research has revealed serious concerns about the availability and/or quality of the key microcapsule polymeric components, poly(methylene-co-cyanoguanidine), sodium cellulose sulfate, and sodium alginate. Therefore, we synthesized the library of the first two polymers that were characterized and tested in microcapsule preparation. Selected empty microcapsules were tested in immunocompetent C57bl/6 mouse model and macaque monkeys used as pre-clinical non-human primate model. In a mouse model, microcapsules were highly biocompatible and encapsulated islets transplanted to diabetic animals reverted diabetes for at least 3 months. This promising behavior was not transferred to the monkey model, where obtained data indicated insufficient biocompatibility mainly due to deteriorated microcapsule stability. The optimization of these microcapsule characteristics represents our current direction in this topic.

References to the research:

- Adrian et al. Complexation of CXCL12, FGF-2 and VEGF with heparin modulates the protein release from alginate microbeads. International Journal of Molecular Sciences, 2021, 22, 11666, https://doi.org/10.3390/ijms222111666
- Kroneková et al. Structural changes in alginate-based microspheres exposed to in vivo environment as revealed by confocal Raman microscopy. Scientific Reports, 2018, 8, 1637. https://doi.org/10.1038/s41598-018-20022-y
- Bochenek et al. Alginate encapsulation as long-term immune protection of allogeneic pancreatic islet cells transplanted into the omental bursa of macaques, Nature Biomedical Engineering 2018, 2, 810 https://www.nature.com/articles/s41551-018-0275-1

Details of the impact:

The impact of this research is magnifold. Firstly, with respect to science and technology, our research provides guidelines for approaching the design of microspheres for cell encapsulation in diabetes treatment and, more generally, in any mode of cell therapy. This is based on thorough understanding of polymeric materials and microspheres as an implantable biomaterial. Secondly, we utilize and disseminate this knowledge targeting all the stakeholders in diabetes treatment. Thirdly, we contribute to the global knowledge that has a potential to introduce the diabetes treatment to a specific group of diabetes type 1 patients, for whom the other means of insulin delivery do not provide sufficient glucose control. This would impact on quality of life with all the beneficial consequences for the patients, their relatives and society.

Sources to corroborate the impact:

Tens of outputs to lay public have been delivered during the reporting period in TV, radio, social media, newspapers, lecture for diabetes associations to disseminate the current state in the field to all the relevant stakeholders. The establishing of the islet isolation and transplantation program in Slovakia has been one of the ongoing tasks, the process involving the Ministry of Health and hospitals with organ transplantation programs that is catalyzed by PI SAS.

2.6.2. List of the most important studies and/or other activities commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes (title, name of institution, contract value, purpose (max 20 words))

Name	Institution	Purpose	Contract value
Lacík Igor	Scientific Board at the Ministry of Health of Slovak Republic	Criteria and Guidelines to evaluate the scientific projects Working group for biomedicine and biotechnology for research and development capacities in RIS3	2017 –present
	Ministry of Health of Slovak Republic	Working group of the domain Healthy society	2019 - present
	IUPAC	Vice-president of the Polymer Division IUPAC	2020 - present
	Ministry of Education, Science, Development and Sport of the Slovak Republic	Slovak Committee for Scientific Degrees (DSc)	2012 - 2021
	Ministry of Health of Slovak Republic	Member of the Scientific board	2019 - 2020
		Czech Committee for Scientific Degrees (DSc) – member	2021 - present
Mosnáček Jaroslav	Ministry of Education, Science, Development and Sport of the Slovak Republic	Czech Committee for Scientific Degrees (DSc) – member	2018 - 2020
	Slovak Accreditation Agency	external reviewer for Slovak accreditation agency for universities	2020
	National Science Center of Poland	member of international panel of experts	2021
Peter Cifra	Ministry of Education, Science, Development and Sport of the Slovak Republic	Slovak Committee for Scientific Degrees (DSc) - Committee for Macromolecular Chemistry - chairperson	2018 - 2020
		Czech Committee for Scientific Degrees (DSc) – member	till 2018
Danko Martin	National Science Center of Poland	member of international panel of experts	2021
Omastová Mária	Ministry of Education, Science, Development and Sport of the Slovak Republic	Slovak Committee for Scientific Degrees (DSc)	2020 - present
Opálková Šišková Alena	Ministry of Education, Science, Development and Sport of the Slovak Republic	independent observer on ongoing opponent's beneficiary projects stimulus	2021
Špitálsky Zdenko	National Science Center of Poland	member of international panel of experts	2021

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues (study title, name of institution, contract value, country of partner, purpose (max 20 words))

1. **Kinetic coefficients and models for existing and future polymerization processes and systems at BASF;** BASF R&D contract, duration of the project: 9.2015-8.2018; funding 105 000 €; **Lacík Igor** – principal investigator
2. **Kinetic coefficients and models for polymerization processes: co- and terpolymerization studies in water, alcohols and their mixtures***.* BASF R&D contract, duration of the project: 04.2019-04.2022; funding 120 000 €; **Lacík Igor** – principal investigator
3. **Contract research with Otsuka Pharmaceutical Factory, Inc, Japan –** 12 individual studies on various topics in the field of microcapsule design in the period 2016 - 2021; funding total 134 000 €; **Lacík Igor** – principal investigator

2.6.4.1 List of intangible fixed assets (internally registered IP (confidential know-how), patent applications, patents granted, trademarks registered) denoting background IPR

1. BIOLOGICALLY DEGRADABLE POLYMERIC COMPOSITION WITH HIGH DEFORMABILITY
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Patent No.: 10-1651319; Country: Korea
   Patent No.: 2605592; Country: Russia
   Patent No.: 194040; Country: Singapur
   Patent No.: CN 103459498 (B); Country: Canada
   Patent No.: EP 2710076; Country: Europe
   Patent No.: JP 5830163 (B); Country: Japan

2. SPÔSOB VÝROBY NANOKOMPOZITNÉHO MATERIÁLU S ANTIBAKTERIÁLNYMI VLASTNOSŤAMI, TAKÝTO MATERIÁL A JEHO POUŽITIE
   (METHOD OF PRODUCTION OF NANO-COMPOSITE MATERIAL WITH ANTIBACTERIAL PROPERTIES, SUCH MATERIAL, AND ITS USE)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Patent No.: 288876 Country: Slovakia

3. MANUFACTURE METHOD OF NANOMATERIAL WITH ANTIBACTERIAL PROPERTIES, THE MATERIAL THEREOF, AND ITS USE
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Patent No.: EP3589682B1 Country: Europe

4. SPÔSOB PRÍPRAVY KOMPOZITNÉHO SORBENTU NA ODSTRAŇOVANIE KONTAMINANTOV Z VÔD
   (METHOD OF PREPARING A COMPOSITE SORBENT FOR REMOVAL OF CONTAMINANTS FROM WATERS)
   Owner: Polymer Institute of the Slovak Academy of Sciences; Dúbravská cesta 9; 845 41 Bratislava 45; Slovakia
   Patent No.: 288563

2.6.4.2 List of licences sold abroad and in Slovakia, incl. revenues (background IPR identification, name of institution, contract value, country of partner, purpose (max 20 words))

Licences sold in Slovakia

1. BIOLOGICALLY DEGRADABLE POLYMERIC COMPOSITION WITH HIGH DEFORMABILITY
   Licensee: Panara, a.s.; Country of partner: Slovak Republic
   Purpose: the production of the polymer material in the form of a granulate, a dry-blend, a semi-finished product or a final product, selling the produced products

   Licence No.: SG 194040 Country: Singapore
   Licence No.: CN 03459498 Country: Canada
   Licence No.: JP 5830163 Country: Japan
   Licence No.: KR 10-1651319 Country: Korea

Licenses sold abroad

1. Background IPR identification: SK patent No. 288563 ("Process for preparing a composite sorbent for removing contaminants from water")
   Licensee: AQUA+TECH SPECIALTIES SA
   Contract value:
   - EUR 2,500.00 for the subject matter of the agreement
   - royalties of 5 % of the sale turnover of the “composite sorbent”
   - royalties of 20 % of the sale turnover from any granted “composite sorbent” sub-licence

   Country of partner: Switzerland
   Purpose: use of the invention which is subject of the SK patent No. 288563
2. Background IPR identification: SK patent No. 288507 ("Method of manufacturing nanoporous carbon fibers from cellulosic precursors")
   Licensee: AQUA+TECH SPECIALTIES SA
   Contract value:
   - lump sum of EUR 2,500.00
   - royalties of 5 % of the sale turnover of the microporous carbon fibers
   - royalties of 20% from the remuneration from any granted sub-license for microporous carbon fibers

   Country of partner: Switzerland
   Purpose: use of the invention which is subject of the SK patent No. 288507

2.6.5. Summary of relevant activities, max. 300 words (describe the pipeline of valorization in terms of Number of disclosure, Number of registered IP internally, number of CCR/LIC contracts and their respective summary values, the support you are receiving in specific points internally at the institute, at SAS, externally – also the limitations and drawbacks.

As visible from the number of patents and patent applications, the PISAS management supports protection of the results, which can be potentially interesting for the private sector and can have a social impact in production of advanced products. Slovak patent applications and/or utility models are usually financially covered either from the budget of the institute or, if possible, from projects. The budget of the institute is however not sufficient to cover higher costs for protection on European/International level. For international protection the management therefore encourages the inventors to actively search for potential companies who could be interested in the protected know-how, especially during the first year after the Slovak patent application. PISAS close communicates also with the Cancelary for Technology Transfer in this area, but even they are very helpful in various agreements and contracts preparation as well as communication when some potential bidder is found, we feel that they also have quite limited capacities to help in communication with the private sectors to search the bidders. The Board for external communication was created at the institute in

2020, among the others also with the aim to intensify the communication with the private sector and promote, not only the protected, research results. The pandemic, however, has not allowed more intensive communications so far. In addition, the management of the institute plans to create a new department focused on valorization of the research results. The aim is to create a small team of researchers who will identify: a) research results with potential to be interesting for the private sector; b) identify the potential bidders of the protected as well as new research results; c) identify possible schemes of financial support for small production.

2.7. Popularization of Science (outreach activities)

2.7.1. List of the most important popularization activities, max. 20 items

These are items selected from more than 400 popularization activities mentioned in Table 2.7.2.

1. OPEN DAY on PI SAS, duration: 11/ 2016 – 2019; online: 2020 - 2021
2. RESEARCHER'S NIGHT / EUROPEAN RESEARCHER'S NIGHT – Festival of science, duration: 9/ 2016 – 2019 (exhibition stand); 9/2020 – 2021 (online)
3. WEEKEND WITH SLOVAK ACADEMY OF SCIENCES - VÍKEND SO SAV – PI SAS stand shows a lot from our main research to public; discussions in Živá kniha (Live book) about polymers in medicine, 2018, 2019
4. SPEKTRUM VEDY (Spectrum of science) RTVS (Slovak television), 30 minutes movie on Research and Development of Biodegradable Plastics in SAS and STU, Ivan Chodák, 24.9.2016
5. LAUREATE OF THE PRESTIGIOUS AWARD KRIŠTÁĽOVÉ KRÍDLO 2015 - Igor Lacík in TV Shows on TA3, STV 2, 2/2016
6. VEDA V CENTRE (Science in the center) - scientific discussion; CVTI; guest: Igor Lacík about diabetes treatment, 25.2.2016
7. VEDA A TECHNIKA (Science and Technology) – Slovak Radio International; guest: Igor Lacík about diabetes treatment, 10.2.2016
8. NÁJDI V SEBE VEDCA (Find a scientist in yourself) - organized for primary school students, 2017, 2018, 2019
9. RÁDIOBUDÍK – interviews with scientists about the life of a young scientist – Z. Kroneková, M. Danko, M. Mičušík, Z: Benková, Rádio Regina, 22.11.2017
10. TOP ŠTUDENTSKÁ OSOBNOSŤ ROKA 2016 (TOP STUDENT PERSONALITY OF THE YEAR 2016), V. Némethová – interviews 2016 in STV (Slovak Television), TA3 (News TV) Uj Szo (Daily news in hungarian language); 2017 in Denník Pravda (Daily News)
11. VEDKYŇA ROKA 2016 (Scientist of the year 2016) - M. OMASTOVÁ – in TV shows (TA3, RTVS 2), interview in Radio Slovensko (Slovak radio), articles in Denník SME, Denník N (slovak daily news), 2017
12. ROAD SHOW MLADÝCH VEDCOV PO ŠKOLÁCH (roadshow of young scientists in schools 2017), presentation and discussion with students and TV interview, M. Procházka, RTVS 2, Regional news, 10/2017
13. NOČNÁ PYRAMÍDA, RTVS (Slovak radio) discussion with M. Omastova 90 min https://www.rtvs.sk/radio/archiv/11436/728322, 3.8.2017; discussion with I. Lacík, 16.1.2019
14. NAOZAJ? SÚ PLASTY NAOZAJ TAK NEBEZPEČNÉ? (Really? Are plastics so dangerous?) Rádio Regina – Západ (Slovak regional radio), 20 minutes of questions, 13.10.2017, Ivan Chodák

15. EXPERIMENT scientific TV show, RTVS (Slovak television): 4.3.2021, Jednorazové plasty - disposable plastics, Mária Omastová; 25.3.2021 Nanočipy a biosenzory - Nanochips and biosensors, I. Lacík
16. GEN, 15 min movie about M. Omastova activities, RTVS (Slovak television), 12.12.2021
17. RANNÉ SPRÁVY RTVS – Morning TV News, RTVS (Slovak television), Matej Mičušík 1.3.2021, , https://www.rtvs.sk/televizia/archiv/14026/262473#2586
18. Exhibition Title Slovenskí vedci - prístup povolený (Slovak scientists – admission permitted) Panel exhibition of acknowledged slovak scientists, from PI SAS Mária Omastová, Igor Lacik and Ivan Chodak were selected. Date 20 September – 30 November 2021 in SLOVAK CENTRE OF SCIENTIFIC AND TECHNICAL INFORMATION, Bratislava
19. IXPO festival of technology, Biomaterials for medicine – discussion – Z. Kroneková, 2019
20. NANO-Art exhibitions - Use of technology for nanofibers production and study of various tread and structures used in textile applied art, traveling exhibition: TEXTILE ART OF TODAY-2016, 2017; DO NOT FALL, REUSE, MAINTAIN, NEARBY – FARAWAY – 2017, Festival Expo Conference: Touch the Future, Mini Market Faire - Najväčšia svetová prehliadka inovácií, kreativity a dômyselnosti – 2019; Prague Design Week – 2020, https://polymer.sav.sk/NANO-Art/#about

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2016	2017	2018	2019	2020	2021	total
Articles in press media/internet popularising results of science, in particular those achieved by the Organization	18	19	20	31	37	20	145
Appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	8	16	8	6	9	9	56
Public popularisation lectures	29	36	80	53	3	3	204

2.8. Background and management. Infrastructure and human resources, incl. support and incentives for young researchers

2.8.1. Summary table of personnel

2.8.1.1. Professional qualification structure (as of 31 December 2021)

	Degree/rank				Research position		
	DrSc./DSc	CSc./PhD.	professor	docent/ assoc. prof.	I.	II.a.	II.b.
Male	6	14	1	0	6	10	5
Female	1	15	0	0	1	7	9

I. – director of research with a degree of doctor of science/DrSc.

II.a – Senior researcher

II.b – PhD holder/Postdoc

2.8.1.2. Age and gender structure of researchers (as of 31 December 2021)

Age structure of researchers	< 31		31-35		36-40		41-45		46-50		51-55		56-60		61-65		> 65	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Male	4,0	2,5	6,0	4,2	0,0	0,0	5,0	5,0	4,0	4,0	0,0	0,0	1,0	1,0	0,0	0,0	5,0	3,5
Female	10,0	4,2	3,0	3,0	5,0	4,5	4,0	3,1	0,0	0,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	0,6

A – number

B – FTE

2.8.2. Postdoctoral fellowships (list of positions with holder name, starting date, duration. Add brief information about each fellow's career path before and after receiving PhD degree, etc.)

2.8.2.1. MoRePro and SASPRO fellowships

SASPRO fellowship

1. Filip Rázga; duration: 04/2015 – 03/2018
2. Zoran Marković; duration: 12/2015 – 11/2018. Before Vinča Institute of Nuclear Sciences, Vinča, Beograd, Serbia, after completing a fellowship returning back to the same institute. Cooperation with PI SAS continues in the frame of APVV (SRDA) bilateral project started on 01/2022
3. Christian Peptu; duration: 01/2016 – 12/2018

2.8.2.2. Stefan Schwarz fellowships

1. Anita Eckstein; duration: 06/2014 – 02/2016

2.8.2.3. Postdoctoral positions from other resources (specify)

1. Halyna Ohar, Ukraine, SAIA project 2/2016 – 9/2016
2. Magdalena Maksymiak, Poland, SAIA project 3/2016 – 8/2016
3. Ahmed Nada, Egypt, SAIA project 5/2016 – 6/2016 and 7/2018 – 9/2018
4. Sritama Bose, India, SAIA project 6/2017 – 9/2017
5. José Enrique Martín Alfonso, Spain, SAIA project 05/2017 - 06/2017
6. Hamed Peidayesh: Iran, postdoctoral fellowship, paid from running projects APVV, structural funds (2018 – 2019), partially supported from the Institute budget (30 % to 55 % in 2020 and 2021)
7. Eman AboBakr, Egypt, SAIA project 9/2018-11/2018
8. Soheila Behzadi: Iran, SAIA project, 3/2019 – 12/2019
9. Andrii Misiura: Ukraine, SAIA project, 4/2019 - 07/2019
10. Ajal Ghosal: India, SAIA project, 6/2019 – 7/2019
11. Martin Cvek: Czech Republic, SAIA project, 3/2020 – 10/2020
12. Michal Kawalec: Poland, postdoctoral fellowship, Visegrad project 3/2020-12/2020
13. Tuba Evgin" Turkey, SAIA project, 9/2021 – 7/2021

2.8.3. Important research infrastructure introduced during the evaluation period with the information about the sources of funding *(max. 2 pages)*

PI SAS infrastructure and the infrastructure available at the cooperating institutions allows for achieving the project goals. However, it needs to be specified that the situation is far from the required level with respect to purchasing new infrastructure and the running cost. Nationally, no systematic support exists regarding the infrastructure, i.e., regular infrastructure calls internally at SAS or externally at the national level. The Slovak Research and Development Agency, the major national agency for the scientific calls, does not provide the means to purchase the infrastructure with the limit of 1 700 EUR to purchase just small equipment. Therefore, the major infrastructure can currently be covered by Structural funds, which is not a predictable source of financial resources, EU-funded scientific projects, and contracts.

This situation is reflected in the selected infrastructure listed below:

2016

Potenciostat galvanostat SP-200. Device for electrochemistry and Electroimpedance spectroscopy (Bio-Logic Science Instruments, FRANCE). Financial source: project SAS- TÜBİTAK JRP 2014/2. Price - 16 600.00 €

2018

Digital microscope Leica DVM6 (Leica Microsystems, Germany). Digital microscope Leica DVM6 with objective PlanAPO FOV 12.55 with a big magnification range (40x – 675x) at a high working distance (33 mm). Financial source: project Interreg PlasticFreeDabube. Price - 29 447.82 €

2019

Laboratory Freeze-dryer Alpha 1-2 LDplus (Martin Christ Gefriertrocknungsanlagen GmbH, Germany). Bought from MEraNet Nano2Com project. Price 9 637.56 €

2020

Contact angle measurement OCA 25 (DataPhysics).
Joint finances from MERA.Net projects, Nano2Com, EPIC a En-ActivETICS. Price - ca 25 000.00 €. The OCA 25 is the device for contact angle measurements and droplet shape analysis. The sample table of the OCA 25 is adjustable along all three directions in space via precision axes.

2021

Modular Compact Rheometer Anton Paar MCR 702. Joint finance from MERA.Net projects, Nano2Com, EPIC and En-ActivETICS. Price - 36 990.00 €.

Modular rotational rheometer enabling measurement in rotation and oscillating mode equipped with the patented TruGap™, T-Ready™ and Toolmaster™ technology.

Milli-Q Integral 3, ultra-pure water system, 11 180.02 € (ERA.net M2Neural and contract research)

RI detector Waters 2410, determination of molecular weight of polymers, 9 360.00 € (contract research)

Plate spectrophotometer Multiscan FC, cell viability assays and ELISA, 7 162.80 € (Cukrovka non-profit foundation)

Freezer box Arctiko, -86°C / ULTF320, 7 748.00 € (VEGA 2/0124/18, H2020 NANO-2-COM)

Balances OHAUS – EXPLORER, analytical balances for exact weighing, 0.01mg - 220g, 3 462.00 € (VEGA 2/0121/20)

Isocratic HPLC pump, control panel Agilent 1260 Infinity instruments, Refractive index and UV detectors Knauer Azura required for important molecular characteristics of prepared polymers, following the polymerization kinetics and chromatographic analysis (totally ~ 25 000.00 €; financial source SAS-MOST JRP 2015 and 2019)

RI detector Knauer AZURA as a part of experimental SEC system for characterization of polymers (7 815.60 €, financial source SAS-MOST JRP 2019/07)

UV detector Knauer AZURA as a part of experimental HPLC system for characterization of additives (5 978.09 €, financial source VEGA 2/0158/17)**.**

Potentiostat/galvanostat PGSTAT204 + FRA32M Module for Cyclic Voltammetry (9 984.00 €, financial source SAS-MOST JRP 2019/07)

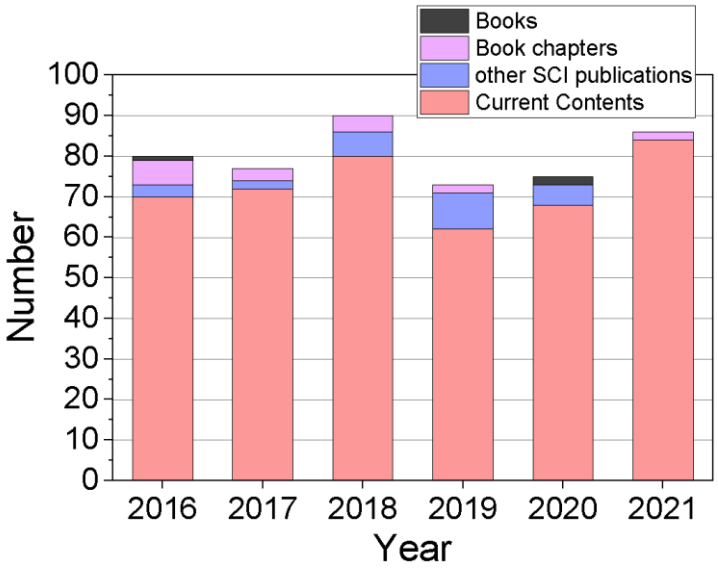
Rotary evaporator Heidolph (7 174.02 €, financial source SAS-MOST JRP 2019/07)

In-house High-performance computing (HPC) system - the system was extended by 4 new racks with total 144 CPU's, 12 new disks (16 TB), 2 remote network data storages 16 TB, 32 GB RAM, new cooling rack, new switch and router, new UPS and network adapters, new exhaust of air conditioning installed in basement (15 000.00 € APVV, VEGA)

In addition to the devices mentioned above, we also acquired instruments of common lab equipment in total cost amount of almost 51 000.00 €.

2.9. Supplementary information and/or comments on all items 2.1 – 2.8 (max. 2 pages in total for the whole section)

The number of publications has been stable during the assessed period with the average number of publications per year of 80. This means an average increase by almost 20 publications per year in comparison with the previous assessment with 61 publications per year. The PI SAS Management and Scientific Board constantly discuss with the scientists the need to publish in high quality journals, where, although not necessarily, the quality and visibility of published work is expressed by the journal impact factor and quartile. With this respect, the positive and significant trend in reducing the proportion of publications in Q3 and Q4 journals was achieved during the evaluation period reaching 92.8% of the results published in Q1 and Q2 journals (67.5% in Q1 and 25.3% in Q2 according to WOS) in 2021. For comparison, in the period 2016-2019, 20 - 30 % of results were published in Q3 and Q4 journals. These formal statistics contain another positive feature, which is the generation exchange started in the previous evaluation period. Hence, the contribution of scientists from the younger generation to the scientific outputs represents a good perspective for the PI SAS future.



The number of citations of PI SAS also has also increased over the years for the last 20 years. This development is logical in view of the continuously increased number of publications by PI SAS scientists but also indicates that the research outputs produced at PI SAS are of interest to the scientific community.

The mission of PI SAS is to achieve a strong national and international position in polymer science, research, and development. This has led to the tradition of organizing scientific meetings and workshops, where many foreign scientists, as well as representatives of the Slovak industry and academia, participate. The creation of new contacts for national and international cooperation in the research areas covering the PI SAS expertise is a natural part of the scientific life of PI SAS scientists and this activity is strongly supported by the management board. This has been leading to new opportunities for cooperation and projects in various project calls globally.

Numerous invitations of individual researchers for short and longer stays in foreign laboratories invited lectures at research institutions and universities, invitations to international projects, participation at conferences, etc. signify activities of PI SAS research staff to increase the visibility of our expertise and capabilities. The table below summarizes the mobility of the PI SAS research staff abroad (either training at the research institution or participating in the conferences) and training of the foreign scientists at PI SAS during the years 2016 through 2021. The number of both visiting foreign institutes by researchers from PI SASA as well as visiting PI SAS by foreign researchers was significantly affected during the last years by pandemic.

Scientists from PI SAS at foreign institutes			**Scientists from PI SAS at conferences**		**Scientist visiting PI SAS**	
Year	**number**	**days**	**number**	**days**	**number**	**days**
2016	32	902	33	281	32	1194
2017	29	1312	33	336	31	669
2018	31	506	40	430	34	1042
2019	32	696	33	332	24	905
2020	10	159	3 3 online	16 4	7	699
2021	13	272	11 14 online	53 52	1	90

Generally, PI SAS welcomes the flow of scientists, PhD students, and postdocs in both directions to and from the Institute. Our aim is to increase the portion of flow to the Institute that would correspond to the significance and visibility of PI SAS abroad. The National Scholarship Programme of the Slovak Republic (SAIA) was used as one feasible option to gain foreign researchers for postdoc stays at our Institute. PI SAS also organizes the invited lectures of outstanding researchers from Europe at PI SAS. During the assessment period, totally over 30 professors and researchers from various foreign universities and research institutes gave a lecture at PI SAS. To point just some of them: prof. Gogotsi (USA), prof. Luxenhofer (Germany), prof. Hogenboom (Belgium), prof. Liska (Austria), prof. Sohn (South Korea) etc. The visits of these outstanding researchers speak about strong contacts with important institutions abroad as well as contribute to the visibility of our Institute.

The PI SAS funding is based on the multi-source principle. The external funding is the key condition to perform the scientific activities and fulfill the mission and, in principle, the existence of PI SAS. This multi-source principle is based on the national and international projects, and the contracts with industry. Overall, the external funding at the level of 50 % of the institute budget warrants stable conditions, which has been achieved over the last years.

PI SAS has been successful at the national level in the competition for the national projects via the Slovak Research and Development Agency (the most important national funding body for the research project) and via the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences.

The contracts with national and international partners also represent an important source of financial resources as well as contacts with the industrial partners and direct utilization of the knowledge produced at the Institute in the application area. Here, we feel that the number of existing cooperation relations should increase. We actively search for the opportunities for this type of collaboration, we discuss with potential partners in Slovakia, and participate in the fairs and meetings devoted to making more contacts and visibility of the expertise of the Institute.

With respect to the EU projects, even though the PI SAS scientist participated, in the role of partners, in preparation and submission of in total 14 projects within the H2020, just 2 of them were supported. This reveals that it becomes extremely difficult to succeed in obtaining this type of grant in the area of polymer science and related areas where polymer science is utilized. In addition, during the evaluation period, a considerable effort was devoted to the preparation of Structural Funds projects, which were finally canceled during the evaluation period by the ministry/government. It is a strongly demotivating step and, at the same time, it undermines scientific work and aid to industry or innovation. Finally, PI SAS was successful in obtaining the projects from other call of Structural Funds EU and ERDF, as well as projects of ERA.net, COST, Marie-Curie mobility, which are seen as an excellent opportunity provided by the EU for contribution to the polymer science and related scientific fields in the European Research Area, in transfer of knowledge, in initiating the collaboration, and training the young generation. In 2021, the Institute became a member of FIT-4-NMP, which assists the newcomers in achieving projects of the Horizon Europe programme.

The significance of PI SAS and, consequently, the impact of PI SAS on the community can be demonstrated in several areas. The label “PI SAS” is well-known by its professionals and provides expertise and solutions at the national and international level. This has been leading to numerous collaborations with the impact on the outcomes of a number of partners from academia and industry. PI SAS is the member of Plastics Cluster Slovakia and Automotive Cluster Slovakia, which gives the opportunity to closely communicate with the stakeholders in the polymer-related fields. The researchers of PI SAS actively work in national and international chemical societies, various scientific committees, agencies, ministries, and other bodies with the impact on community and society. PI SAS influences the life of the young generation (high school students, undergraduate, and graduate students) by education in polymer science and science in general. Through the popularization activities, PI SAS reveals to the lay public the important role of polymer materials on human society and well-being from controlled drug delivery, biomaterials that save life to exploring space. Overall, in Slovakia, the polymer science principal institutions are PI SAS and the Institute of natural and synthetic polymers of the Faculty for Chemical and Food Technology, Slovak Technical University. Therefore, the social impact of PI SAS is understood as both the opportunity and responsibility to guarantee all the aspects related to polymer science.

PI SAS realizes the importance of popularization activities to promote the scientific achievements and activities of the Slovak Academy of Sciences and PI SAS specifically. The dissemination of information to lay public is therefore among the priorities of PI SAS. The visits of students, teachers, visitors, companies, Open Days, Nights of Researchers, popularization articles, appearance in TV and radio broadcasting, dedicated documentary movies, and posting on social media become standard outcomes of the PI SAS researchers at all levels from PhD students to senior scientists. The non-profit foundation Cukrovka (www.cukrovkanf.sk) has been established at PI SAS to communicate on our studies into diabetes treatment by encapsulated cells. These activities demonstrate that the science at PI SAS provides the prospectsdata and an appropriate language to communicate with lay public has been found and, vice versa, that the lay public is interested in these results. This communication is highly stimulating and inspiring and has to be further intensified.

3. Implementation of the recommendations from the previous evaluation period

Based on partial indicators reflecting the research output, response to the research output, position in international and national context, project structure and external funding resources, education, socio-economic impact, popularization of science, and personal management, the overall assessment of PI SAS for the period of 2012-2015 states:

- the Institute is well established and nationally and internationally visible. The national visibility is strengthened by a high number of public outreach activities. The scientists are active in the organization of workshops and conferences. It was successful in obtaining substantial funding from various sources;
- the Institute has already established a considerable number of connections with the industry;
- the Institute addressed the recommendations of the previous assessment, which were in part realized during the past years;
- the performance and the prospects of the institute are at the top of the SAS section II institutes.

The institute was accredited in category A:

The research is internationally leading within the European context. The Institute has demonstrated important contributions to the field and is considered an international player in Europe

The evaluation panel made three recommendations for further improvement of the institute:

1. The research focus should be further strengthened on the strongest topics of the institute, consolidating the high number of research projects.

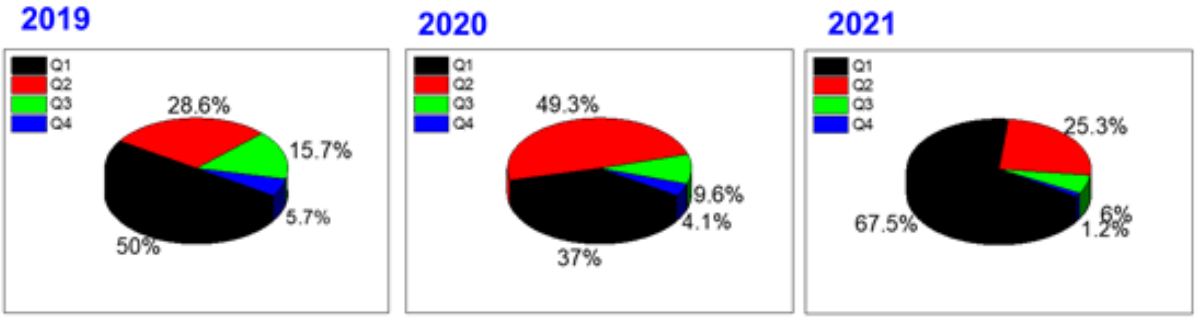
In order to strengthen the strong topics of the institute and consolidate the high number of research projects, the 3 Core and 5 Key topics of the institute were identified, as were already listed in Part 1.8, considering the excellence of current basic research, tradition expertise, infrastructure, actual research trends, and expertise required from the partner institutions. The core topics covering the research for biomedical applications, development of materials from renewable resources, and materials based on (2D) nanoparticles and hybrids, are not specific for the individual departments, right opposite, the topics are parallely developed at the departments from a little bit different expertise view, while the management emphasizes the need for cooperation between the departments in development of the core topics with the aim to cover as complex as possible expertise in these topics. This should lead to the strengthening position of the Institute in these topics toward international cooperations and increase the chance to be involved in large EU projects. Unlike the Core topics, the Key topics are specific for the departments, while the scientific groups are internationally recognized as leaders in developing the topics. The management strongly supports the submission of new research projects, even small ones, fitting both types of topics, and thus leading to the topics' development. Similarly, gaining the new employees with the expertise in these topics is supported and new PhD topics are evaluated before they are open from the viewpoint of matching the core and/or key topics. In 2020, the Board for External Communication was created at the Institute with the aim to improve the communication with the industrial partners and evaluate the current orientation of the Institute from the viewpoint of of requirements of the application sphere and the needs of society and as a base for creation of strategic plan for more applied research orientation.

2. The Institute should aim at further increase in publications in high-impact journals.

Strategy for increasing publication in high-impact journals consisted of various approaches. The first one was based on the principle that a lower number but high-quality publications were preferred, Thus, more significant awarding of publications in high-impact journals was introduced with the aim to encourage decision of scientists to choose these journals, instead of “easily publishable” journals, and thus minimize publishing in 3rd and 4th quartiles journals. The second one was connected with the above mentioned identification of Core and Key topics, which should be more intensively

developed and could lead to a higher number of high quality publications. In order to further promote the outputs from the results achieved primarily at the Institute, the first and corresponding authors are significantly more financially awarded.

As already mentioned in 2.9., this strategy led to substantial decrease of publications in Q3 and Q4 journals down to 6 % and 1 %, respectively, in 2021. The figure below shows the progressive increase in the ratio of publications in Q1 and Q2 compared to publications in Q3 and Q4 over the last 3 years. It should be pointed out that this increase did not have an effect on the number of publications, as can be seen in the figure in part 2.9.



3. The institute should continue its efforts in attracting younger scientists (also internationally).

The activities toward attracting younger scientists can be divided into several levels. Starting with the activities to become visible already for youngest generation, which in future could potentially join the institute either as PhD students or postdocs, the PI SAS is highly active in propagating the research starting with primary school students, within the co-organization of Nájdi v sebe vedca (Find a Scientist in Yourself) and Letná škola mladých vedcov (Summer School of Young Scientists), and high school students, within the Open Door Day. At the universities, the PI SAS employees provide some lectures within the subjects running at the universities, even though the space provided to us is quite limited. Therefore, we focused mainly on offering the students the opportunity to gain practical experience in our labs within their summer internships or to employ them for contract on agreement as scientific support forces (see the list in part 2.5.8).

The institute was successful in incorporation of new study programmes in order to broaden the base for PhD study applicants. In order to compete partially with the salaries in industry and thus to attract the applicants for PhD studies, in addition to the scholarship, they can also get a contract for partial work, usually from 15-25%, depending on the annual evaluation of the PhD students. All students are also involved in running projects allowing covering of their active participation at the international conferences as well as short term stays at foreign partner institutes. Thus, they can gain new experience in other research institutes and new contacts important for their future career.

The Institute actively entered The Programme SASPRO – EU Mobility Programme co-funded by the Slovak Academy of Sciences for high quality researchers, which resulted in granting three successful applicants for the institute out of about fifty applicants in total for SAS. These scientists not only performed high-quality research at the Institute but also had influence on the PhD students and young postdocs in their environment. In addition, in the recently opened second programme of SASPRO II, we had 4 registered candidates, and one of them, Dr. Sadik Cogal from Turkey, was successful and will start his stay at the Institute on July 1, 2022. The lead researchers at the institute regularly apply as the hosting researchers within the SAIA National Scholarship Programme or Erasmus to host foreign PhD students and postdocs usually for 1-10 months to do the research at the institute. The open positions for the post-doctoral positions have been regularly posted via the hiring organizations and the webpage of the Institute in order to provide the opportunity for gifted young researchers to offer the research position at the Institute from Slovakia or abroad. All these activities resulted in rather significant exchange of young researchers in the last years, including the foreign countries.

The Institute requires postdocs, especially those who defended their theses at PI SAS, to spend longer time (from 6 months to 3 years) as postdocs inforeign research groups in order to gain new experience. After their return to the Institute, these researchers can increase the quality of the

research and incorporate new modern research topics at the Institute. In order to ease returning from postdocs, the Institute offers more freedom in their research, providing also the possibility to apply for a Starting grant at the Institute for 1 year. This can enable them to verify their research idea, gain some preliminary results, and apply for regular grants. In addition, very recently the Management of the institute agreed to provide the reintegration financial benefits up to 200 Euro in addition to the regular salary for postdocs returning after at least 2 year stay in aforeign research group. This should cover the period until the postdocs will be involved in the projects or will get their own projects.

One of the problems we have found was the problem with returning researchers after maternity leave. Therefore, a similar scheme of financial support was recently agreed by the Management also for the people returning after regular 3 years of maternity leave to financially stabilize them during the period of 2 years until they will be involved in the projects. In addition, financial support of up to 400 Euro was agreed for those who decide to return from maternity leave after a period shorter than the regular 3 years. This can help to cover the costs of private creche and enable them to return back to the research significantly sooner and to continue with building their research career.

4. ***Research strategy and future development of the institute for the nextfive years*** (Recommended 3 pages, max. 5 pages)

Research strategy of the institute in the national and international contexts, objectives, and methods (including the information on when the strategy was adopted)

PI SAS is the research institution active in the areas of polymer chemistry, physics, characterization, materials including biomaterials, and the interdisciplinary sciences, in which polymer science plays a crucial role. PISAS was established 60 years ago and in its path from history to present PI SAS has created firmed foundations for polymer science in Slovakia with a significant impact of the "PI SAS label" in some areas of international polymer science.

The PI SAS strategy has always been the expertise-, human resources- and new knowledge-driven, with the vision to continuously strengthen and justify its position in the global polymer science. Owing to the external conditions in Slovakia with respect to problematic support of science and development, the competition for internationally available resources (mainly personnel and project opportunities) with the research institutions in established countries becomes more difficult. In 2022, PI SAS was transferred to the public research institution that is perceived as an opportunity to utilize our expertise in other forms such as, for example, start-ups and spin-offs. The PI SAS guiding principle is the high-quality standards in all its activities, which is the PI SAS attribution that determines the research strategies and future development. This is outlined below with respect to personnel, research topics, research environment, and international recognition.

Personnel:

PI SAS is determined to hire high-quality employees. The scientists and PhD students are naturally of primary importance, nevertheless, the staff in all other positions is equally important and has to possess required expertise, loyalty, and dedication to PI SAS. We realize that the competition with other sectors of the society in Slovakia and abroad in hiring suitable personnel is an uneasy task, therefore, the "good to be here" conditions need to be offered to PI SAS employees. The young generation of scientists needs to recognize that PI SAS understands its role in polymer science very seriously and that it can provide a proper level of training and a good start of the scientific career.

As described in this questionnaire (part 2.5.8), various quality mechanisms have already been implemented at PISAS. The steps below are seen as strategically important to be additionally implemented to the currently existing system and are expected to attract dedicated young researchers from Slovakia and abroad. In this content, the Institute Management will:

- establish criteria for hiring the staff by considering their skills, personal qualities, and their commitment to the key PISAS topics. The intention would be to have a certain level of staff diversity.
- create a system that helps young researchers and PhD students to be true thinkers and find their future directions by:
    - utilizing the whole capacity of PI SAS to increase the knowledge and experience of young researchers and PhD students by organizing a series of scientific seminars and laboratory practice available at PI SAS for doctoral students and young researchers;
    - regular active evaluation of the PI SAS capability regarding its training topics and of the knowledge of PhD students on the Core and Key topics of PI SAS. This will enhance the rather narrow expertise of PhD students in the polymer science observed currently and also enhance the intra-institutional cooperation;
    - organizing a series of scientific seminars (online) by the world's top scientists, where young researchers and PhD students could have the opportunity to discuss with them. This will give the possibility to build networks and provide the opportunities for young researchers for their future scientific career;
    - organizing a series of lectures held by the researchers from PI SAS focused on the Core and Key topics of PI SAS.

Research topics:

The knowledge generated by polymer science has entered all the areas of human society, which is further evolving in all directions. PI SAS followed the modern trends in the past and it will follow them in the future, based on personnel, capacity, national and international cooperation with academic institutions and industry. Additionally, the PI SAS research topics will be driven by both the society needs according to urgent global challenges we face (e.g., the 2030 United Nation Agenda for Sustainable Development goals towards clean water and sanitation, affordable and clean energy, climate action, good health and well-being) and scientific curiosity, the engine generating new knowledge.

Compared to the last accreditation, PI SAS has defined its current Core and Key topics that have been introduced in part 1.8. This is a good basis that is expected to be extended and/or amended within the next few years. The Action plans of four PI SAS scientific departments, defined in 2021, indicate the future directions in the research topics, from which the following ones can be highlighted:

- combination of polymer chemistry and life sciences towards new therapeutic approaches
    - immunomodulatory polymers, drug carriers, amphiphilic nanoparticles, cell encapsulation, tissue regeneration, 3D bioprinting
- precise polymer synthesis in conjunction with tailored polymer composition and architecture
    - reversible deactivation radical polymerization techniques, kinetics and mechanism of polymerization, application-driven polymers such as adhesives, paints, coatings, toners, chromatography column packing materials, optoelectronic, and biomedical devices; focus on environmentally friendly solvents such as water to reduce economic and environmental costs
- biobased / biodegradable polymers
    - thermoplastic starch as the additive to bioplastics as well as the matrix material, tailored modification of polysaccharides and polyesters for biomaterials and polymers to replace current oil-derived polymers in specific areas, furan-based photoactive derivatives for sensors, biodegradable nonwoven materials for filtration application (respirators) in combination with their biodegradation, organogels, and hydrogels made from bio-sourced monomers with switchable hydrophobic/hydrophilic properties
- polymer composites and nanocomposites
    - 2D (nano)particles as graphene, graphene nanoplatelets, and MXenes for, e.g., hydrogen storage, conductive electrodes in solar cells, batteries, gas sensors, and supercapacitors
- conductive electrospun fibrous mats
    - based on biopolymers or recycled synthetic polymer with polypyrrole, polythiophene, and polyaniline for, e.g., OLEDs and batteries
- confined polymers through molecular simulations
    - thermodynamics of confined polymers, surfaces modified by polymers, and topological polymers with emphasis on bio-polymers, such as DNA and chromatin, as well as classical polymers, with the focus on helical confinement as a new confinement type capable of separating the knotted polymers based on their chirality and on polymers chemically or physically grafted onto the surfaces or interfaces of pharmacological drug delivery systems or tissue scaffolds.

Research environment:

The management realises that the research environment is one of the most important factors affecting the personnel growth as well as institute competitiveness. The strategy for improving the research environment is as follows:

- to ensure regular modernisation of the Institute infrastructure and thus to provide top-level working conditions,
- to support innovative research activities and breakthrough thinking of the researchers and to provide perspective and conditions for researchers to build their scientific career at PI SAS,
- to support all activities leading to a sustained Institute funding based on balanced resources consisting of national (VEGA, SRDA, contracts, and structural funds) and international resources (projects of EU including H2020 and ERC, other R&D projects, and contracts),

- to enhance the cooperation with the industry nationally and internationally to highlight our expertise on special topics,
- to retain the equal opportunity environment and promote the gender balance,
- to strengthen the intra-institute cooperation, teaming, fair, and critical atmosphere,
- to support scientists who have decided to end parental leave prematurely.

In order to take advantage of the transformation of the Institute to a research public institution and enhance the independence of the Institute on the state budget, the steps towards establishing a new department, focused primarily on earning funds from private activities, are planned to be realised in near future. The aim is to manage closer cooperation with the private sphere and to take care especially of a substantial increase of small production volume currently running as well to increase the number of production cases possible to be performed in the Institute compartments. These activities could lead to the creation of start-ups/spin-offs in the future.

International recognition:

There is a number of cooperation with academia and industry both nationally and internationally indicating a good level of recognition in the field of polymer science. However, although the principal research scientists are well-recognized internationally, and with them the PI SAS as their affiliation, also the middle age senior research scientists have to improve their international recognition in the next years. The ways to accomplish this task generally exist and will be promoted by the Institute management:

- Proper dissemination of the information about the institute's expertise via high-ranked international journals, invited lectures at the conferences and institutions, mutual cooperation and projects, and other mechanisms
- Strengthening the exchange of research staff and students utilizing current and creating new mechanisms,
- Increasing the visibility by organizing a continuous series of Institute seminars given by well-recognized scientists and by organizing regular international conferences,
- Initiation of contacts with foreign universities to act as an external institution for PhD. studies, and
- Continuous meetings with receiving advice from the members of the External Board consisting of internationally recognized foreign experts on the profile Institute topics and industry representatives.