

BULGARIAN ACADEMY OF SCIENCES



2014

INSTITUTE OF POLYMERS

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Publishing the booklet the Institute of Polymers - BAS aims at informing the academic community, businesses and the general public about its research activities in 2014. The booklet presents briefly the scientific scopes of IP-BAS, the most significant achievements in fundamental and applied research, as well as the activities of national and public importance. We expect the visibility of our activities to augment the possibility of future collaborations with new partners from academia and industry.



<http://polinnova.polymer.bas.bg>

The web site of the POLINNOVA project informs of all activities carried out within its frames.

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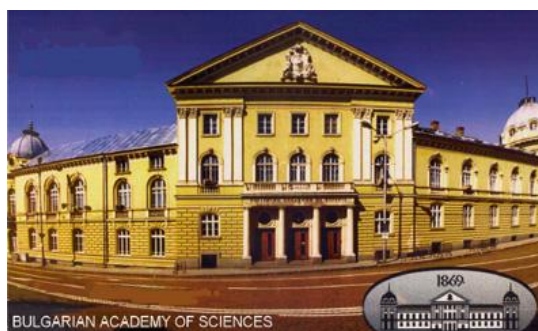
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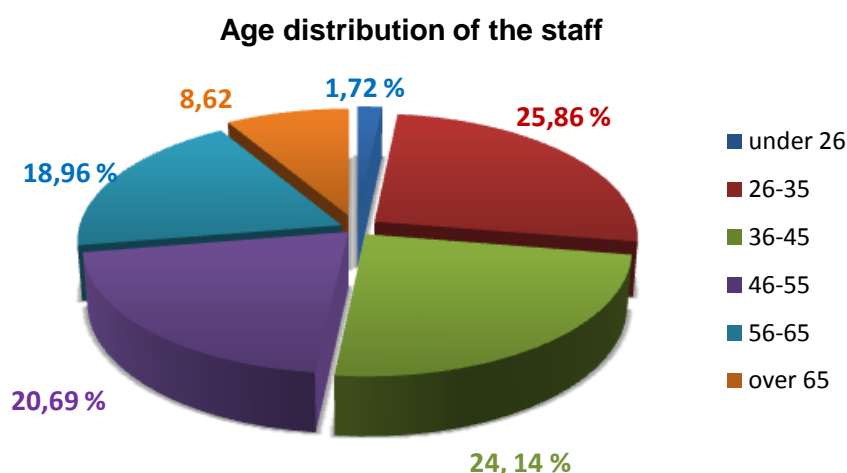
The booklet is published with the financial support of the POLINNOVA project - "Strengthening the research capacity and innovation potential of the Institute of Polymers at the Bulgarian Academy of Sciences for further integration into the ERA ", financed by the 7th Framework Programme of the European Union, "Capacities - Research Potential "(GA № 316086).

The history of the Institute of Polymers (IP) started back in 1960 when, within the Institute of Organic Chemistry – BAS, the department of Macromolecular Chemistry was established. In 1973 the department became an independent research entity called "Central Laboratory of Polymers", which on 1st March 1990 was granted the status of an Institute. Today the Institute of Polymers - BAS is an autonomous research entity within the thematic priority "Nanosciences, Materials and New Technologies" of the Bulgarian Academy of Sciences.

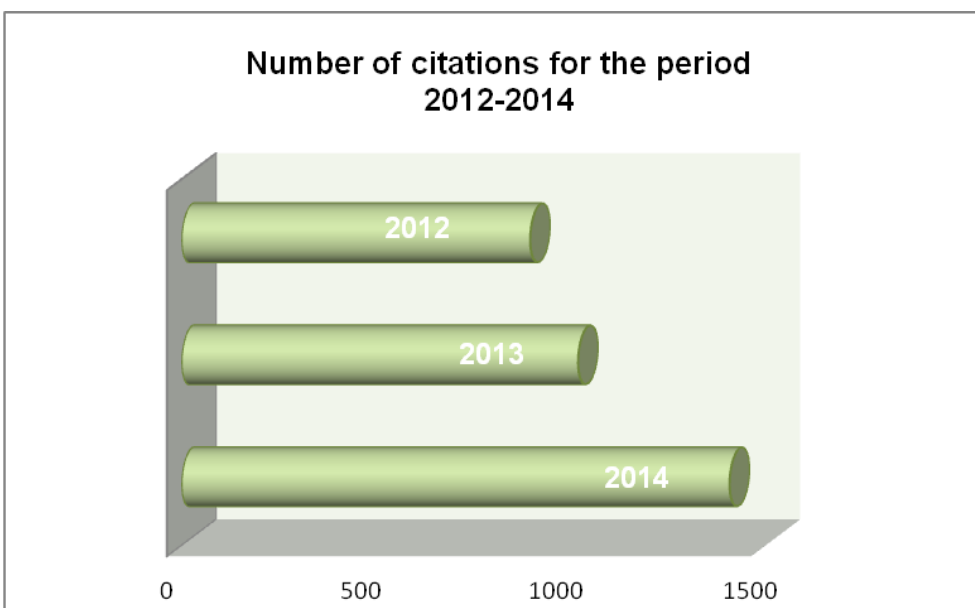
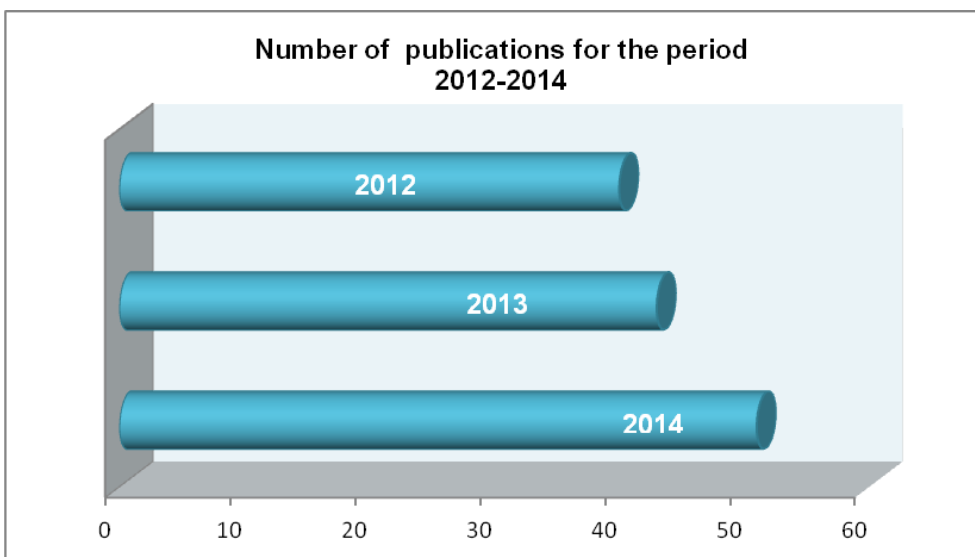
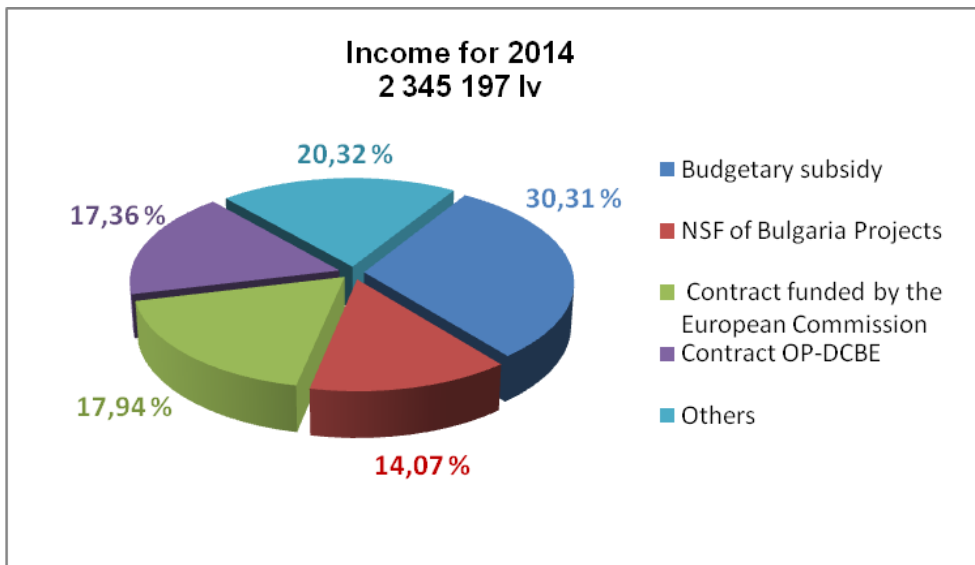
IP has been endeavoring to promote itself as a leading Bulgarian center for research, innovations and training of PhD students, graduates and specialists in the field of polymer science as well as to be integrated successfully into the European Research Area.

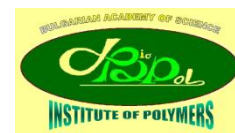
The mission of the Institute of Polymers is to carry out research and education/training in macromolecular sciences that are relevant to the development and application of polymers and polymeric materials. Its research policy is in accordance with the priority of the European Union for knowledge based economy. The institute is realizing successfully the model based on knowledge accumulation and education via scientific research and its transformation into new technologies and products to meet the requirements of the society.

The research at IP-BAS is organized on a project basis and is financed by budget subsidy and competitive grant programs of the National Scientific Fund (NSF), other international scientific programs and framework programs of the European Union (EU). That guarantees carrying out research in areas of priority for Bulgaria and Europe, as well as an effective and transparent spending of taxpayers' money. The Institute staff is of 57 full-time employees, including 37 researchers (professors – 4; associate professors – 11; assistant professors – 15; research assistants – 6; specialists with PhD degree - 1); 17 - technical staff and 3-maintaining personnel (16 with higher education and 3 specialists with secondary education). The organizational structure of IP includes six research laboratories, accounting and administrative units. In 2014 four experienced researcher with expertise in the field of polymers and polymeric materials and an experienced technician - specialist in analytical equipment were recruited additionally within the POLINNOVA project. Thus in total, in 2014 eight experienced researchers and two technicians were working on the project.



The research laboratories are carrying out investigations in certain thematic areas, in accordance with the scientific strategy of IP-BAS. The activities are coordinated through the annual research plan of the Institute.





BIOLOGICALLY ACTIVE POLYMERS

Head of laboratory: Prof. Nevenka Manolova, DSc



- *Biodegradable and biocompatible polymers*
- *Bio-sourced polymers*
- *Fibrous materials by electrospinning and electrospraying*
- *Polymer materials for biomedical applications*
- *Bioactive nanohybrids*
- *Biohybrids for eco-safe agriculture*

Two original centrifugal electrospinning apparatuses have been designed, constructed, and put into operation (Kancheva M, Toncheva A, Manolova N, Rashkov I, Mater Lett, 2014, 136, 150-152). They enable the fabrication of non-woven micro- and nano-fibrous materials of large surface area for a very short time at an economical operating mode. Polyester materials with improved mechanical properties have been obtained by appropriate combination of polymers having different thermal behavior (Kancheva M, Toncheva A, Manolova N, Rashkov I, EXPRESS Polym Lett, 2015, 9, 49-65).

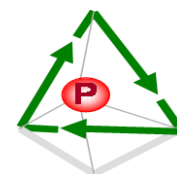
Original approaches have been proposed for preparation of new fibrous materials by combination of the electrospinning and electrospraying techniques. Materials from the biodegradable poly(lactic acid) and polyhydroxybutyrate loaded with zinc oxide or hydroxyapatite (HA) nanoparticles have been prepared (Virovska D, Paneva D, Manolova N, Rashkov I, Karashanova D, Appl Surf Sci, 2014, 311, 842-850; Ramier J, Boudierlique Th, Stoilova O, Manolova N, Rashkov I, Langlois V, Renard E, Albanese P, Grande D, Mat Sci Eng C, 2014, 38, 161-169; Ramier J., Grande D, Boudierlique Th, Stoilova O, Manolova N, Rashkov I, Langlois V, Albanese P, Renard E, J Mater Sci: Mat Med, 2014, 25, 1563-1575). The fibrous materials containing zinc oxide have photocatalytic and antibacterial activity, and the HA-loaded ones are potential candidates for use in tissue engineering (for bone regeneration).

New curcumin-loaded materials from a poly(lactic acid)-based copolymer have been prepared by electrospinning (Yakub G, Toncheva A, Manolova N, Rashkov I, Kussovski V, Danchev D., J Bioact Compat Polym, 2014, 29, 607-627). They are suitable as wound-healing dressings as well as for the design of artificial blood vessels.

For the first time materials that maintain their integrity and possess good mechanical properties from the immiscible poly(lactic acid) and poly(butylene succinate) have been obtained. This has been achieved by electrospinning (Stoyanova N, Paneva D, Mincheva R, Toncheva A, Manolova N, Dubois Ph, Rashkov I, Mat Sci Eng C, 2014, 41, 119-126).

New materials with antitumor activity have been prepared by applying electrospinning and subsequent modification with an inherently bioactive polyelectrolyte (Ignatova M, Kalinov K, Manolova N, Toshkova R, Rashkov I, Alexandrov M, J Biomat Sci, Polym Ed, 2014, 25, 287-306).

PHOSPHORUS-CONTAINING MONOMERS AND POLYMERS



Head of laboratory: Assoc. Prof. Ivanka Kraicheva, Ph. D.



- ***Polymeric drug formulations***
- ***Phosphorus-containing polymers with own biological activity***
- ***Phosphorus- and silicon-containing inorganic polymers***

A new mechanism of Atherton – Todd reaction is discussed. The reaction is widely used for the synthesis of biological active low- and high-molecular amidophosphates, as well as for the design of polymer drug conjugates obtained on the basis of poly(alkylene H-phosphonate)s. [V. Mitova, N. Koseva, K. Troev, Study on the Atherton – Todd Reaction Mechanism, RSC Adv. (2014) 4, 64733-64736].

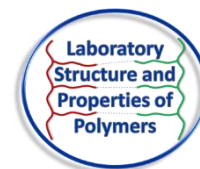
Polymer complex constructed from aminofostine (WR 2721) and poly(hydroxyoxyethylene phosphate) was synthesized. The radioprotector was immobilized on the polymer backbone via ionic bonds. The aminofostine is used as a selective cytoprotector of normal tissues in radiotherapy. The polymer complex showed a significantly better radioprotective effect than the parent compound. [N. Koseva, I. Tsacheva, V. Mitova, E. Vodenicharova, J. Molkentine, K. Mason, K. Troev, Polymer complex of WR 2721. Synthesis and radioprotective efficiency, Eur. J. Pharm. Sci. (2014) 65, 9–14].

Macromolecular conjugates of a dinuclear platinum complex and poly(oxyethylene H-phosphonate)s were synthesized. The conjugates exhibited profound cytotoxicity including cisplatin resistant cell line. The conjugation approach increases the therapeutic index of drug and the potential for its clinical implementation [V. Mitova, S. Slavcheva, P. Shestakova, D. Momekova, N. Stoyanov, G. Momekov, K. Troev, N. Koseva, Polyphosphoester conjugates of dinuclear platinum complex: Synthesis and evaluation of cytotoxic and the proapoptotic activity, Eur. J. Med. Chem. (2014) 72, 127-136].

Novel polyphosphoesters containing anthracene-derived aminophosphonate and hydrophilic H-phosphonate units were synthesized and tested for in vitro antitumor activity and in vitro and in vivo safety. The subcellular distribution of the substances was studied in normal and tumor cells [I. Kraicheva, E. Vodenicharova, S. Shenkov, E. Tashev, T. Tosheva, I. Tsacheva, A. Kril, M. Topashka-Ancheva, A. Georgieva, I. Iliev, I. Vladov, T. Gerasimova, K. Troev, Synthesis, characterization, antitumor activity and safety testing of novel polyphosphoesters bearing anthracene-derived aminophosphonate units, Bioorg. Med. Chem. (2014) 22, 874-882].

Novel phosphorus- and silicon-containing inorganic polymers were synthesized [V. Mitova, N. Koseva, K. Troev, Reactive phosphorus- and silicon-containing inorganic polymers, 1st International Conference on Inorganic Polymers, September 19-23, Maribor, Slovenia].

STRUCTURE AND PROPERTIES OF POLYMERS



Head of laboratory: Prof. Petar Petrov, DSc



- ***Stimuli responsive polymer materials***
- ***Photochemical crosslinking***
- ***Polymer aggregates and nanoparticles***
- ***Conjugated polymers***
- ***Polymer modified carbon nanotubes and graphene***
- ***Polymer nanocomposites and hybrid nanoparticles***

Original polymer materials for biomedical applications have been developed. Nano-sized polymeric particles from amphiphilic block copolymers comprising biodegradable poly(ϵ -caprolactone) and pH-responsive poly(acrylic acid) have been exploited as carriers of poorly water-soluble anticancer drug SN38. The system exhibits sustained release of the drug in physiological media. (Djurdjic, B., Dimchevska, S., Geskovski, N., Petrusevska, M., Gancheva, V., Georgiev, G., Petrov, P., Goracinova, K. Synthesis and self-assembly of amphiphilic poly (acrylic acid)–poly (ϵ -caprolactone)–poly (acrylic acid) block copolymer as novel carrier for 7-ethyl-10-hydroxy camptothecin *Journal of Biomaterials Applications* 29(6)(2015) 867–881)

Optimal condition for fabrication of organic solar cells based on thin active layers from spin-coated aqueous dispersions of poly(3,4-ethylenedioxythiophene) doped with poly(styrenesulfonic acid) or solutions of poly(3-hexylthiophene) and [6.6]-phenyl-C61-butyric acid methyl ester in chlorobenzene and 1,2-dichlorobenzene have been established. (Sendova-Vassileva, M., Dikov, H., Popkirov, G., Lazarova, E., Gancheva, V., Grancharov, G., Tsocheva, D., Mokreva, P., Vitanov, P. Transparent back contacts for P3HT:PCBM bulk heterojunction solar cells *Journal of Physics: Conference Series*, 514 (2014) Article number 012018)

Original method for construction of neutron detector device based on thin soap film has been developed. The neutron detector may be used in homeland security, for example to screen vehicles and cargo at ports and border crossings for nuclear material, well logging in geological survey, nuclear power generation and neutron imaging. (Sen, I., Koseva, N., Petrov, P., Kostadinov, K. Method for neutron detection and neutron detector thereof PCT/BG2014/000024 - 26.06.2014)

CONJUGATED POLYMERS

Head of laboratory: Prof. Vesselin Sinigersky, PhD

- *Proton- and anionconducting solid polymer electrolytes*
- *Preparation of polybenzimidazole (PBI) based membranes for fuel cells and electrolyzers*
- *PBI based composite membranes for fuel cells and electrolyzers, containing montmorillonite*
- *PBI fibers prepared by wet- and electrospinning, mono- and bioriented PBI foils*
- *Novel biodegradable polymer materials for food packaging*
- *Synthesis of electron conducting polymers – carbonyl-olefin exchange reaction*



-High temperature membranes for fuel cells working up to 180°C -- chemically cross-linked para-, meta- and AB-PBI, doped with PA – membranes with improved mechanical properties and proton conductivity , M. Staneva, D. Budurova, F. Ublekov, Iv. Radev, H. Penchev, V.Sinigersky, Improving the Mechanical Properties and Preserving the Proton Conductivity of p-PBI Membranes by Varying the Phosphoric Acid Doping Level, J. Chem. Eng. Chem. Res. V. 1, 2014, 15-23

- Nanocomposite membranes based on PBI with incorporated inorganic filler (montmorillonite), – improving the mechanical properties and proton conductivity (reached values up to 450 mS.cm⁻¹). Protonated montmorillonite as a highly effective proton-conductivity enhancer in p-PBI membranes for PEM Fuel Cells, F. Ublekov, H. Penchev, V. Georgiev, Iv. Radev, V. Sinigersky, Material Letters, Volume 135, 15 11 2014, 5–7

- Anion conductive membranes – m-, p- and AB PBI doped with KOH

- A new method for mechanical stabilization of polybenzimidazoles

- Novel biodegradable polymer materials, based on polylactic acid and polyhydroxyalkanoates, suitable for food packaging applications. For the preparation of this materials highly efficient technological processes e.g. reactive extrusion have been used.

- New method for the synthesis of R-substituted polyethyenes bearing carbonyl or olefin end groups – methathesis of phenylalkynes and an aldehyde catalyzed by nanosized catalysts, S. Dimova, K. Zaharieva, V. Sinigersky, Z. Cherkezova-Zheleva, Ivan Mitov, “Synthesis and characterization of oligomeric conjugated structures via coupling reaction using magnesium ferrite type catalyst”, Journal of International Scientific Publications: Materials, Methods & Technologies, 8 (2014) 233-240

- PEGylated calix[4]arene systems as drug delivery platforms (joint research with Lab. Polymerization Processes, IP BAS), E.Drakalska, D. Momekova, Y. Manolova, D. Budurova, G. Momekov, M. Genova, L. Antonov, N. Lambov, St. Rangelov, Hybrid liposomal PEGylated calix[4]arene systems as drug delivery platforms for curcumin. International Journal of Pharmaceutics, Volume 472, Issues 1–2, 10 September 2014, p. 165-174

AMPHIPHILIC AND IONOGENIC POLYMERS



Head of laboratory: Assoc. Prof. Darinka Christova, PhD

- ***Amphiphilic copolymers and networks of controlled composition, structure and hydrophilic-hydrophobic balance***
- ***Temperature and pH-responsive polymer materials for application in medicine, pharmacy and biotechnology***
- ***Hybrid electroactive IPNs and hydrogels***
- ***Composite polymer membranes with temperature controlled permeability***



In 2014 r. Laboratory Amphiphilic and Ionogenic Polymers was celebrating 25th anniversary. In October Bulgarian-Slovak seminar entitled CHALLENGES IN THE DEVELOPMENT OF SMART MULTIFUNCTIONAL POLYMER MATERIALS AND PERSPECTIVES FOR THEIR BIOMEDICAL APPLICATIONS was held in Hisarya supported by FNI within DNTS/Slovakia 01/2 project.

Current research activities comprise synthesis of well-defined amphiphilic and ionic/ionogenic polymers of controlled macromolecular structure and tailored properties using advanced polymerization methods and post-polymerization transformations, and investigation of their stimuli-responsive properties. The efforts are directed to the development of temperature- and pH-responsive copolymers of diverse macromolecular architecture (linear, branched, crosslinked) and intelligent materials that reversibly change properties in response external stimuli.

The potential of temperature- and pH-sensitive copolymer networks of various compositions as effective carriers of drugs was studied. Therapeutic agents of distinctive properties were considered as model drug molecules – ibuprofen, a hydrophobic analgesic with a very low solubility in aqueous media, and water soluble corticosteroid dexamethasone phosphate. The release kinetics profiles of the drug loaded networks proved the feasibility of these materials as highly effective platforms for sustained drug delivery. Another drug delivery system was developed based on a series of cationic block copolymers and dexamethasone phosphate. Nanosized pH-responsive drug carriers of low cytotoxicity and high (up to 80%) drug loading capacity were obtained. The ability of these new drug carriers to regulate dexamethasone release for 24 hours was demonstrated in vitro.

Hybrid polymer networks and hydrogels of a variety of compositions and structure were synthesized and studied in view of potential biotechnological application. These include polymer-silica hybrid micro- and nano-gels based on sol-gel method for biomedical application; smart hydrogels for synthetic membranes with temperature-controlled permeability; electroactive copolymer hydrogels and composites for application as actuators, switches and sensors.

Most relevant publications:

[1] D. Georgieva, B. Kostova, S. Ivanova, D. Rachev, V. Tzankova, M. Kondeva-Burdina, D. Christova. pH-Sensitive Cationic Copolymers of Different Macromolecular Architecture as Potential Dexamethasone Sodium Phosphate Delivery Systems. *Journal of Pharmaceutical Sciences* 103 (2014) 2406-2413.

[2] B. Kostova, S. Ivanova, K. Balashev, D. Rachev, D. Christova. Evaluation of poly(2-ethyl-2-oxazoline) containing copolymer networks of varied composition as sustained metoprolol tartrate delivery systems. *AAPS PharmSciTech* 15 (2014) 939-946.

[3] D. Christova. Smart Polymers: Research on stimuli-responsive polymer materials at the Laboratory of Amphiphilic and Ionogenic Polymers in Sofia. *HORIZON 2020 PROJECTS: PORTAL* 2014/3 (2014) 82-83.

[4] J. Rydz, B. Zawidlak-Węgrzyńska, D. Christova. Degradable Polymers. In: *Encyclopedia of Biomedical Polymers and Polymeric Biomaterials*. Ed. M. Mishra. Taylor & Francis Group 2015.

[5] J. Rydz, W. Sikorska, M. Kyulavska, D. Christova. Polyester-based (bio)degradable polymers as environmentally friendly materials for sustainable development. *International Journal of Molecular Sciences* 16 (2015) 564-596.



POLYMERIZATION PROCESSES

Head of laboratory: Prof. Stanislav Rangelov, DSc



- ***Synthesis of well-defined polymers and copolymers via controlled polymerization techniques;***
- ***Formation of polymeric and hybrid nanostructures via self-assembly and co-assembly;***
- ***Advanced polymeric materials for pharmaceutical, biomedical, biotechnological, and ecological applications***

Controlled polymerization techniques are employed to prepare a variety of amphiphilic copolymers of different chain architecture, topology, and functionality, which offer great potential in creating tailor-made supramolecular nanoparticles. A combination of experimental techniques is employed to obtain information about dimensions, structure, and dynamics of various systems in dilute solution. Polymeric and hybrid nanoparticles, prepared by self-assembly and co-assembly, have important pharmaceutical, medical, and analytical applications, in particular as vehicles for delivery of drugs, genes, diagnostic and therapeutic agents.

Polymers of the family of polymethacrylates with pendant oligo(ethylene glycol) chains were employed as templates for preparation of polymeric nanocapsules. Various protocols were applied to prepare well-defined mesoglobules, which were covered by a thin cross-linked polymeric shell based on PNIPAM or PHEMA. Following extensive dialysis, the core was removed and nanocapsules were obtained.

Novel gene delivery vector systems based on hybrid polymer-magnetic micelles were reported. The hybrid micelles were used to form complexes with linear and plasmid DNA. The resulting magnetopolyplexes displayed a narrow size distribution, particle dimensions below 360 nm, low toxicity, and ability to introduce pEGFP-N1 molecules into the cells. The application of a magnetic field markedly boosted the transgene expression efficiency.

Publications:

- Haladjova, E.; Rangelov, S.; Tsvetanov, Ch.; Simon, P. ***Polymer* 2014, 55, 1621-7.**
- Haladjova, E.; Rangelov, S.; Tsvetanov, Ch.; Posheva, V.; Peycheva, E.; Maximova, V.; Momekova, D.; Mountrichas, G.; Pispas, S.; Bakandritsos, A. ***Langmuir* 2014, 30, 8193-200.**
- Bakardzhiev, P.; Rangelov, S.; Trzebicka, B.; Momekova, D.; Lalev, G. ***RSC Advances* 2014, 4 (70), 37208-19.**
- Haladjova, E.; Toncheva-Moncheva, N.; Apostolova, M.; Trzebicka, B.; Dworak, A.; Petrov, P.; Dimitrov, I.; Rangelov, S.; Tsvetanov, Ch. ***Biomacromolecules* 2014, 15, 4377-95.**
- Dimitrov, I. In: ***Cationic Polymers in Regenerative Medicine***, Sangram K. Samal and Peter Dubruel eds, RSC Polymer Chemistry Series No. 12, 2014, ch. 4, pp. 99-132.

Priority research fields of IP-BAS in 2014

The priority research fields of IP-BAS are compliant with three priority areas of the National Research Development Strategy 2020, namely **Energy, Energy Efficiency and Transport. Development of Green and Eco Technologies; Health, Quality of Life, Biotechnology and Ecological Foods; New Materials and Technologies**. The research plan of IP for 2014-2016 r. includes research topics within the above thematic areas as well as within priority areas of the European Union FP for Research and Innovation Horizon 2020. The main research fields at IP-BAS are:

- **Polymer Materials for Alternative Energy Sources and Polymers of Renewable Unconventional Resources**
 - (i) polymer membranes for energy; (ii) active polymer layers for organic solar cells; (iii) “green” synthesis of biodegradable polymers; (iv) biodegradable polymer compounds and nanocomposites.
- **Polymer Materials for Biomedical, Pharmaceutical and Biotechnological Applications**
 - (i) intelligent systems based on temperature- and pH-sensitive polymers for drug carriers; (ii) nanosized carriers (nanoparticles, nano- and micro-fibrous materials) of drugs and DNA; (iii) hydro- and cryogels as drug carriers; (iv) phosphorous containing bioactive materials – poly(amine phosphonate)s and supramolecular; (v) new polymer materials of improved biocompatibility or targeted bioactivity (antibacterial and/or antitumor activity).
- **New Polymers and Innovative Polymeric (Nano)Materials and Technologies**
 - (i) preparation and characterization of polymers of various macromolecular architecture, topology and functionality, implementing controlled polymerization processes; (ii) preparation and characterization of aqueous colloidal systems of amphiphilic copolymers – formation and stabilization of aggregates of various structures; (iii) preparation and characterization of polymer-organic and polymer-inorganic hybrid nanomaterials (nanoparticles and nanofibers); (iv) development of hi-tech approaches and equipment for obtaining fibrous materials by electrospinning/ electrospaying and by centrifugal electrospinning.

Performed Research and Achievements

In 2014 the research within priority area **Energy Efficiency and Transport. Development of Green and Eco Technologies** was devoted to the preparation of new polymer fuel cells. A part of the research was carried out within a project supported by the National Science Fund (NSF) which was completed in 2014. The results from the research carried out within the project were published in 2 articles and were the basis of a new project submitted to the latest call of NSF which won financing. In 2014 a paper summarizing the results achieved in co-operation with a team from the Technical University of Denmark on the preparation of new materials for fuel cells was published. Research on the development of new polymeric solar cells was also being conducted at IP-BAS. A paper was published in the field and a project won financing from NSF. The research project on developing new lubricants which won financing from the National Innovation Fund at the Ministry of Economy also belongs to this priority area.

A significant part of the research potential, 55% of the scientific production and of the projects (6 research themes funded by the budget and 67% of the projects that won financing from NSF) of IP-BAS belong to priority area **Health, Quality of Life Biotechnology and Ecological Foods**. The investigations were focused on obtaining new polymer materials of tailored properties with regard to creating a new generation of drug carriers possessing antibacterial and/or antitumor activity, DNA carriers and new wound dressing materials.

In 2014, the research at IP-BAS was focused on the preparation of: new polymeric delivery systems of antitumor platinum coordination compounds based on polyphosphoesters; new polyphosphoesters conjugated with anthracene, known for its antitumor activity; new nanosized polymer carriers of DNA as delivery systems of genes; liposome-based drug carriers; new systems for drug release from polymeric hydro- and cryogels, namely metoprolol from polymeric hydrogels based on poly(2-ethyl-2-oxazoline) and metronidazole based on hydroxyethylcellulose and chitosan cryogels; new micro- and nanofibrous polymeric materials with antibacterial and/or antitumor activity (with or without a biologically active natural or synthetic substance) or with regenerative activity against bone tissue obtained by the electrospinning or electrospinning/electrospaying technology.

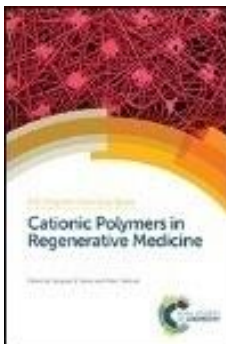
In the past 2014 intensive research in the field of **New Polymers and Innovative Polymeric (Nano)Materials and Technologies** was performed. An essential part of the papers published and accepted for publication in 2014 report the results on obtaining new polymer (nano)materials (nanoparticles, nanocapsules, micelles, liposomes, micro- and nanostructured hydro- and cryogels, as well as nanofibrous materials obtained by electrospinning and/or electrospinning/electrospaying and centrifugal electrospinning).

Scientific Results of IP-BAS in 2014

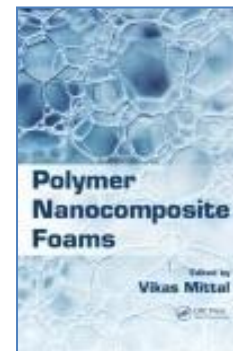
The scientist at IP-BAS worked on **9 project themes** financed by the **budget subsidy**. The activities involved realization of **1 project** funded by **FP7** and of **2 projects** under **OP "Human Resources Development" (OP "HRD")**, and **1 project** under **"Development of the Competitiveness of the Bulgarian Economy" (OP "RKSBI")** programme. The staff was working on **8 projects** funded by the **NSF**, and **9 projects** within **bilateral agreements with foreign academies of sciences**. In December 2014 **7 new projects** were approved for funding by **NSF**: IP is a coordinator of 3 of the projects and a partner in 4 of them. The results of the research work are published in **48 articles** and **2 book chapters**, issued in 2014, **33** of the publications are in specialized journals with impact factor (IF), and 70% of them in journals having **(IF) > 2.0**. **Compared to 2013 the number of publications (without monographs and popular science articles) increased by 20%**. The results of the research of the IP have been published in leading international journals with impact factor such as: *Progress in Polymer Science*, *Biomacromolecules*, *Langmuir*, *Carbohydrate Polymers*, *International Journal of Pharmaceutics*, *RSC Advances*, *Advances in Polymer Science*, *European Journal of Medicinal Chemistry*, *European Polymer Journal*, *European Journal of Pharmaceutical Sciences*, *Bioorganic & Medicinal Chemistry*, *International Journal of Polymeric Materials and Polymeric Biomaterials*, *Materials Science and Engineering C*, *Applied Surface Science*, *Journal of Bioactive and Compatible Polymers: Biomedical Applications*.

Two book chapters were authored by scientists from IP-BAS last year:

1. I. Dimitrov, *Poly(L-lysine)-Based Copolymers. Synthetic Strategies and Biomedical Applications*, In: **Cationic Polymers in Regenerative Medicine**, Sangram Samal, Peter Dubruel, eds., Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF, United Kingdom, RSC Polymer Chemistry Series No. 12, **2014**, ch. 4, pp. 99-132, ISBN: 978-1-84973-937-5.



2. P. Petrov, Chapter 8, *Carbon Nanotube-Polymer Nanocomposite Aerogels and Related Materials: Fabrication and Properties*, In **Polymer Nanocomposite Foams**, Mittal, Vikac (Ed.), CRC Press, Taylor & Francis Group, LLC, **2014**, 169-188, ISBN: 978-1-4665-5813-7.



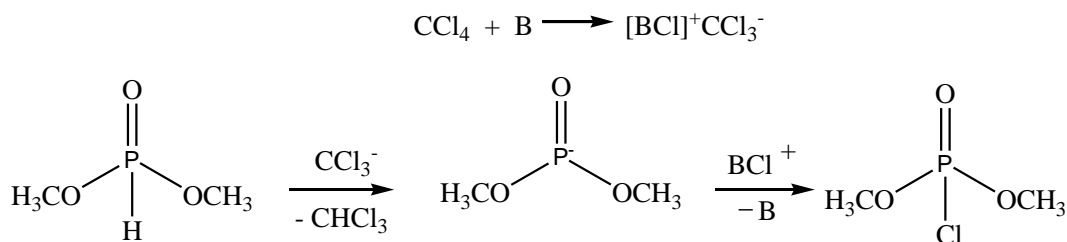
The following papers have been published in high impact factor journals:

1. **review**, A. Kowalczyk, R. Trzcinska, B. Trzebicka, A.H.E. Müller, A. Dworak, Ch.B. Tsvetanov, *Loading of polymer nanocarriers: Factors, mechanisms and applications*. **Progress in Polymer Science**, 39, 2014, 43-86, ISSN: 0079-6700, **IF²⁰¹³ 26.854**.
2. **review**, E. Haladjova, N. Toncheva-Moncheva, M. Apostolova, B. Trzebicka, A. Dworak, P. Petrov, I. Dimitrov, S. Rangelov, Ch. Tsvetanov, *Polymeric nanoparticle engineering: from temperature-responsive polymer mesoglobules to gene delivery systems*. **Biomacromolecules**, 15, 2014, 4377-4395, ISSN 1525-7797, **IF²⁰¹³ 5.788**.
3. I. Dimitrov, Sh. Takamuku, K. Jankova, P. Jannasch, S. Hvilsted, *Proton conducting graft copolymers with tunable length and density of phosphonated side chains for fuel cell membranes*. **Journal of Membrane Science**, 450, 2014, 362-368, ISSN: 0376-7388, **IF²⁰¹³ 4.908**.
4. E. Haladjova, S. Rangelov, Ch. Tsvetanov, V. Posheva, E. Peycheva, V. Maximova, D. Momekova, G. Mountrichas, S. Pispas, A. Bakandritsos, *Enhanced gene expression promoted by hybrid magnetic/cationic block copolymer micelles*. **Langmuir**, 30, 2014, 8193-200. Print Edition ISSN: 0743-7463, **IF²⁰¹³ 4.384**.
5. V. Stoyneva, D. Momekova, B. Kostova, P. Petrov, *Stimuli sensitive super-macroporous cryogels based on photocrosslinked 2-hydroxyethylcellulose and chitosan*, **Carbohydrate Polymers**, 99, 2014, 825-830, ISSN: 0144-8617, **IF²⁰¹³ 3.916**.

In 2014 **68 communications (oral and poster)** were presented at international scientific forums. In the course of 2014 419 papers authored by IP-BAS scientists were cited **1407**, setting the **average citation rate at 3.36**.

Best Fundamental Research Achievement in 2014

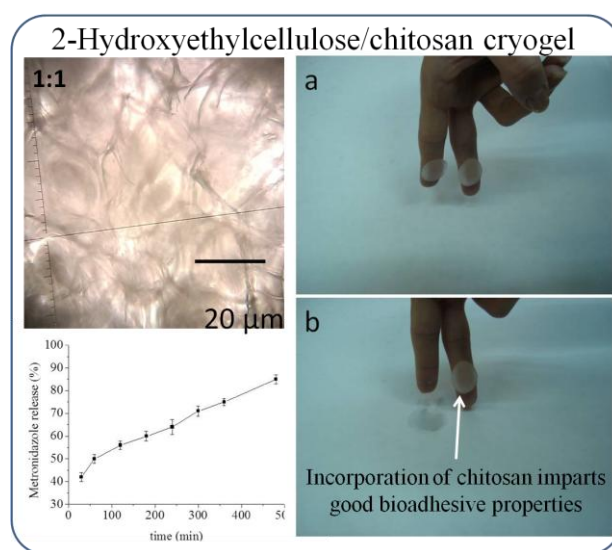
Experimental evidence clarifying the mechanism of the reaction between dialkyl esters of H-phosphonic acid and carbon tetrachloride in the presence of a base (B), so-called. Atherton-Todd reaction has been found. The study contributes to the phosphorus chemistry.



It has been established that the trichloromethanide anion (CCl_3^-) formed as result of the interaction between tetrachloromethane and the base deprotonates the dialkyl esters of H-phosphonic acid to a dialkyl phosphonate anion. The latter cleaves a chlorine cation that causes the formation of dialkyl chlorophosphate and restoration of the base. Dialkyl chlorophosphate is highly reactive towards amines, alcohols, thiols, etc., under mild conditions. Therefore Atherton-Todd reaction is used widely in the synthesis of biologically active low and high molecular weight amidophosphates, as well as in the preparation of drug conjugates based on poly(alkylene H-phosphonate)s. (Leader Prof. DSc Kolio Troev. The results have been published in the paper: V. Mitova, N. Koseva, K. Troev, Study on the Atherton – Todd Reaction Mechanism. *RSC Advances* 4, **2014**, 64733-64736, ISSN 2046-2069; *IF²⁰¹³* 3.708).

Best Applied Research Achievement in 2014

A drug delivery system based on new polymer carriers has been designed for sustained release of the antibacterial substance metronidazole. That allows less often administration of the medicine and its prolonged effect. The polymeric carriers are biocompatible and biodegradable microporous hydrogels (cryogels) synthesized via photochemical crosslinking of frozen aqueous solutions of hydroxyethylcellulose and chitosan. Optimization of the experimental conditions yielded materials of good physico-mechanical and mucoadhesive properties. The sustained drug release lasts more than 8 hours. The prepared drug delivery system could find application in treating vaginal infections. (Leader Prof. DSc Petar Petrov. The results are published in the paper: V. Stoyneva, D. Momekova, B. Kostova, P. Petrov, Stimuli sensitive super-macroporous cryogels based on photo-crosslinked 2-hydroxyethylcellulose and chitosan, *Carbohydrate Polymers*, 99, **2014**, 825-830, ISSN: 0144-8617, *IF²⁰¹³* 3.916).



Innovation Activity at IP in 2014

In 2014, IP undertook measures and initiatives to enhance the innovation activities of the Institute. In order to regulate the procedure for, protection and use of intellectual property of IP **Internal Intellectual Property Rules at the Institute of Polymers – BAS** were drawn and adopted. With financial support for the POLINNOVA project (GA № 316086) a patent application was filed at EPO (I. Sen, P. Petrov, N. Koseva, K. Kostadinov "Method for neutron detection and neutron detector thereof"). Another application is processed at the Bulgarian Patent Office (N. Koseva, V. Mitova, P. Shestakova, G. . Momekova, K. Troev, "Nanosized polyelectrolyte associates with antitumor activity, method for preparation and application").

The scientists from IP are authors of 28 protected patents, of which – 1 Bulgarian, 1- Japanese, 26 – European and other countries like USA, France, China, Canada, etc. The patents are of international co-authorship and the protection costs are covered by foreign companies and organizations.

Tuition at IP in 2014

In 2014 **13 PhD students** were working on their thesis at IP. **Four new graduates** were enrolled for PhD studies. Scientists from IP were co-supervising **4 PhD students** from other academic institutions. **Three courses** were delivered at the **Doctoral School**. Scientists from IP gave **lectures and seminars** to students from the **Faculty of Physics, Sofia University**. In 2014 **1 MSc thesis** was prepared at the Institute and **4 specialists** were trained at IP.

Special attention is paid to the career development of the staff. In 2014 Dr. Radostina Kalinova was promoted to Assistant Professor and DSc Petar Petrov was promoted from Associate to full Professor at the Laboratory of Structure and Properties of Polymers.

Societal Impact of the Activities Performed at IP

The research at IP is organized on a project basis and is financed by the budget subsidy, by grants provided through the calls of the **National Science Fund (NSF)**, by the operational programs "**Human Resources Development**" and "**Development of the Competitiveness of the Bulgarian Economy**", by foreign scientific programs and **FP of EU**. That guarantees carrying out research in priority areas of public interest, and an effective and transparent use of taxpayers' money.

Polymeric materials contribute to the progress in a number of areas such as medicine, pharmacy, environment, transport, information and communication technologies, etc. Application of nanotechnology in polymer engineering and materials science is expected to lead to the creation of innovative materials and technologies essential for achieving sustainable economic growth and quality of life. Novel polymer carriers of biologically active agents (antimicrobials of natural or synthetic origin, antitumor drugs, DNA, etc.) are obtained at IP: polymers of inherent biological activity; radioprotective polymer materials, conductive macroporous polymer composites, high-temperature membranes for fuel cells, etc.

Training of students and specialists ensures highly competent professionals and researchers, creating conditions for continuity and development of polymer science in the country. Moreover, the modernization of the analytical and specialized equipment allows not only to strengthen the research capacity and innovative potential of the Institute, but also allows improving the contacts of IP with industry, carrying out specific analysis and giving professional advice, participation in research and innovation projects. During 2014 IP provided analytical services and consultancy for 11 companies and 4 universities.

IP Relations with the Institutions in 2014

In 2014 the traditional intensive cooperation with Bulgarian and foreign academic organizations and universities continued. Cooperation with following institutions was maintained as well:

- **Kozloduy Nuclear Power Plant, Ltd** – Co-operation within the frames of a Memorandum for realization of scientific and technical co-operation;
- **Bulgarian Association POLYMERS** whose members are 37 Bulgarian companies. The Association is a twinning partner in the realization of the POINNOVA project;
- In 2014 the **Science, Innovations and Security Cluster** was established. IP also joined the cluster whose members are enterprises and institutes at the Ministry of Defense, research institutes and non government organizations.
- A co-operation agreement was signed with **Chemical Products, Ltd. - Yambol (Bulgaria)**.

Expertise provided by the Scientists of IP in 2014

In 2014 **17 researchers** from IP provided expert services. **Eight** of them sit in **11 expert commissions**: National Contact Points Network for realization Nanotechnologies, advanced materials and advanced manufacturing and processing programme within the FP Horizon 2020 of EC (**Prof. DSc Nevenka Manolova**); Marie Skłodowska-Curie actions Programme Committee (**Assoc. Prof. Dr. Neli Koseva**); National Representative of the Polymer Division of the International Union of Pure and Applied Chemistry (IUPAC) (**Profs. DSc Nevenka Manolova and Stanislav Rangelov**); Representative in the *Domain "Chemistry and Molecular Sciences and Technologies"* COST Programme of EC (**Assoc. Prof. Dr. Darinka Christova**); Expert Council on Science, Technology and Innovations at the Sofia Municipality (**Assoc. Prof. Dr. Neli Koseva**); Expert Council at the National Council on Innovations – Ministry of Economy (**Assoc. Prof. Dr. Olia Stoilova**); Evaluator at the National Innovation Fund (**Assoc. Prof. DSc Vladimir Baranovsky**).

In 2014, researchers from IP prepared **opinions and statements, provided expertise and consultation** on: (i) Presentation and discussion of current environmental projects for the Sofia Municipality (Prof. DSc Kolio Troev); (ii) Presenting the concept about the use of carbon dioxide to the Expert Council of the Municipality of Sofia (Prof. DSc Kolio Troev); (iii) reports on Accreditation procedure for program accreditation of professional field 5.6 Materials and Materials Science at UCTM - Sofia (Assoc. Prof. Dr. Nelly Koseva); (iv) Expert Evidence for the Administrative Court - Varna and for the District Court - Varna (Assoc. Prof. Dr. Hristo Novakov); (v) Analysis and consultation on multilayer polymeric materials intended for contact with food for the needs of the Laboratory "Materials for food contact" at the National Center for Public Health and Analysis at the Ministry of Health (Assist. Prof. Dr. Violeta Mitova).

In 2014, scientists from the IP have drawn the following reviews and opinions:

(a) Reviews on project submissions: (1) *Research Council KU Leuven, Belgium*; (2) *FWO, Belgium*; (3) *The National Science Center, Poland*; (4) *South Africa's National Research Foundation (NRF)*; (5) *OC-2014-1 call of COST programme*; (6) for NSF; **(b) Reviews and opinions on PhD and DSc theses as well as on competitions for academic titles**, PhD theses – 6 reviews; DSc theses – 2 reviews; professorship – 1 review and 1 opinion; **(c) Reviews on articles submitted to specialized journals** – 110. The total number of written expertise materials is 142.

Scientists from IP are members of **the editorial boards of 14 scientific journals**: *Clinical Pharmacology and Biopharmaceutics*; *Phosphorus, Sulfur, Silicon and Related Elements*; *Journal of Pharmaceutics*; *Journal of Bioactive and Compatible Polymers: Biomedical Applications*; *International Journal of Polymeric Materials and Polymeric Biomaterials*; *Химия и индустрия*; *Nancontainers*; *Journal of Polymers*; *The Scientific World Journal: Chemical Engineering*; *Списание на БАН*; *Фармация*; *Polymery*; *Macedonian Journal of Chemistry and Chemical Engineering* u *International Scholarly Research Notices*.

IP has been established as a center for debates and dissemination of expertise in the field of polymers and polymer materials. The Colloquium chaired by Prof. DSc Petar Petrov is a forum in which prominent scientists from the country and abroad present their achievements and new accomplishments in polymer science. In 2014, researchers from abroad gave lectures at four of the Colloquium meetings:

- **Dr. Silvia Halacheva**, Institute for Materials Research and Innovation, University of Bolton, Greater Manchester, **United Kingdom**;
- **Prof. Dr. Yasuhiko Iwasaki**, Department of Chemistry and Materials Engineering, Faculty of Chemistry, Materials and Bioengineering, Kansai University, Osaka, **Japan**;
- **Prof. Richard Hoogenboom**, Department of Organic and Macromolecular Chemistry, Ghent University, **Belgium**;
- **Assoc. Prof. Shin-ichi Yusa**, Department of Materials Science and Chemistry University of Hyogo, Himeji, **Japan**.

IP is a member of a consortium of 10 Bulgarian scientific research institutions and universities for building **"Infrastructure for production and research of new materials with applications in industry, biomedicine and the environment; research, diagnostics, restoration and conservation of metal artifacts"**(two modules) which is a part of the National roadmap of scientific infrastructure, adopted by Resolution 692 of the CM of the Republic of Bulgaria on 21st September 2010.

International Co-Operation at IP in 2014

The researchers have been fostering long lasting and fruitful scientific contacts with colleagues from academic institutes and universities in Europe and Asia. The research is carried out within the framework of joint projects at academic and institutional level.

Within contracts and agreements with foreign academies

In 2014, the scientists from IP participated in **9 projects** within contracts and agreements with foreign academies: **4** with the **Polish Academy of Sciences** (Centre of Polymer and Carbon Materials), **2** with the **Russian Academy of Sciences** (A. N . Nesmeyanov Institute of Organoelemental Compounds and Institute of Chemical Physics), **1** with the **Slovak Academy of Sciences**, **1** of the **Arab Republic of Egypt** and **1** with **Japan**. As a result of the joint research in 2014 appeared **3** publications. The research stays within the framework of bilateral cooperation by the Bulgarian side were for 60 days and by partners - **69** days.

Within contracts and agreements with other research institutes

A major part of research stays in 2014 for short- and long-term research (**21 stays of 25**) were covered by the grant of **POLINNOVA project (GA № 316086)**, and 1 for a short-term research stay was funded by contract **BG051P0001-3.3.06-0017 OP "Human Resources Development" / OP "HRD" /**.

In 2014 **14 foreign scientists visited IP**, from Belgium, Slovakia, Egypt, Japan, Turkey and Poland, respectively. International cooperation facilitates the scientific exchange and mobility of researchers. Participation in international teams contributes to the improvement of competitiveness and stimulates innovation activities of researchers from IP. (**25% of published articles in 2014** are in co-authorship with scientists from the foreign partners of the IP).

In 2014 IP was a member of the following research networks: European scientific network for artificial muscles "COST"; Precision Polymer Materials (Research Network of the European Science Foundation - Precision Polymer Materials (P2M) network from ESF); "Electrospun Nano-Fibres for Bio Inspired Composite Materials and Innovative Industrial Applications", COST Action CM1302: European Network on Smart Inorganic Polymers (SIPs); COPOLYMAT - between IP and the Center for Polymer and Carbon Materials, Polish Academy of Sciences. In 2014 IP became a member of the European Energy Research Alliance (EERA).

Important projects of IP-BAS in 2014

In 2014 IP was implementing a project "**Strengthening research capacity and innovative potential of the Institute for Polymers, Bulgarian Academy of Sciences for further integration into the ERA**" (POLINNOVA, GA №316 086), funded under the **7FP of the European Union**, aimed at unlocking the full potential of the EU in support of the vanguard initiative, under which research and innovation are key factors for sustainable development, competitiveness and social progress. The total project cost is BGN 4,207,698. The project's duration is **42 months**. In 2014 within the frames of the project **a mass spectrometer was purchased**. It upgraded the apparatus for thermal gravimetric analysis existing at IP-BAS. **21 short- and long-term research stays for carrying our investigations at the partnering research organizations were realized within the project**. The project also helped the dissemination of the scientific results of IP through **issuance of printed materials** and through the participation of researchers from the Institute in scientific forums (29 of 44 active participations in scientific events were covered by the project grant).

In 2014, IP was implementing two projects funded by **OP "Human Resources Development"**. One of them (**BG051P0001-3.3.06-006**) was completed in mid2014. The second project (BG051P0001-3.3.06-0017) - "Development of scientific potential for sustainable career development of young scientists, PhD students and postdocs in priority areas of polymer science " supported PhD students and young scientists from the target group in terms of their research with the purchase of chemicals and supplies, as well as providing financial resources for attending scientific forums to present their results. One short research stay was realized with the financial support of the project. The total cost of the project is BGN 269 406.93. The project duration is 30 months.

In 2014, IP also performed activities related to the project funded by OP "**Development of the Competitiveness of the Bulgarian Economy**" (**BG161P0003-1.2.04-0096-S0001**) "Support for applied research at the Institute of Polymers to develop new polymeric and composite materials from unconventional resources with applications in environmental, energy saving and health-related technologies". The project aims at creating a modern pro-innovative infrastructure in IP by purchasing and upgrading of equipment suitable for applied research in priority areas. The total project cost is BGN 2395 365.00. The project duration is 22 months. Within this project the following equipment was purchased in 2014:

- *X-ray diffractometer **Bruker AXS D8 Advanced ECO**;*
- *HLPC/GPC analytical system **LC-20 (Prominence, Nexera XR), Shimadzu**;*
- *Gas chromatography analytical system **Agilent 7890B**;*
- *Automatic viscometer **PolyVisco®**, Cannon Instrument*;
- *Equipment for spraying and vacuum drying of aqueous and organic solvents **Mini Spray Drier B-290 Advanced, Buchi**;*

In 2014, a three-year contract was signed between the IP and "NPP Kozloduy". The institute is providing analytical services and consultation for control of sealing rubber materials. The total value of the contract is BGN 20 000.00.

Events of 2014

During the period February 17th-19th 2014 a training course *Horizon 2020 - the EU program for research and innovation* (with the support of project POLINNOVA (GA № 316 086). The researchers from IP had the opportunity to get acquainted with the basic requirements for project applications under the Horizon 2020 framework program.



IP was awarded two diplomas at the National launching conference of the Horizon 2020 EU program for research and innovation, held on 18th and 19th February 2014 in Sofia (Bulgaria). The conference was organized by the Ministry of Education and Science acting as a national coordinator of the program and the European Commission. The project coordinators of the PASPORT and POLINNOVA projects (funded by FP7): Prof. DSc Kolio Troev and Assoc. Prof. Neli Koseva, respectively, were honored with the award for significant merit.



In 2014 PhD student **Elena Korina** from IP won the **Professor Ivan Schopov award for outstanding young scientist in the field of polymers.**



➤ During the period 24th -26th March 2014 in Sofia (Bulgaria) **11th European Workshop on Phosphorus Chemistry, EWPC11** was held. It was organized by the Laboratory Phosphorus-containing Monomers and Polymers at IP. The workshop was attended by **114 researchers** from Bulgaria, France, Germany, Spain, UK, Netherlands, Switzerland, Hungary, Sweden, Romania, Poland, USA, Italy, Ireland and Slovakia. **Two plenary lectures, 24 oral and 55 poster communications** were presented. In 2014 the **Laboratory of Phosphorus-containing Polymers and Monomers** celebrated **25th anniversary** with a lecture by the youngest member of the laboratory - PhD student Zornica Todorova.

➤ On 21.05. 2014 **The Open Doors Day** took place. The event intended to promote the research achievements of IP.



БЪЛГАРСКА АКАДЕМИЯ НА НАУКИТЕ
ИНСТИТУТ ПО ПОЛИМЕРИ
ОТВОРЕНИ ВРАТИ

Уважаеми гости и колеги,
На 21 май 2014 г. Институтът по полимери кани всички желаещи да се запознаят с актуалните научни изследвания и най-новите постижения в областта на полимерите и полимерните материали.

Ще бъдат представени програмите за обучение на студенти и докторанти, както и експертните услуги, които предлагаме.

От 16 до 20 юни в сградата на института ще бъде представена изложба посветена на 25-ата годишнина на лаборатория „Биологичноактивни полимери“ и “10 години електроохлаждане в България”.

гр. София, ул. „Акад. Георги Бончев“, блок 103 В

Начало: 9⁰⁰ часа
Край: 17⁰⁰ часа

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<http://www.polymer.bas.bg>
<http://polinnova.polymer.bas.bg>

Събитието се организира в рамките на честванията на 145 години от основаването на БАН

The **V-th Poster Session “Young Scientists in the World of Polymers”** was held at the Institute of Polymers on 5th June 2014. It was funded within the **POLINNOVA** and **BG051P0001-3.3.06-0017** projects and dedicated to the 145th anniversary of the Bulgarian Academy of Sciences. Young scientists and PhD students from IP, SU, MU-Sofia, UCTM and other institutes at BAS were provided with the opportunity to present the results from their research.

Институтът по полимери към БАН
има удоволствието да покани докторанти и млади учени за участие в

ПЕТАТА ПОСТЕРНА СЕСИЯ „МЛАДИТЕ УЧЕНИ В СВЕТА НА ПОЛИМЕРИТЕ“

организирана в рамките на
проект POLINNOVA “Укрепване на научноизследователския капацитет и иновационен потенциал на ИП към БАН по 7^{FP} и
проект „Изграждане на научния потенциал за устойчиво кариерно развитие на младите учени, докторанти и постдокторанти в приоритетни области на полимерната наука“ по схема за предоставяне на безвъзмездна финансова помощ. Подкрепа за развитието на докторанти, постдокторанти, специализанти и млади учени, ЕСФ, МОН, ОП “Развитие на човешките ресурси” 2007-2013

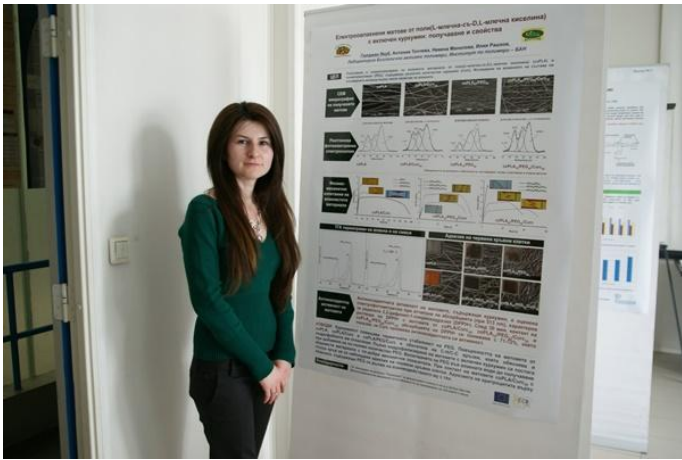
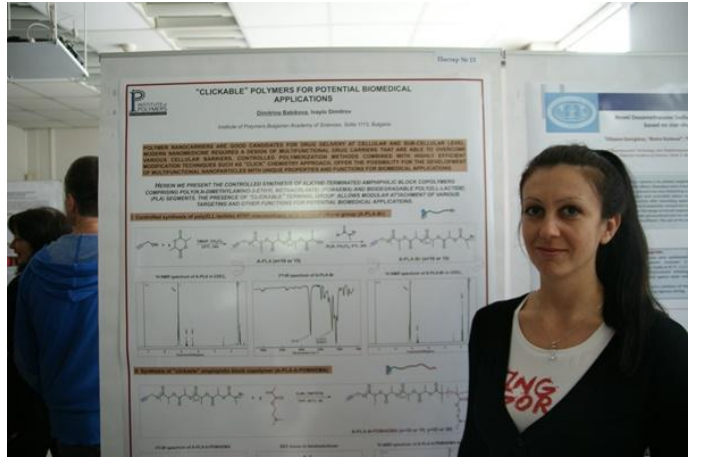
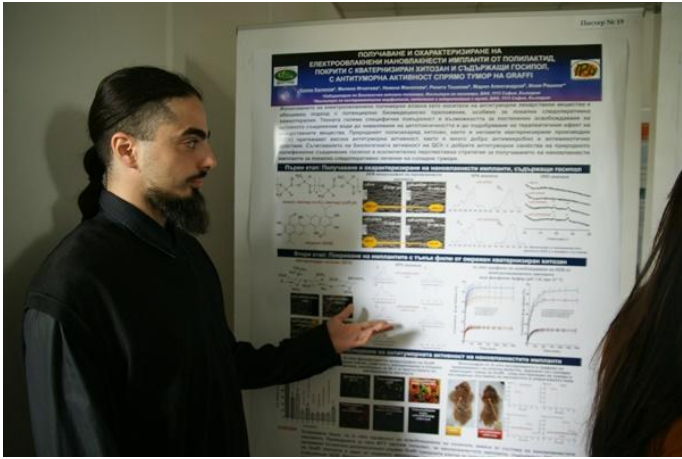
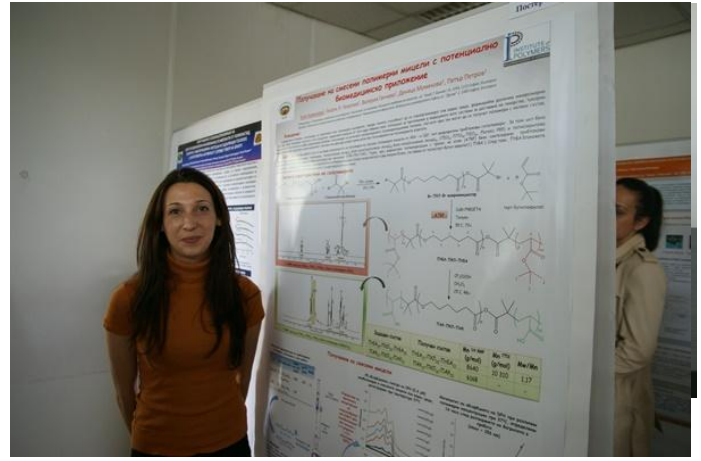
Желаещите да участват трябва да изпратят попълнена заявка за участие и готов постер на адрес:
polinnova@polymer.bas.bg

Дата на провеждане: 5 юни 2014г.	Краен срок за подаване на заявки за участие: 22 май 2014г.	Изисквания към постерите: размери 70/100 см
Място на провеждане: ИП-БАН, ул. Акад. Г. Бончев, бл. 103-В, тр. София, Заседателна зала.	Краен срок за изпращане на постери: 29 май 2014г.	Формат на файла .pdf
		Език български или английски

формулярът за участие е достъпен на следните адреси:
<http://polinnova.polymer.bas.bg> и
<http://youngresearchers.polymer.bas.bg>

Програма на постерната сесия:
14:00-14:10ч. Откриване
14:10-16:00ч. Представяне на постерите
16:00-17:00ч. Кофеил





➤ On 9th June 2014 the Acad. Stefan Vodenicharov, President of the Bulgarian Academy of Sciences and Corr. Member Iliya Rashkov opened the Jubilee exhibition “Electrospinning – a High Technology for Producing Vanguard Micro- and Nanofibrous Materials” dedicated to the **25th anniversary of the Laboratory Biologically Active Polymers, 10th anniversary of electrospinning in Bulgaria and 145th anniversary of the Bulgarian Academy of Sciences**. Dr. Todor Chobanov - Deputy Mayor of Sofia, members of the academic circles, representatives of the business and pharmaceutical companies, directors of institutes at BAS, colleagues from the University of Sofia and UCTM, visiting scientists from Mons University – Belgium.



The internationally known prominent scientists - Dr. L. Mespouille and Dr. R. Mincheva from the Laboratory of Polymeric and Composite Materials, Center of Innovation and Research in Materials and Polymers, University of Mons, Belgium delivered lectures at the opening.

The Jubilee Exhibition was on display at the Administrative Building of BAS and at IP-BAS. During the period 23rd October – 7th November 2014 it was hosted at the New Bulgarian University.

The exhibition attracted the attention of the media and it was widely covered by the press and the electronic media.



➤ In 2014, the Laboratory Amphiphilic and Ionogenic Polymers under at IP organized Bulgarian-Slovak seminar on Challenges in the development of intelligent multifunctional polymeric materials and prospects Biomedical their application. The seminar within a project for scientific Bulgarian-Slovak co-operation funded by **NSF/Ministry of Education and Science Programme** was held in the period 28th-29th October 2014 in Hisarya, Bulgaria.

➤ The Laboratory **Amphiphilic and Ionogenic Polymers** also celebrated its **25th anniversary** in 2014 and the 80th jubilee of its founder - **Prof. DSc R. Velitchkova**.

Within the project **POLINNOVA** on 7th November 2014 at the Sense Hotel, Sofia (Bulgaria), a workshop on "**Challenges faced by Scientific Organizations and Businesses when Implement the Innovation Strategy Bulgaria 2020**" was held. The meeting was organized by **IP** with the participation of **academic organizations** (institutes of the Bulgarian Academy of Sciences, University of Chemical Technology and Metallurgy, University "Prof. Dr. Assen Zlatarov" - Bourgas, Veliko Tarnovo University "St. St. Cyril and Methodius", University of Architecture, Civil Engineering and Geodesy), **business representatives** (cluster "Srednogie" Branch Association "Polymers", the company "Chemicals" Ltd., the company "Biovet" AD.), **Sofia Municipality** and **the Ministry of Economy and Energy**. The workshop was officially opened by Mr. Todor Chobanov, Deputy Mayor of Sofia, and the morning session of the meeting was closed by Mrs. Yordanka Fandakova, Mayor of Sofia. The Workshop was attended by 65 participants. The following lectures were presented:

- Strategy for Development of the Innovation Capacity of a research organization (Assoc. Prof. Nelly Koseva, Director of IP);
 - A Strategy for Development of Innovations and Technology in An Industrial Cluster (Industrial Cluster "Srednogie");
 - The experience of a large company in the field of innovations" ("Biovet");
 - The experience of SMEs in the field innovations ("Chemicals" Ltd., Yambol).
- The team of the **Institute of Polymers** was awarded with a **diploma and a plaquette for the realization of scientific projects of over BGN 1,000,000** in connection with the celebration of the 145th anniversary of BAS held at the Great Hall of BAS on 11 December 2014.
- In connection with the celebration of the 145th anniversary of BAS held at the Great Hall of BAS on 11 December 2014 scientific teams winners in the completion of **Competition for Excellent Scientific Achievements** in the course of the recent five years. In the filed **Nanosciences, New Materials and Technologies** the team of **Laboratory Biologically Active Polymers at IP** was awarded for their achievements in the field of Creating a New Generation of Micro- and Nano-structured Polymer Materials via Developing the Vanguard Nanotechnology of Electrospinning.

Publishing and Dissemination Activity

The booklet of IP informing the academic community, businesses and the general public about the research activities of the Institute has been published annually through the grant for the POLINNOVA project (GAN^o 316 086). In 2014 a coverage of the expert and research activities of the Institute was also issued through the grant for the POLINNOVA project (GAN^o 316 086). The article contained information about the available at IP-BAS facilities for carrying out investigations and analysis. The advertising materials were sent to current and potential partners from the academia and industry, and were distributed at scientific and industrial forums.

The website of IP-BAS is constantly updated with the latest information. It also advertises expertise and services that the Institute offers. In accordance with the requirements of law, the necessary information on the procedures for earning an academic degree or title is published in a timely manner on the website. The Institute has an advertising page in the electronic catalog of Golden Pages Bulgaria, as well as in catalogs "Compass", Who's who in European Commerce and Industry, Europe World of Learning, etc.