

Preamble

The Polymer Institute of the Slovak Academy of Sciences (PISAS) is the research institution active in the areas of polymer chemistry, polymer (bio)materials, polymer physics and other polymer science related areas. PISAS was established 55 years ago and in its path from the history to present has created firm foundations for polymer science in Slovakia with a significant impact on national and international polymer science.

The PISAS mission is (1) to perform the excellent basic and applied research in the contemporary topics of polymer science, (2) to act as the external education institution, (3) to provide external services to academic and industrial partners, and (4) to disseminate results to professional and lay public.

As a result of the PISAS accreditation for years 2012 - 2015, the international accreditation panel of experts evaluated our institute with the highest rating A characterized as *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.*

Primarily, this evaluation is understood as a result of mechanisms established by the past and present institute managements focusing on the high quality research, human resources and work environment. We have been keeping in mind the words of the PISAS founder Dr. Milan Lazar, who defined the eligibility of a research institution to exist as *It has been valid in the past, is valid today and will be valid in the future that the research institute exists only until it achieves high quality results demonstrated in any accreditation or any time interval.* The validity of this statement is obvious for PISAS and any research institution.

The accreditation panel has formulated its recommendations for the institutes of the Slovak Academy of Sciences, Slovak Academy of Sciences and the Ministry of Education, which are a must guidelines for the Slovak research, development and education institutions in order to get closer to the standard level of European and world research and education organizations.

This evaluation declares that PISAS has already been successfully following most of these guidelines. In the future we should (1) strengthen the core research topics, (2) aim at publishing in high-impact journals, and (3) attract young scientists, also internationally. All these points are reflected in the action steps for the next years in this Action plan. Although this accreditation is for PISAS positive, we are aware of existing weakness and threads that may negatively influence the PISAS vision (1) to substantially enhance its recognition in the global polymer science and related fields, and (2) to continuously prove its usefulness to professionals and lay public.

The principal steps are defined in this Action plan for the period of 2018 – 2022 covering various categories proposed by the Presidium SAS.

Research strategy for the next 5 years

a) Current situation

The research has been conducted at 4 research departments (Biomaterials research, Composite materials, Molecular simulation, Synthesis and characterization of polymers). These departments have been created in 2002 after the institute re-structuring and represent the scientific profile of the institute. The research strategy has been formulated within this profiles primarily by the research leaders in the responsibility of the heads of departments.

The strategy has led to several topics where the “PISAS label“ has been globally recognized, to a

number of manuscripts including a substantial number in high-ranked journals, and to national and international recognition expressed by invited lectures, organized international conferences, projects and contracts with industrial partners, and the exchange of scientific personnel.

This strategy is the expertise-, human resources- and new knowledge-driven. It strongly depends on the financial support, which has been a crucial factor in the current situation characterized by continuously low and non-systematic governmental support. A high number of existing projects (80 – 100 projects per year, national and international, and of different size and different funding level) is a positive sign of researchers' activities and provides necessary resources. On the other hand this high number results in a substantial research fragmentation and administrative burden, realized also by the accreditation panel, which reduction is planned in the future in case the external conditions will enable this step. The research topics possess the signs of modern research approaches characterized by intra- and inter-institute collaboration, national and international collaboration, a non-negligible number of national and foreign contracts and multi-disciplinarity.

The institute management has been promoting the conditions for research quality in cooperation with the scientific board, heads of research departments and the board of young researchers. The external board was established in 2015 consisting of internationally recognized foreign experts and the representative from industry to obtain the external expert view. Overall, the processes established at PISAS in the last years create proper basis for the future establishment under the conditions of the public research institution.

The research strategy for the next years is planned to be re-approached at the levels influencing personnel, research topics, research environment, and international recognition development.

b) Strategy for the next 5 years

Principles adopted at the personnel level:

- to promote the “good to work here” principle for all institute employees with a dedicated individual role,
- to evaluate the research employees on regular basis, with both positive and negative consequences,
- to stimulate and support the excellent researchers,
- to stimulate and enhance the opportunities for research employees to combine the scientific career with the Polymer Institute SAS,
- to increase the ratio of PhD students and post-doctoral fellows to the permanent research staff (to gradually invert the current pyramid characterized by a high number of permanent research staff and lower number of PhD students and young post-doctoral fellows),
- to promote the potential leaders from young/medium age generation researchers in creating their research groups and becoming the world-recognized experts in their areas, and
- to internationalize the personnel environment.

Principles adopted at the research topics level:

- to support the topics having character of the institute “core” topics across the institute expertise,
- to support the key research topics of the global impact and where the institute has already

been recognized as a key player,

- to evaluate the current topics and support them in case they have proven impact on the global polymer science community,
- to identify the global leading topics of interest where the institute is having the capability to contribute and, consequently, consider to initiate these topics at the institute,
- to identify and support the new topics with the potential to become the core and/or leading institute topics of global importance,
- to identify and support the topics and activities leading to cooperation and contracts with national and international academic and industrial partners,
- to make the conditions promoting multidisciplinary and interinstitutional research at the national and international level,
- to identify and support the topics with a potential of real and valuable institutional intellectual property, and support creation of start-up or spin-off companies, and
- to abandon those topics and projects which obtained poor evaluation or do not exhibit the above attributes.

Principles adopted at the research environment level:

- to provide perspective and conditions for researchers to build the scientific career at PISAS
- to retain the equal opportunity environment and promote the gender balance,
- to strengthen the intra-institute cooperation, teaming, fair and critical atmosphere,
- to provide top-level working conditions and access to required infrastructure, and
- to support all the research 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).

Principles adopted at the international recognition level:

- to properly disseminate the information about the institute expertise via high-ranked international journals, invited lectures at the conferences and institutions, mutual cooperation and projects, and other mechanisms
- to strengthen the exchange of research staff and students utilizing current and creating new mechanisms,
- to enhance the visibility by organizing a continuous series of institute seminars given by well-recognized scientists, and by organizing regular international conferences,
- to initiate contacts with foreign universities to act as the external institution for the PhD studies, and
- to continue getting the advice from the members of the External board consisting of internationally recognized foreign experts on the profile institute topics and of the industry representative.

Action plan

Enhanced quality of research outputs

a) Current situation

The current situation has been at the good level. Within the institutes of SAS, PISAS is having the leading position in the number of publications per the number of researchers (or any other parameter). This comparison to the Slovak research institutes is not as critical as is the objective quality of the research outputs expressed by the $IF > 3$ for more than 50 % of publications, most (~60 %) of publications published in the 1st quartile and negligible to none publications in the 3rd and 4th quartiles of the Scimago Journal Ranking, and around 50 % publications with PISAS as the corresponding affiliation. These are indeed positive publication outcomes reflected in a continuously increased number of citations demonstrating that PISAS is visible in the polymer science globally and its research is useful.

PISAS has developed the model for evaluation of researchers applied since 2002, which also involves the critical view on the publication outcomes. The publication outcomes are one of the criteria of the overall usefulness of a researcher to the institute outcomes. As a part of the research outputs evaluation, we have a model to financially support the researchers based on their publication results considering the IF and number of co-authors. Lately we have a few manuscripts published by Nature journals and Nature publishing group. To succeed in these journals requires the top topic and result, usually sound both collaborators and the way of writing. We do submit and will continue submitting the manuscripts to these journals.

We understand that several aspects require an improvement and will be tackled during the next period. The principal ones include (1) an imbalanced contribution of individual researchers to the overall institute outcomes, (2) an insufficient contribution of individual researchers as corresponding authors, (3) insufficient contribution of young researchers due to missing or ineffective training scheme, and (4) non-proportional contribution of scientists with respect to their age, experience, and academic/scientific titles. All these aspects depend on quality of the research staff and the potential of PISAS to employ high quality research staff.

b) Action plan for the next 5 years

- to create the mechanisms for obtaining a high quality research staff that will replace the low-performing research staff,
- to update current model for evaluation of research outputs of researchers and to create a flexible scheme to award high quality outputs,
- to minimize publishing in 3rd and 4th quartiles of Scimago Journal Ranking and to encourage publishing in the 1st quartile; adopt the principle that a lower number but high quality publications is preferred over the vice versa situation,
- to avoid non-balanced contribution, taking into account the research experience, and
- to provide the soft skills training of PhD students and young generation of scientists.

Enhanced quality of PhD training and career plan of researchers

a) Current situation

PISAS currently acts as an external institution for three PhD programs: macromolecular chemistry, physical chemistry and technology of macromolecular materials. Our priority is to provide an excellent training, which is partly hampered by (1) a legislation, since we act as the external institution and the scope and quality of education is not in our hands, (2) a low number of suitable PhD candidates, (3) vague rules determining the eligibility for the PhD defense, and (4) a non-existing system for internationalization of the PhD studies.

PISAS has developed and uses the scheme for approval the PhD topics as well as the evaluation of PhD students that consists of annual reporting to the scientific board and institute management in the form of presentation (in English language) and summarizing the achieved results and overall outputs. This enables to recognize strength and weakness of a particular PhD student, which in some cases has led to the PhD termination. Overall, in the last years we observe rather broad distribution in the quality of defended PhD students from truly excellent to rather weak.

A number of defended PhD students stay at PISAS that at glance may be taken as a negative sign of inbreeding. We definitely prefer and support the young generation to gain the experience at a foreign research institution, nevertheless, two points are against imposing this as a rule: (1) there is a limited opportunity for young PhD's, who prefer staying in Slovakia from e.g. personal reasons, to get an employment in the polymer science, and (2) the running projects need a high quality personnel which is not easily to be replaced in our country.

We have developed and adopt the mechanism to evaluate young generation of post-doctoral researchers (since 2012) with the requirements on research outputs for the period from 1 to 12 years after the PhD defense. This mechanism is applied in considering the contract duration between 1 and 5 years. It takes into account the exceptions such as maternity leaves. The reason for implementing this mechanism is to demonstrate the PISAS interest in the career development of young/medium age generation of researchers.

With respect to the internalization, PISAS has recently signed the MoU's with two Iranian universities to open the possibility for Iranian students to perform PhD studies and post-doctoral stays at our institute.

b) Action plan for the next 5 years

- to warrant the high quality PhD conditions, and the career development and perspectives in the research environment from PhD to DSc,
- to increase the number of PhD students covered by external resources,
- to select the PhD topics that are within the key and perspective institute topics,
- to select the PhD supervisors based on recent research scientific history, the history in supervising the PhD students, research outputs, research projects and resources, and international cooperation,
- to follow the principle valid at foreign universities that, upon an increased number of post-doctoral and PhD students, the PhD students are directly supervised by young researchers to create functional communication and training atmosphere,
- to impose the participation of PhD students at the international conferences and foreign scientific institutions,
- to internationalize PhD studies by identification of foreign universities for which PISAS can

act as the external PhD training institution, by hiring the students from other countries based on personal contacts, MoU's, National scholarship programs, dual PhD programs, and other mechanisms,

- to introduce, as a rule, internal criteria for the PhD defense that will include (1) the minimum number of published research papers related to the PhD study with proven major contribution of the PhD student (first and/or corresponding author), (2) the proven added knowledge by the student (and not the supervisor), (3) the number of oral presentations at the international conferences, and (4) the mid-term (a few weeks to a few months) stay at the foreign institution;
- within the career plan, after the PhD defense to provide the career opportunities preferably at the external foreign institutions with minimized and balanced inbreeding,
- to provide the perspective for excellent PhD students to return after post-doctoral studies to the institute; for this to define transparent recommendation criteria on research outputs allowing the career plan of particular researchers to be connected with PISAS from the post-doctoral level to obtaining DSc degree,
- to identify and promote top researchers with all the attributes to successfully apply for the ERC and other prestigious grants.

Conclusion

PISAS sees no other future than that of the excellent research institution with a strong impact on global polymer science. This Action plan lists the possible directions to enhance its current status. A number of these tasks obviously cannot be realized without applying the recommended and systematic actions steps for the Slovak Academy of Sciences and Slovakian research space recommended by the international accreditation panel of experts, to which the PISAS Action plan will be immersed. Otherwise, if the external conditions for conducting the research and development remain unchanged, the future for science in Slovakia may become questionable.

Approved by Management and Scientific board of Polymer Institute SAS

Sept 30 2017