

Evaluation of research and professional activity of research-oriented institutes of the Czech Academy of Sciences for the period 2015–2019

Final Report

Name of the Institute: Institute of Macromolecular Chemistry of the CAS, v. v. i.

Evaluated teams and their leaders:

1. Supramolecular systems and self-association processes (Petr Štěpánek)
2. Biomacromolecular and bioanalogous systems: Tissue engineering (Ognen Pop-Georgievski)
3. Biomacromolecular and bioanalogous systems: Therapeutics (Tomáš Etrych)
4. Polymer materials (Zdeněk Starý)
5. Structure and dynamics of macromolecules (Jiří Brus)
6. Polymers for optoelectronics and energy applications (Jiří Pflieger)

Part A: Evaluation of the institute

Strengths:

- Quality of scientific personnel
- Good opportunities for training of early career researchers
- Some of the published work is visible at the international level

Weaknesses:

- Pyramidal management structure impedes adventure in research
- Poor age-distribution profile
- Notable gender imbalance, especially at senior and leadership positions

Opportunities:

- Introduce flat organisational structure
- Restructure all research centres by adopting a flat structure model designed to empower young researchers.
- Cease activities in the area of materials for optoelectronics
- Establish a research focus on computer-aided molecular design
- Limit the number and narrow the focus of research activities
- Adopt the principles of the Athena Swan Charter

Threats:

- Culture of resistance to change
- Excessive effort invested in mature areas of research
- Research activities heavily influenced by established expertise

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Commensurate in quality with those from congener European organisations.	
H1.2	Contribution of workers on the outputs reached
Variable.	
H1.3	Quality of all outputs and results
Average.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Fundamental research on polymer therapeutics.	
H1.5	Contribution of the participation of the authors in large collaborations
Variable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
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Some of the contributions in the field of polymer therapeutics appear promising.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are not very well developed.	
H2.3	Relation to practice
Established polymer characterisation techniques may be amenable to commercial exploitation in the form of a commercial service subject to compliance with relevant ISO standards. Current research activities are far removed from the marketplace. Attempts to contribute to topical research on supercapacitors and ORR electrocatalysts fall well short of the internationally leading level.	
H2.4	Participation in AV21 strategy
Cooperative.	
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate was implied to members of the commission but the current level of cooperation is rather low.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Average and progressively diminishing level of visibility.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
Mainly as junior partners.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Below average.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
There is an urgent need for significant restructuring. Promising young researchers must be given the freedom to explore new and topical areas of research.	
D2.2	Assessment of the previous research objectives and their achievement
The age-determined hierarchical structure impedes the development of new or topical research activities and suppresses the creativity of young researchers.	
D2.3	Assessment of implementation of recommendations from past evaluation

Changes appear to have been made reluctantly and implemented only in part.	
D2.4	Success in receiving grants
Commendable success: some Horizon 2020 funding.	
D2.5	Adequacy of instrumental equipment
Meets current needs but marked by the absence of highly specialised equipment.	
D2.6	Effectiveness of management
Dated management structure and procedures simply support the <i>status quo</i> and discourages innovation and high-risk scientific research.	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The dynamism and enthusiasm of young people appears to be suppressed by a culture that promotes the part-time employment of retirees. Significant barriers that are imbedded in the culture of the institution inhibit the progression of female researchers.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Female researchers are invisible at positions of senior leadership. Members of the commission could not identify any evidence of a credible effort to improve opportunities for female members of staff.	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
The Institute is at a phase of managed decline, which can only be reversed with fundamental reorganisation that involves a change in management structure and procedures.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Significant, mainly at the national level.	
D3.2	Effectiveness of joint research centres
The Institute supports the ambitious goals of BIOCEV and EATRIS-ERUC as an active member.	
D3.3	Success rate in supervision of PhD students
Commensurate with expectation.	
D3.4	Participation of PhD students in the outputs
Variable, with some notable contributions.	
D3.5	Participation of the institute in master or bachelor studies
Notable.	

D3.6	Assessment of cooperation intensity with universities in the form of teaching
Notable.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The commission commends the activities on Czech mass media.	
D4.2	Publishing activities and its quality
None of note.	
D4.3	Participation in professional organisations in the area of research and development
Commensurate with expectation.	

Other comments of the commission:

The commission noted the inability to halt the progressive decline in the international visibility of the institute. In parallel, members of the commission concurred that there is a significant pool of underutilised scientific talent within the institute. In an effort to understand the underlying reasons for the notable decline in international reputation, members of the commission adapted their line of questioning such as to deconvolute the factors that contribute to the apparent deterioration in standards.

The lines of questioning were manifold, with particular emphasis on the:

- 1) unconventional age distribution profile of the institution;
- 2) apparent gender imbalances;
- 3) topicality and novelty of the research portfolio; and,
- 4) management ethos and receptiveness to change.

The commission noted that 120 students are distributed among the 17 Departments (5 research centres), 40 of whom are studying at PhD level, and that ca. 40/120 scientific employees are older than 60. With a few notable exceptions, the contributions of the older members of staff were not apparent. The internal assessment of the quality of research appears to be based on the impact factor of the journal, rather than the direct impact of each of the specified publications.

The commission noted the lack of awareness of the well-documented and widely deployed principle that gender balance and cultural diversity at all levels have a positive impact on both the productivity and creativity of research teams. The culture of part-time work being the preserve of women in caring situations and of long-serving senior employees who have exceeded retirement age needs to be questioned. The commission was unable to uncover the institute-specific strategies for the recruitment of more female researchers and for the mentoring of women towards positions of senior leadership.

The research portfolio is fragmented, as is exemplified by the initiation of 156 projects over 5 years (more than one project per individual scientist). The proposed increase of research activities in the field of drug delivery was seen by the commission as a step in the right

direction, but no strategy has been presented in the director's report towards the specified goal. The rapid decline in the activities of one of the research centres in Biomacromolecular and Bioanalogous Systems highlights the need for the restructuring of these centres. The research activities of the Structure and Dynamics team are decoupled from those of the rest of the Institute (dynamics, soft materials), which opens up the opportunity to split Structure and Dynamics into a service (Analytical Chemistry) and a research (Materials) groups. Research activities in the field of optoelectronics are several decades out of date, and should be sacrificed to allow a degree of flexibility in the proposed restructuring. Contrary to recommendations made at the previous review cycle, not a single area of research was assessed by the commission to venture into high-risk/high-reward activities or to present evidence of novel, innovative or adventurous research that would help place the institute firmly on the map of excellence in optoelectronics research.

Members of the commission developed the impression that the director was not receptive to suggestions about change, which became apparent following a rather disdainful response to a question about the possible establishment of a computer-assisted synthesis group. The director's goal appears to be to increase the share of CAS direct funding as much as possible (he stated that his goal is 75%, which is at best unrealistic considering that the funding that this institute receives from CAS is similar to that of the other institutes this commission assessed). The director gave the impression of seeking to preserve the status quo while reducing the need to pursue competitive external funding. The previous evaluation commission recommended restructuring, which resulted in three departments (not named) being closed and one (not named, but probably Biological Models) being added. The director characterized this process as being "dynamic" but gave no plans for future restructuring. Of the risks specified at the last evaluation (too many topics, too few risky ideas, diminishing international status, not publishing in top journals) only the issue of publications has been addressed effectively. The structure of the Institute reflects at best traditional, at worst out-of-date ideas. For instance, essentially no modern materials institute or centre can do without modelling and simulation and the aspect of polymer dynamics is largely neglected. This is a classical "trial-and-error" experimental approach, which inhibits the capability of researchers at the institute to reach their full potential.

Members of the commission applaud the declared contributions to the Polymer Society (chairmanship) and acknowledge its inherent benefits of exerting influence and augmenting the sphere of research interactions.

Part B: Evaluation of teams

1. Supramolecular systems and self-association processes

Strengths:

- Quality of scientific personnel
- Good opportunities for training of early career researchers
- Some of the published work is notable at the international level

Weaknesses:

- Institutional barriers to ventures in high-risk research
- Diversity of activities compromises quality

Opportunities:

- Introduce a flat organisational structure
- Limit the number and narrow the focus of research activities

Threats:

- Culture of resistance to change
- Research activities heavily influenced by established expertise

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Commensurate in quality with those from congener European organisations.	
H1.2	Contribution of workers on the outputs reached
Variable.	
H1.3	Quality of all outputs and results
Average.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Fundamental research on polymer therapeutics.	
H1.5	Contribution of the participation of the authors in large collaborations
Variable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Some of the contributions in the field of polymer therapeutics are amenable to further development and possible clinical assessment.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are not very well developed at institutional level.	
H2.3	Relation to practice
Current research activities are far removed from the marketplace. The institution must develop strategies towards reduction to practice.	
H2.4	Participation in AV21 strategy
Yes.	
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate is not underpinned by a sound strategy towards that goal.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Average at the international level; leading at the national level.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
Some notable international collaborations but below expectation considering the status of the academy at the national level.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Below average within the international context.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The team will benefit from restructuring into a flat structure that empowers promising young researchers to explore new and topical areas of research.	
D2.2	Assessment of the previous research objectives and their achievement
Some progress towards the achievement of the research objectives.	
D2.3	Assessment of implementation of recommendations from past evaluation
Changes appear to have been made only in part.	
D2.4	Success in receiving grants
Some notable successes, mainly as junior partners.	
D2.5	Adequacy of instrumental equipment

Meets current needs.	
D2.6	Effectiveness of management
Dated management structure and procedures.	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The dynamism and enthusiasm that is inherent to young people appear to be suppressed by cultural barriers that operate within most parts of the institution.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Female researchers are invisible at positions of senior leadership.	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Significant, mainly at the national level.	
D3.2	Effectiveness of joint research centres
Effective.	
D3.3	Success rate in supervision of PhD students
Commensurate with expectation.	
D3.4	Participation of PhD students in the outputs
Variable, with some notable contributions.	
D3.5	Participation of the institute in master or bachelor studies
Notable.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Notable.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Below the standards set by competitor institutions at the international level.	
D4.2	Publishing activities and its quality

None of note.	
D4.3	Participation in professional organisations in the area of research and development
Commensurate with expectation.	

Other comments of the commission:

Members of the commission applauded the research efforts exploring perfluorinated molecular moieties, yttrium-90 chemistry and ROS-inspired macromolecular design.

Suggested future work involving terbium-161 did not rationalise molecular design in terms of all performance demands for use in the treatment of cancer. The presentation failed to communicate the contributions of the group relative to those of its clinical partners. Members of the commission commented that the diversity of activities compromises quality in favour of quantity and recommended the redirection of research effort and resources towards a select few areas of research.

2. Biomacromolecular and bioanalogous systems: Tissue engineering

Strengths:

- Quality of some of the scientific personnel

Weaknesses:

- Strong barriers to new ventures in high-risk research
- Research activities progressively less visible at the international level

Opportunities:

- Merge with the congener team.

Threats:

- Culture of resistance to change
- Research activities heavily influenced by dominant individuals.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
High but of progressively decreasing significance to the relevant field of research.	
H1.2	Contribution of workers on the outputs reached
There is a notable decline in the level of scientific innovation.	
H1.3	Quality of all outputs and results
Average within the European context.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Fundamental research on biomedical materials.	
H1.5	Contribution of the participation of the authors in large collaborations
Younger researchers need to be encouraged to initiate collaborations as lead partners.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Some of the contributions in the field of biomaterials offer some promise in the field of detection.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are not very well developed at the institutional level.	

H2.3	Relation to practice
Current research activities are far removed from the marketplace. The activities in applied/mature areas of research would benefit from the development of sound strategies towards reduction to practice.	
H2.4	Participation in AV21 strategy
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate needs to be underpinned by a sound strategy towards that goal.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Weakening at the international level; leading at the national level.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
Funded international collaborations are well below expectation considering the significance of the team at the national level.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Below average within the international context.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
There is an urgent need for significant restructuring. Promising young researchers must be given the freedom to explore new and topical areas of research.	
D2.2	Assessment of the previous research objectives and their achievement
Limited progress towards the achievement of the research objectives.	
D2.3	Assessment of implementation of recommendations from past evaluation
Changes appear to have been implemented only in part.	
D2.4	Success in receiving grants
Some.	
D2.5	Adequacy of instrumental equipment
Meets current needs.	

D2.6	Effectiveness of management
	Dated management structure and procedures.
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
	The dynamism and enthusiasm that is inherent to young people appear to be suppressed by the cultural barriers that operate within most parts of the institution.
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
	Female researchers are invisible at positions of senior leadership.
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
	Significant.
D3.2	Effectiveness of joint research centres
	Low.
D3.3	Success rate in supervision of PhD students
	Commensurate with expectation.
D3.4	Participation of PhD students in the outputs
	Some notable contributions.
D3.5	Participation of the institute in master or bachelor studies
	Notable.
D3.6	Assessment of cooperation intensity with universities in the form of teaching
	Notable.

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
	Below the standards set by competitor institutions at the international level.
D4.2	Publishing activities and its quality
	None of note.

D4.3	Participation in professional organisations in the area of research and development
Commensurate with expectation.	

Other comments of the commission:

The presentation on biomacromolecular and bioanalogous systems conveyed to members of the commission that this once highly productive team is in terminal decline. The focus of the presentation was around research published at the early part of the evaluation period; the commission was unable to uncover any credible plan towards the reinvigoration of this team. The proposed use of molecular brushes for the fabrication of biosensing devices is a mature topic of research, as is the presented work on micro- and nano-particles. Members of the commission concluded that the human and physical resources absorbed by this group would be more productive if absorbed into the therapeutics team.

3. Biomacromolecular and bioanalogous systems: Therapeutics

Strengths:

- Quality of scientific personnel
- Good opportunities for training of early career researchers
- Some of the published work is highly visible at the international level
- Willingness to pursue commercially relevant research

Weaknesses:

- Diversity of activities compromises depth of investigation

Opportunities:

- Introduce flat organisational structure
- Direct effort and resource towards fewer research activities

Threats:

- Culture of resistance to change
- Research activities heavily influenced by established expertise

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Competitive at the global level.	
H1.2	Contribution of workers on the outputs reached
Variable; some notable contributions.	
H1.3	Quality of all outputs and results
Above average.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Fundamental research on polymer therapeutics.	
H1.5	Contribution of the participation of the authors in large collaborations
Variable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Some of the contributions in the field of polymer therapeutics are highly promising.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are not very well developed at institutional level.	

H2.3	Relation to practice
Research must be guided by sound strategies towards reduction to practice.	
H2.4	Participation in AV21 strategy
Compliant.	
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate is not underpinned by a sound strategy towards that goal.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Competitive at the international level; leading at the national level.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
International collaborations are significant but the benefits to the team and institution appear to be mainly witnessed in the form of publications.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Average within the relevant international context.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
Promising young researchers must be given the freedom to operate independently and to explore new and topical areas of research.	
D2.2	Assessment of the previous research objectives and their achievement
Some progress towards the achievement of the research objectives.	
D2.3	Assessment of implementation of recommendations from past evaluation
Changes appear to have been implemented in part.	
D2.4	Success in receiving grants
Below expectation in view of the number and quality of publications and the extent of interactions with industry.	
D2.5	Adequacy of instrumental equipment
Meets current needs.	
D2.6	Effectiveness of management
Dated management structure and procedures.	

D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
In common with most teams at the institution, the dynamism and enthusiasm that is inherent to young people is not harvested fully.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Gender balance is skewed towards males at senior positions.	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
Compliant.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Significant at both the national and international level.	
D3.2	Effectiveness of joint research centres
D3.3	Success rate in supervision of PhD students
Commensurate with expectation.	
D3.4	Participation of PhD students in the outputs
Variable, with some notable contributions.	
D3.5	Participation of the institute in master or bachelor studies
Notable.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Notable.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
On a par with competitor institutions at the international level.	
D4.2	Publishing activities and its quality
Some of international significance.	
D4.3	Participation in professional organisations in the area of research and development

Commensurate with expectation.

Other comments of the commission:

The presentation communicated to members of the commission the capability of this group of researchers to execute work to a very high standard but also a reluctance to venture into internationally leading research activities, as is exemplified by the utilisation of RAFT techniques as a tool rather than as an area of polymer research that is amenable to refinement. Unconventionally, the rationale for the research conducted by this group was presented as inspired by the work of a named scientist, which further reinforced the perception by members of the commission that the excessive celebration of past achievements stifles the development of new ideas. Research activities in dated fields of research (hydroxymethacrylamide “stealth” polymers, magnetic nanoparticles, drug-free polymer therapeutics) need a narrower focus, to amplify quality and hence impact. Attempts to commercialise research were applauded by members of the commission.

4. Polymer materials

Strengths:

- Quality of some of the scientific personnel

Weaknesses:

- Strong cultural barriers to new ventures in high-risk research
- Research activities progressively less visible at the international level

Opportunities:

- Devolve activities on polymer characterisation to a service unit
- Distribute other personnel to other teams according to skills base

Threats:

- Culture of resistance to change
- Research activities heavily influenced by historical factors

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Of lower quality than those from congener European organisations.	
H1.2	Contribution of workers on the outputs reached
Variable.	
H1.3	Quality of all outputs and results
Below average.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Fundamental research on polymer recycling and self-healing. The commercial availability of a pest-repelling technology is noted.	
H1.5	Contribution of the participation of the authors in large collaborations
Variable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Some of the contributions in the field of polymer recycling.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are not very well developed.	
H2.3	Relation to practice

Must develop sound strategies towards reduction to practice.	
H2.4	Participation in AV21 strategy
Compliant.	
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate is not underpinned by a sound strategy towards that goal.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Below average at the international level; notable at the national level.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
International collaborations are well below expectation, considering the status of the academy at the national level.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Below average within the international context.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
There is an urgent need for significant restructuring. Promising young researchers must be given the freedom to explore new and topical areas of research. Polymer characterisation work must be devolved to a separate entity.	
D2.2	Assessment of the previous research objectives and their achievement
Very little progress towards the achievement of the research objectives.	
D2.3	Assessment of implementation of recommendations from past evaluation
Changes appear to have been made reluctantly and implemented only in part.	
D2.4	Success in receiving grants
None of note.	
D2.5	Adequacy of instrumental equipment
Meets current needs but characterised by the absence of specialist instrumentation.	
D2.6	Effectiveness of management
Dated management structure and procedures.	

D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The dynamism and enthusiasm that is inherent to young people appear to be suppressed by cultural barriers that operate within the team.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Female researchers are invisible at positions of senior leadership.	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Mainly at the national level.	
D3.2	Effectiveness of joint research centres
D3.3	Success rate in supervision of PhD students
Commensurate with expectation.	
D3.4	Participation of PhD students in the outputs
Variable, with some as first author.	
D3.5	Participation of the institute in master or bachelor studies
D3.6	Assessment of cooperation intensity with universities in the form of teaching

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Below the standards set by competitor institutions at the international level.	
D4.2	Publishing activities and its quality
None of note.	

D4.3	Participation in professional organisations in the area of research and development
Commensurate with expectation.	

Other comments of the commission:

This team uses very old-fashioned polymer techniques (rheology, mechanical testing, electron microscopy, thermal analysis) as tools for the routine characterisation of polymers. In parallel, the team pursues early stage research on the microwave assisted depolymerisation and recycling of polyurethanes and polycarbonates, which is a commercially important and highly topical field of scientific endeavour. The team also showcased their scientific ventures into the development of self-healing polymers.

5. Structure and dynamics of macromolecules

Strengths:

- Quality of scientific personnel
- Good opportunities for training of early career researchers
- Some of the published work is highly visible at the international level

Weaknesses:

- Cultural barriers to ventures in high-risk research
- Diversity of activities compromises quality

Opportunities:

- Separate the team into research and services entities
- Introduce flat organisational structure
- Limit the number and narrow the focus of research activities

Threats:

- Culture of resistance to change
- Research activities heavily influenced by established expertise

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Commensurate in quality with those from congener European organisations.	
H1.2	Contribution of workers on the outputs reached
Variable.	
H1.3	Quality of all outputs and results
Above average.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Development of methodologies.	
H1.5	Contribution of the participation of the authors in large collaborations
Variable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Mostly of value and capable of accessing the relevant target audiences.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are well developed.	
H2.3	Relation to practice
Must develop sound strategies towards reduction to practice.	
H2.4	Participation in AV21 strategy
Compliant.	
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate is not underpinned by a sound strategy towards that goal.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Average among comparable groups at the international level; leading at the national level.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
International collaborations are notable but do not exceed expectation considering the leading status of the academy at the national level.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Average within the relevant international context.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
There is an urgent need for significant restructuring. Promising young researchers must be given the freedom to explore new and topical areas of research. The team must be separated into research and services entities.	
D2.2	Assessment of the previous research objectives and their achievement
Some progress towards the achievement of the research objectives	
D2.3	Assessment of implementation of recommendations from past evaluation
Changes appear to have been implemented only in part.	
D2.4	Success in receiving grants
None of note.	
D2.5	Adequacy of instrumental equipment

Meets current needs.	
D2.6	Effectiveness of management
Dated management structure and procedures.	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The dynamism and enthusiasm that is inherent to young people appear to be suppressed by cultural barriers that operate within most parts of the institution.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Female researchers are largely invisible at positions of senior leadership.	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
Compliant.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Significant.	
D3.2	Effectiveness of joint research centres
D3.3	Success rate in supervision of PhD students
Commensurate with expectation.	
D3.4	Participation of PhD students in the outputs
Variable, with some notable contributions.	
D3.5	Participation of the institute in master or bachelor studies
Notable.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Notable.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Notable but does not exceed the standard set by competitor institutions at the international level.	

D4.2	Publishing activities and its quality
Significant at the national level.	
D4.3	Participation in professional organisations in the area of research and development
Commensurate with expectation.	

Other comments of the commission:

The research activities on “Dynamics” represent a small portion of the total research effort, and are rather dated. Research on “Structure” is topical but much activity is devoted to the support of the development of generic drugs by a named pharmaceutical company, with few tangible benefits for the group. Research efforts on domain-selective NMR crystallography appear limited to data collection and interpretation, rather than to method development for the refinement of the approach.

Members of the commission noted that while much relatively routine work supports the activities of other groups, research efforts are decoupled from those of the rest of the Institute. Consequently, members of the commission commented on the need to separate the research and service activities and to shift the focus of this group towards topical research.

6. Polymers for optoelectronics and energy applications

- Strengths:**
- Quality of scientific personnel
 - Good opportunities for training of early career researchers
- Weaknesses:**
- Pyramidal management structure impedes adventure in research
 - Poor age-distribution profile
 - Notable gender imbalance at senior and leadership positions
- Opportunities:**
- Redistribute talented members of staff to other groups
- Threats:**
- Culture of resistance to change
 - Research activities heavily influenced by established expertise

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Dated and of progressively decreasing quality.	
H1.2	Contribution of workers on the outputs reached
Variable.	
H1.3	Quality of all outputs and results
Average.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
None of note.	
H1.5	Contribution of the participation of the authors in large collaborations
Variable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
None.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities
Knowledge transfer mechanisms are not very well developed.	

H2.3	Relation to practice
Current research activities are far removed from the marketplace.	
H2.4	Participation in AV21 strategy
Compliant.	
H2.5	Cooperation with regions of the Czech Republic
The willingness to cooperate was implied to members of the commission but the current level of cooperation is rather low.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
Average and progressively diminishing level of visibility.	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
Mainly as junior partners.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Below average.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
Promising young researchers must be given the freedom to explore new and topical areas of research.	
D2.2	Assessment of the previous research objectives and their achievement
The age-determined hierarchical structure impedes the development of new or topical research activities.	
D2.3	Assessment of implementation of recommendations from past evaluation
Changes appear to have been made reluctantly and implemented only in part.	
D2.4	Success in receiving grants
Some success.	
D2.5	Adequacy of instrumental equipment
Meets current needs but marked by the absence of highly specialised equipment.	
D2.6	Effectiveness of management
Dated management structure and procedures.	

D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The dynamism and enthusiasm of young people appears to be suppressed by a culture that promotes the part-time employment of retirees. Significant barriers that are imbedded in the culture of the institution inhibit the progression of female researchers.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Female researchers are invisible at positions of senior leadership. Members of the commission could not identify any evidence of a credible effort to improve opportunities for female members of staff.	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
The team is at the final stages of its terminal decline.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Some at the national level.	
D3.2	Effectiveness of joint research centres
D3.3	Success rate in supervision of PhD students
Below expectation.	
D3.4	Participation of PhD students in the outputs
Variable.	
D3.5	Participation of the institute in master or bachelor studies
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Notable.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
None of note	

D4.2	Publishing activities and its quality
None of note.	
D4.3	Participation in professional organisations in the area of research and development
Commensurate with expectation.	

Other comments of the commission:

Members of the commission noted that the presented research on polyaniline, polypyrrole and polyphenylene oxide, although carefully executed, is rather dated. The suggested use in supercapacitor technology is not underpinned by relevant work at the internationally competitive level while the suggested use as fabric treatment does not compete favourably with established technologies. The work on ion-exchange membranes is equally dated.

Members of the commission agreed that the activities of this group are too far detached from the state of the art in the field of research to benefit from a simple re-focus. It is therefore proposed that the group is dissolved and that the considerable human resource is absorbed by other groups following assessment of the complementarity of scientific skills.

Top 10 publications for the 6 evaluated teams

Selected 10 significant publications (numbers in parentheses refer to the list in Phase I)

Supramolecular systems and self-association processes (SUPRAMOL)

1. (3) LOUKOTOVÁ, Lenka, KUČKA, Jan, RABYK, Mariia, HÖCHERL, Anita, VENCLÍKOVÁ, Kristýna, JANOUŠKOVÁ, Olga, PÁRAL, P., KOLÁŘOVÁ, V., HEIZER, T., ŠEFC, L., ŠTĚPÁNEK, Petr, HRUBÝ, Martin. Thermoresponsive .beta.-glucan-based polymers for bimodal immunoradiotherapy - Are they able to promote the immune system? *Journal of Controlled Release.*, 268 (2017), 78-91.
2. (14) JÄGER, Eliezer, HÖCHERL, Anita, JANOUŠKOVÁ, Olga, JÄGER, Alessandro, HRUBÝ, Martin, KONEFAL, Rafal, NETOPILÍK, Miloš, PÁNEK, Jiří, ŠLOUF, Miroslav, ULBRICH, Karel, ŠTĚPÁNEK, Petr. Fluorescent boronate-based polymer nanoparticles with reactive oxygen species (ROS)-triggered cargo release for drug-delivery applications. *Nanoscale.*, 8 (2016), 6958-6963.
3. (31) SURMAN, František, RIEDEL, Tomáš, BRUNS, M., KOSTINA, Nina Yu., SEDLÁKOVÁ, Zdeňka, RODRIGUEZ-EMMENEGGER, Cesar. Polymer brushes interfacing blood as a route toward high performance blood contacting devices. *Macromolecular Bioscience.*, 15 (2015), 636-646
4. (24) TROUSIL, Jiří, FILIPPOV, Sergey K., HRUBÝ, Martin, MAZEL, T., SYROVÁ, Z., CMARKO, D., SVIDENSKÁ, S., MATĚJKOVÁ, J., KOVÁČIK, L., PORSC, Bedřich, KONEFAL, Rafal, LUND, R., NYSTRÖM, B., RAŠKA, I., ŠTĚPÁNEK, Petr. System with embedded drug release and nanoparticle degradation sensor showing efficient rifampicin delivery into macrophages. *Nanomedicine: Nanotechnology, Biology and Medicine.*, 13 (2017), 307-315.
5. (2) SEDLÁČEK, Ondřej, JIRÁK, D., GÁLISOVÁ, A., JÄGER, Eliezer, LAASER, J. E., LODGE, T. P., ŠTĚPÁNEK, Petr, HRUBÝ, Martin. 19F magnetic resonance imaging of injectable polymeric implants with multiresponsive behavior. *Chemistry of Materials.*, 30 (2018), 4892-4896.
6. (41) CALUMBY ALBUQUERQUE, Lindomar J., SINCARI, Vladimir, JÄGER, Alessandro, KONEFAL, Rafal, PÁNEK, Jiří, ČERNOCH, Peter, PAVLOVA, Ewa, ŠTĚPÁNEK, Petr, GIACOMELLI, F. C., JÄGER, Eliezer. Microfluidic-assisted engineering of quasi-monodisperse pH-responsive polymersomes toward advanced platforms for the intracellular delivery of hydrophilic therapeutics. *Langmuir.*, 35 (2019), 8363-8372.
- (7. 34) FILIPPOV, Sergey K., BOGOMOLOVA, Anna, KABEROV, Leonid I., VELYCHKIVSKA, Nadiia, STAROVOYTOVA, Larisa, ČERNOCHOVÁ, Zulfiya, ROGERS, S. E., LAU, W. M., KHUTORYANSKIY, V. V., COOK, M. T. Internal nanoparticle structure of temperature-responsive self-assembled PNIPAM-b-PEG-b-PNIPAM triblock copolymers in aqueous solutions: NMR, SANS, and light scattering studies. *Langmuir.*, 32 (2016), 5314-5323.

8. (8) SEDLÁČEK, Ondřej, MONNERY, B. D., MATTOVÁ, J., KUČKA, Jan, PÁNEK, Jiří, JANOUŠKOVÁ, Olga, HÖCHERL, Anita, VERBRAEKEN, B., VERGAELLEN, M., ZADINOVÁ, M., HOOGENBOOM, R., HRUBÝ, Martin. Poly(2-ethyl-2-oxazoline) conjugates with doxorubicin for cancer therapy: in vitro and in vivo evaluation and direct comparison to poly[N-(2-hydroxypropyl)methacrylamide] analogues. *Biomaterials.*, 146 (2017), 1-12.

9. (11) KABEROV, Leonid I., VERBRAEKEN, B., RIABTSEVA, Anna, BRUS, Jiří, RADULESCU, A., TALMON, Y., ŠTĚPÁNEK, Petr, HOOGENBOOM, R., FILIPPOV, Sergey K. Fluorophilic-lipophilic-hydrophilic poly(2-oxazoline) block copolymers as MRI contrast agents: from synthesis to self-assembly. *Macromolecules.*, 51 (2018), 6047-6056.

10. (35) SEDLÁČEK, Ondřej, ČERNOCH, Peter, KUČKA, Jan, KONEFAL, Rafal, ŠTĚPÁNEK, Petr, VETRÍK, Miroslav, LODGE, T. P., HRUBÝ, Martin. Thermoresponsive polymers for nuclear medicine: which polymer is the best? *Langmuir.*, 32 (2016), 6115-6122.

Biomacromolecular and bioanalogous systems: Tissue engineering (BIOMOL – Tissue engineering)

(1) RIEDEL, Tomáš, SURMAN, František, HAGENEDER, S., POP-GEORGIEVSKI, Ognen, NOEHAMMER, C., HOFNER, M., BRYNDA, Eduard, RODRIGUEZ-EMMENEGGER, Cesar, DOSTÁLEK, J. Hepatitis B plasmonic biosensor for the analysis of clinical serum samples. *Biosensors and Bioelectronics*, 85(15 November), 2016, 272-279.

(2) KOSTIV, Uliana, KOTELNIKOV, Ilya, PROKS, Vladimír, ŠLOUF, Miroslav, KUČKA, Jan, ENGSTOVÁ, Hana, JEŽEK, Petr, HORÁK, Daniel. RGDS- and TAT-conjugated upconversion of NaYF₄:Yb³⁺/Er³⁺&SiO₂ nanoparticles: in vitro human epithelioid cervix carcinoma cellular uptake, imaging, and targeting. *ACS Applied Materials and Interfaces*, 8(31), 2016, 20422-20431.

(4) VOROBII, Mariia, DE LOS SANTOS PEREIRA, Andres, POP-GEORGIEVSKI, Ognen, KOSTINA, Nina Yu., RODRIGUEZ-EMMENEGGER, Cesar, PERCEC, V. Synthesis of non-fouling poly[N-(2-hydroxypropyl) methacrylamide] brushes by photoinduced SET-LRP. *Polymer Chemistry*, 6(23), 2015, 4210-4220.

(6) GOLUNOVA, Anna, CHVÁTIL, David, KRIST, Pavel, JAROŠ, J., JURTÍKOVÁ, V., POSPÍŠIL, J., KOTELNIKOV, Ilya, ABELOVÁ, Lucie, KOTEK, Jiří, SEDLAČÍK, Tomáš, KUČKA, Jan, KOUBKOVÁ, Jana, STUDENOVSKÁ, Hana, STREIT, L., HAMPL, A., RYPÁČEK, František, PROKS, Vladimír. Toward structured macroporous hydrogel composites: electron beam-initiated polymerization of layered cryogels. *Biomacromolecules*, 16(4), 2015, 1146-1156

(17) DUŠKOVÁ-SMRČKOVÁ, Miroslava, DUŠEK, Karel. How to force polymer gels to show volume phase transitions. *ACS Macro Letters*, 8(3), 2019, 272-278.

(18) SEDLAČÍK, Tomáš, PROKS, Vladimír, ŠLOUF, Miroslav, DUŠKOVÁ-SMRČKOVÁ, Miroslava, STUDENOVSKÁ, Hana, RYPÁČEK, František. Macroporous biodegradable cryogels of synthetic poly(α-amino acids). *Biomacromolecules*, 16(11), 2015, 3455-3465.

(19) RIEDEL, Tomáš, HAGENEDER, S., SURMAN, František, POP-GEORGIEVSKI, Ognen, NOEHAMMER, C., HOFNER, M., BRYNDA, Eduard, RODRIGUEZ-EMMENEGGER, Cesar,

DOSTÁLEK, J. Plasmonic hepatitis B biosensor for the analysis of clinical saliva. *Analytical Chemistry* 89(5), 2017, 2972-2977.

(20) HLÍDKOVÁ, Helena, KOTELNIKOV, Ilya, POP-GEORGIEVSKI, Ognen, PROKS, Vladimír, HORÁK, Daniel. Antifouling peptide dendrimer surface of monodisperse magnetic poly(glycidyl methacrylate) microspheres. *Macromolecules*, 50(4), 2017, 1302-1311.

(3) MÁZL CHÁNOVÁ, Eliška, POP-GEORGIEVSKI, Ognen, KUMOREK, Marta M., JANOUŠKOVÁ, Olga, MACHOVÁ, Luďka, KUBIES, Dana, RYPÁČEK, František. Polymer brushes based on PLLA-b-PEO colloids for the preparation of protein resistant PLA surfaces. *Biomaterials Science*, 5(6), 2017, 1130-1143.

(23) SVOBODA, Jan, SEDLÁČEK, Ondřej, RIEDEL, Tomáš, HRUBÝ, Martin, POP-GEORGIEVSKI, Ognen. Poly(2-oxazoline)s one-pot polymerization and surface coating: from synthesis to antifouling properties out-performing poly(ethylene oxide). *Biomacromolecules* 20(9), 2019, 3453-3463.

Biomacromolecular and bioanalogous systems: Therapeutics (BIOMOL – Therapeutics)

(2) LYNN, G. M., LAGA, Richard, DARRAH, P. A., ISHIZUKA, A. S., BALACI, A. J., DULCEY, A. E., PECHAR, Michal, POLA, Robert, GERNER, M. Y., YAMAMOTO, A., BUECHLER, C. R., QUINN, K. M., SMELKINSON, M. G., VANEK, O., CAWOOD, R., HILLS, T., VASALATIY, O., KASTENMÜLLER, K., FRANCICA, J. R., STUTTS, L., TOM, J. K., AH RYU, K., ESSER-KAHN, A. P., ETRYCH, Tomáš, FISHER, K. D., SEYMOUR, L. W., SEDER, R. A. In vivo characterization of the physicochemical properties of polymer-linked TLR agonists that enhance vaccine immunogenicity. *Nature Biotechnology*. 2015, 33(11), 1201-1210.

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(49) KOSTKA, Libor, KOTRCHOVÁ, Lenka, ŠUBR, Vladimír, LIBÁNSKÁ, Alena, FERREIRA, C. A., MALÁTOVÁ, Iva, LEE, H. J., BARNHART, T. E., ENGLE, J. W., CAI, W., ŠÍROVÁ, Milada, ETRYCH, Tomáš. HPMa-based star polymer biomaterials with tunable structure and biodegradability tailored for advanced drug delivery to solid tumors, *Biomaterials*. 235, 2020, 119728.

(15) KOZIOLOVÁ, Eva, GOEL, S., CHYTIL, Petr, JANOUŠKOVÁ, Olga, BARNHART, T. E., CAI, W., ETRYCH, Tomáš. A tumor-targeted polymer theranostics platform for positron emission tomography and fluorescence imaging. *Nanoscale*. 2017, 9, 10906-10918.

(8) BRAUNOVÁ, Alena, KOSTKA, Libor, SIVÁK, Ladislav, CUCHALOVÁ, Lucie, HVĚZDOVÁ, Zuzana, LAGA, Richard, FILIPPOV, Sergey K., ČERNOCH, Peter, PECHAR, Michal, JANOUŠKOVÁ, Olga, ŠÍROVÁ, Milada, ETRYCH, Tomáš. Tumor-targeted micelle-forming block copolymers for overcoming of multidrug resistance. *Journal of Controlled Release*. 2017, 245, 41-51.

(7) STUDENOVSKÝ, Martin, SIVÁK, Ladislav, SEDLÁČEK, Ondřej, KONEFAL, Rafal, HORKOVÁ, Veronika, ETRYCH, Tomáš, KOVÁŘ, Marek, ŘÍHOVÁ, Blanka, ŠÍROVÁ,

Milada. Polymer nitric oxide donors potentiate the treatment of experimental solid tumours by increasing drug accumulation in the tumour tissue. *Journal of Controlled Release*. 2018, 269, 214-224.

(21) POLA, Robert, KRÁL, Vlastimil, FILIPPOV, Sergey K., KABEROV, Leonid I., ETRYCH, Tomáš, SIEGLOVÁ, Irena, SEDLÁČEK, Juraj, FÁBRY, Milan, PECHAR, Michal. Polymer cancerostatics targeted by recombinant antibody fragments to GD2-positive tumor cells. *Biomacromolecules*. 2019, 20, 412-421.

(13) PATSULA, Vitalii, KOSINOVÁ, L., LOVRIĆ, M., FERHATOVIC HAMZIC, L., RABYK, Mariia, KONEFAL, Rafal, PARUZEL, Aleksandra, ŠLOUF, Miroslav, HERÝNEK, V., GAJOVIĆ, S., HORÁK, Daniel. Superparamagnetic Fe₃O₄ nanoparticles: synthesis by thermal decomposition of iron(III) glucuronate and application in magnetic resonance imaging. *ACS Applied Materials and Interfaces*. 2016, 8, 7238-7247.

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Polymer materials (MATER)

(4) Paruzel A., Michalowski S., Hodan J., Horák P., Prociak A., Beneš H., Rigid polyurethane foam fabrication using medium chain glycerides of coconut oil and plastics from end-of-life vehicles, *ACS Sustainable Chemistry & Engineering*, 5, 7 (2017), 6237-6246.

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(33) Matějka L., Špírková M., Dybal J., Kredatusová J., Hodan J., Zhigunov A., Šlouf M., Structure evolution during order-disorder transitions in aliphatic polycarbonate based polyurethanes. *Self-healing polymer*, *Chemical Engineering Journal*, 357 (2019), 611-624.

(1) Depa K., Strachota A., Šlouf M., Brus J., Cimrová V., Synthesis of conductive doubly filled poly(N-isopropylacrylamide)-polyaniline-SiO₂ hydrogels, *Sensors and Actuators B – Chemical*, 244, (2017), 616-634.

(9) Beneš H., Popelková D., Štuncová A., Popelka Š., Jůza J., Pop-Georgievski O., Konefal M., Hrubý M., Aqueous-based functionalizations of titanate nanotubes: a straightforward route to high-performance epoxy composites with interfacially bonded nanofillers, *Macromolecules*, 51, 15 (2018), 5989-6002.

(5) Perchacz M., Donato R. K., Seixas L., Zhigunov A., Konefal R., Serkis-Rodzen M., Beneš H., Ionic liquid-silica precursors via solvent-free sol-gel process and their application in epoxy-amine network: a theoretical/experimental study, *ACS Applied Materials and Interfaces*, 9, 19 (2017), 16474-16487.

(23) Strachota B., Matějka L., Sikora A., Spěváček J., Konefal R., Zhigunov A., Šlouf M., Insight into the cryopolymerization to form a poly(N-isopropylacrylamide)/clay macroporous gel: structure and phase evolution, *Soft Matter*, 13, 6 (2017), 1244-1256.

(27) Šlouf M., Vacková T., Nevoralová M., Pokorný D., Micromechanical properties of one-step and sequentially crosslinked UHMWPEs for total joint replacements, *Polymer Testing*, 41 (2015), 191-197.

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Structure and dynamics of macromolecules (STRUCTURE)

(1) Brus J., Kobera L., Schoefberger W., Urbanová M., Klein P., Sazama P., Tabor E., Sklenák Š., Fishchuk A. V., Dědeček J. Structure of framework aluminum Lewis sites and perturbed aluminum atoms in zeolites as determined by $^{27}\text{Al}\{^1\text{H}\}$ REDOR (3Q) MAS NMR spectroscopy and DFT/molecular mechanics

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