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 Physics of Materials of the CAS, v. v. i.

Evaluated teams and their leaders:

1. Advanced High-temperature Materials Group (Antonín Dlouhý)
2. High Cycle Fatigue Group (Pavel Hutař)
3. Low Cycle Fatigue Group (Jiří Man)
4. Brittle Fracture Group (Ivo Dlouhý)
5. Structure of Phases and Thermodynamics Group (Aleš Kroupa)
6. Electrical and Magnetic Properties Group (Martin Friák)

Part A: Evaluation of the institute

Strengths:
Broad expertise, both theoretically and experimentally, ranging from quantum-mechanical calculations and numerical methods, phase and phase equilibrium properties of materials, experimental techniques (from atomic and nano scales to the macroscopic level), characterization of microstructures to the design and processing of novel materials. Excellent balance between basic research and applications. Very strong international reputation, well established long-term basic research topics and clear and focused plans for future research projects. Excellent international contacts. Overall well-balanced age structure. The Institute successfully operates almost 100 instruments and devices, including several unique and top-of-the-line laboratory test machines.

Weaknesses:
About 55% of the institute budget is covered by (short-term) competitive grants, but large-scale experimental equipment and addressing basic research problems require long-term funding commitments; Increasing the number of competitive grants may result in fragmentation and discontinuity of the experimental expertise.

Opportunities:
Assuming both a successful transfer of expertise and a moderate modernisation of the experimental equipment, the Institute has the potential to produce excellent scientific results also in the future.

Threats:
Maintaining and upgrading the lab equipment is challenging and requires a long-term financing plan; Loss of expertise due to the retirement of experienced scientists in the coming years.

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

H1.1	Quality of selected outputs of Phase I
The quality of selected results (excellent output 1+2) is above the national average in this field (Materials Engineering).	
H1.2	**Contribution of workers on the outputs reached**
Members of the group contributed to the output; the productivity per FTE and FC is average.	
H1.3	**Quality of all outputs and results**
The Institute consists of experimentalists and theoreticians (modelling) studying the properties, behaviour and microstructure of materials; addressing basic questions in solid state and condensed matter physics as well as engineering challenges for applications; the main output is publications: In 2019 alone more than 120 (some of excellent quality), several chapters in books.	

H1.4	The most valuable discoveries and findings in the fields, their importance for the field
All six teams have produced quite a number of results, several of excellent quality and highly relevant for the field.	
H1.5	**Contribution of the participation of the authors in large collaborations**
Not applicable	

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

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Several projects are highly relevant for society: materials like superalloys or advanced steels are highly relevant for industrial applications, safety (fatigue is involved in 80% of premature failures of structural components), lead-free solders, hard coatings and hydrogen storage, medical applications and public health.	
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**
Dissemination of knowledge and societal relevance are emphasized as part of the mission of the Institute.	
H2.3	**Relation to practice**
The Institute has long term relations with several industrial partners with the aim to improve current materials or design new ones, set standards for safe engineering applications, improve the utility properties of products and improve manufacturing technologies.	
H2.4	**Participation in AV21 strategy**
The Institute coordinates the program “New Materials Based on Metals, Ceramics and Composites“.	
H2.5	**Cooperation with regions of the Czech Republic**
The Institute cooperates within all subjects in research, education and industry with partners in the Czech Republic.	

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
The Institute is outstanding on national level and can compete with the best international institutes in the field. Because of the quantity and quality of their publications, the long list of ongoing projects and the collaborating partners, the Institute has a high standing in the community.	

D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
Very strong cooperation on national and international level (78 universities and research institutes from 25 countries).	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
The Institute organized three conference, three colloquia, three symposia and several scientific meetings and workshops. Members of all teams presented numerous invited talks.	

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 major research directions are reflected by the six different research teams; the planned future activities follow these directions.	
D2.2	**Assessment of the previous research objectives and their achievement**
Research objectives were achieved in the fields of materials for high temperature applications, in fatigue damage of materials and application of fracture mechanics, theoretical modelling of materials and thermodynamic properties and phase diagrams, theoretical and experimental study of electrical and magnetic properties of advanced materials, research and evaluation of brittle states in steels, ceramics and composite, investigation of materials for health care and perspective materials for hydrogen storage.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
Three recommendations from the past evaluation - re-organisation of the internal structure, internal programs to stimulate actions to enforce strengths and to reduce weaknesses, Identification of new research topics – were addressed and implemented.	
D2.4	**Success in receiving grants**
The teams of the Institute are successful in receiving grants: 39 national, 2 EU and 4 international projects.	
D2.5	**Adequacy of instrumental equipment**
The teams operate a large number of instruments and devices (close to 100) - equipment which is highly relevant for the field. Maintenance and modernisation of the equipment is a challenge.	
D2.6	**Effectiveness of management**
The organization of the Institute into six teams of appropriate size of mixed expertise (from experimental techniques to theoretical modelling) seems to be very effective.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The HR strategy is well defined, with the focus on five key points. The overall age structure is well balanced.	

D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Possible gender issues were not addressed explicitly.	
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 one of six partners in the CEITEC consortium.	

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
Strong collaboration with universities on national and international level, altogether 78 universities and research institutes.	
D3.2	**Effectiveness of joint research centres**
Productive collaboration with other CAS institutes (e.g. ISI), national (National Centre for Mechatronics for Smart Technologies for Mechanical Engineering, National Centre Machinery) and international (e.g. PSI) infrastructure and research centers. Administration of the IPMinfra Research Infrastructure.	
D3.3	**Success rate in supervision of PhD students**
Successful supervision of many PhD students, 19 defended their theses during the evaluation period.	
D3.4	**Participation of PhD students in the outputs**
PhD students from all teams contributed to publications.	
D3.5	**Participation of the institute in master or bachelor studies**
Supervision and co-supervision of 10 bachelor and 24 master theses.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Members of the Institute taught courses at bachelor (39), master (62) and PhD (24) level at three different universities.	

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

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Popularisation of science is a regular activity at the Institute, e.g. co-organisation of an annual science festival in the Czech Republic and organising open days.	
D4.2	**Publishing activities and its quality**
The Institute publishes information about their research for the general public on the Institute's webpages.	

D4.3	Participation in professional organisations in the area of research and development
Institute members serve on various research committees, editorial boards, advisory boards, government working groups and as reviewers for scientific journals and as conference organizers; they are members of several professional organisations.	

Other comments of the commission:
The Commission received the impression that IPM is a very strong Institute with broad expertise, both theoretically and experimentally, with long-standing experience in experimental techniques, while maintaining an excellent balance between basic research and applications. IPM has a very strong international reputation, and the Institute has the potential to continue producing excellent scientific results also in the future.
Concluding Remark: The Commission is aware of the fact that virtual site visits cannot replace person-to-person meetings. Nevertheless, based on the documentation provided and the virtual site visits, the Commission has made every effort to arrive at an objective and comprehensive Evaluation of the Institute.

Part B: Evaluation of teams

1. Advanced High-temperature Materials Group

Strengths:
Broad expertise, both theoretically and experimentally, ranging from numerical methods, experimental techniques, characterization of microstructures to the design and processing of novel HT materials. The Team successfully operates more than 50 instruments and devices. Well balanced age structure; clear and focused plans for future research projects. Excellent international contacts.

Weaknesses:
Gender imbalance.

Opportunities:
Increased teaching activities at local universities might attract more master and PhD students.

Threats:
Keeping the high level of experimental expertise might be challenging.

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

H1.1	Quality of selected outputs of Phase I
The quality of selected results (excellent output 1+2) corresponds to the national average in this field (Materials Engineering).	
H1.2	**Contribution of workers on the outputs reached**
Members of the group contributed to the output; the productivity per FTE and FC is average.	
H1.3	**Quality of all outputs and results**
The Team consists of experimentalists and experts in modelling addressing basic questions in solid state physics; the main output is publications: 130 articles in journals with impact factor (some of excellent quality), 3 book chapters and 38 conference proceedings.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The main research topic is the study of phase diagrams and thermodynamic properties of multicomponent alloy systems and functional materials for hydrogen storage (diffusion processes in solids), both experimentally and theoretically. The group operates an impressive set of instruments (54 devices, including several self-designed and in-house fabricated creep machines). The Team reports the following results to be the most important: (1) kinetics of interaction of impurity interstitials with dislocations, (2) decomposition of the single-phase high-entropy alloy CrMnFeCoNi after prolonged anneals at intermediate temperatures, (3) development of new ODS material with superior strength at temperatures above 1000°C, (4) development of a new creep testing machine for tests up to 1200°C and (5) development of a new AE system detecting damage events in-situ during HT deformation. The results are relevant for the field.	

H1.5	Contribution of the participation of the authors in large collaborations
Not applicable	

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

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The materials studied (superalloys, advanced steels,...) are highly relevant for industrial applications.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
Contribution to the general knowledge about materials	
H2.3	**Relation to practice**
Collaboration with several industrial partners	
H2.4	**Participation in AV21 strategy**
Not explicitly addressed	
H2.5	**Cooperation with regions of the Czech Republic**
Collaborations with local universities.	

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

D1.1	Comparison of the team with similar international and national institutes
Because of the quantity and quality of their publications, the long list of ongoing projects and the collaborating partners, the Team has a high standing in the community.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The Team is embedded in active national and international networks where team members play a crucial role.	

D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Members of the Team organized an international conference (ICSMA-17 at IPM) and were members of international committees; 14 invited talks.	

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 major research direction is the “basic experimental and theoretical study of high temperature strength and related microstructural evolution and the design of new heat resistant materials with an improved thermodynamic stability under conditions of high temperature loadings“. Their planned future activities follow this direction.	
D2.2	**Assessment of the previous research objectives and their achievement**
The previous research objectives were well focused, following the major research direction, and good, even excellent results were achieved. New topics were successfully introduced.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The recommendation from the past evaluation was followed and the CMM and AHTM teams were merged.	
D2.4	**Success in receiving grants**
International activities were supported by one EC FP7 project, three bilateral international projects (Materials Center Leoben, Austria) and nine national grants provided by the CSF. National collaborations were mainly supported by the national research grants from CSF, TACR and MIT.	
D2.5	**Adequacy of instrumental equipment**
The Team operates more than 50 instruments and devices, equipment which is highly relevant for the field.	
D2.6	**Effectiveness of management**
Good and efficient team work	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The Team seems to be well structured into four subgroups with complementary expertise and well defined responsibilies. The age structure is balanced, with both senior experts and young scientists.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Gender balance has not yet been achieved (4 out of 12 scientific positions are filled with women).	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
Several of the group members are involved in the CEITEC centre.	

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
Strong collaboration with universities on national (6) and international (16) level.	
D3.2	**Effectiveness of joint research centres**
Effective collaboration with CEITEC and collaborations with about 10 international (e.g. Oak Ridge National Laboratory, USA; Institute for Materials Research SAS, Košice, Slovakia; Fraunhofer IWM Freiburg, Germany) research centres.	
D3.3	**Success rate in supervision of PhD students**
Supervision of two and co-supervision of one PhD student; One PhD defence.	
D3.4	**Participation of PhD students in the outputs**
All PhD students contributed to publications.	
D3.5	**Participation of the team in master or bachelor studies**
Participation of the Team in bachelor and master studies has room for improvement.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Members of the Team taught courses at bachelor, master and PhD level at universities.	

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

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Several lectures at outreach events (CAS Science Week and Scientific Fair, Science Caffe of the library of Czech Academy of Sciences and the Observatory and Planetarium of Brno city).	
D4.2	**Publishing activities and its quality**
Photography (Science Photogenic organized by CAS in 2015).	
D4.3	**Participation in professional organisations in the area of research and development**
Team members serve on various research committees, editorial boards and as a conference organizer; 14 invited talks were given by group members.	

Other comments of the commission:

The commission has a very positive impression of the “Advanced High-temperature Materials Group”.

2. High Cycle Fatigue Group

Strengths:
Strong research Team, well-balanced Team of still relatively young researchers, work in different areas, ability to solve number of research projects

Weaknesses:
Over-loaded senior researchers, who have a lot of professional duties that do not directly correspond to the research activities of the group. They are members of many advisory boards and government working groups. A disadvantage is that their remaining capacity for research activities is limited.

Opportunities:
Team has plenty of potential for further expansion of research topics.

Threats:
Due to the very limited investments in experimental equipment in the previous decades, there are testing machines still in use that are more than 40 years old and that should be replaced by new ones. It may be concluded that the testing capacity of the laboratory may not be sufficient to support future expansion of research.

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

H1.1	Quality of selected outputs of Phase I
The quality is quite high and above the average national level. Average rating of Team is 2.13.	
H1.2	**Contribution of workers on the outputs reached**
Significant contribution of workers.	
H1.3	**Quality of all outputs and results**
The quality of publications can be considered as very good. The total number of publications with an impact factor was 38 in the previous evaluation period. The number of publications markedly increased to 67 in this period. However, the number of publications in other journals decreased from 67 to 40, and the number of papers in conference proceedings decreased from 104 to 90. This is due to the stronger focus of the Team on the quality of publications and the aim to publish mainly papers in journals with higher impact factor, primarily in the first or the second quartile.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Investigation of fatigue cracks propagation, long and short cracks; Advanced numerical simulations of fatigue cracks propagation; Evaluation of long-term resistance of polymer materials; Fatigue performance of promising new materials or materials produced by advanced,technological processes; Fatigue and fatigue/creep damage of high temperature resistant materials; Development of stability criteria of singular stress concentrators and fatigue and fracture of silica-based composites.	

H1.5	Contribution of the participation of the authors in large collaborations
Not relevant.	

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

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The Team works on extremely important topics for safety, because fatigue is involved in 80% of premature failures of structural components. Understanding the physical processes in cyclic plasticity is a necessity for further development of structural materials. Several outputs of the Team are related to strategic partnerships with high-tech companies, which will eventually be implemented in products or services that can have a significant societal relevance.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
Important contribution to the general knowledge in material science.	
H2.3	**Relation to practice**
Successful cooperations with companies such as PBS Velká Bíteš and Bonatrans group.	
H2.4	**Participation in AV21 strategy**
Not explicitly addressed.	
H2.5	**Cooperation with regions of the Czech Republic**
Intensive cooperations have been established with many prestigious universities and research institutes in Brno, namely Masaryk University, Brno University of Technology, Mendel University in Brno, University of Veterinary and Pharmaceutical Sciences in Brno, Veterinary Research Institute. The group participates at several National Centres of Competence supported by the Technological Agency of the Czech Republic.	

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

D1.1	Comparison of the team with similar international and national institutes
The rating of the Team is likely exceeding similar national institutions and is comparable with top international institutes.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
During the evaluation period, the Team strongly increased activities with an international context. This resulted in several international project proposals and 3 successful international projects in the evaluated period.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**

The group has organized 4 international conferences and workshops. Project No. TA 04011525 (Research and Development of Precision Casting Technology of Radial Wheels of New Generation Turbochargers and New Types of Gas Turbines Blades) supported by the Technology Agency of the Czech Republic was selected as the best project of the agency in the Business category for the year 2019. The members presented 4 invited lectures and received 3 Awards.

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 investigation of fatigue damage, propagation of fatigue cracks, and development and application of fracture mechanics are in line with the research directions of the Team and the mission of the Institute. There are many new challenges in the field of fatigue of materials and fracture mechanics, e.g. 3D printed materials, description of damage of different types of composites, damage of new recycled materials, etc.	
D2.2	**Assessment of the previous research objectives and their achievement**
The activities of the group in the evaluated period maintained continuity with the previous period. Moreover, the number of research outputs increased. The budget of the group from external sources was rated as very good. In the evaluated period, the HCF group was very successful in obtaining grants from different grant agencies of total amount 7,068,000 EUR. This is a slight increase in comparison with the previous period. It should be mentioned that the projects with investigator or co-investigator coming from the group create more than 40 % of the total project budget of IPM during the same period. The international cooperation of the group was rated as excellent. Currently, thanks to the extent of the research activities of the group, the number of international and national cooperations is even increasing.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The research activity of the group in the period of 2010-2014 was highly rated by the evaluators. Also, the timelessness of the research topics was considered as excellent. The activities of the group in the evaluated period maintained continuity with the previous period. Moreover, the number of research outputs increased.	
D2.4	**Success in receiving grants**
The budget of the group from external sources is rated as very good. In the evaluated period, the HCF group was very successful in obtaining grants from different grant agencies of total amount 7,068,000 EUR	
D2.5	**Adequacy of instrumental equipment**
Very limited investments in the laboratory equipment in the previous decades. There are testing machines still in use, which are more than 40 years old and which should be replaced by new ones.	
D2.6	**Effectiveness of management**
Good and efficient team work.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**

Presently, a new generation of young researchers is reinforcing the Team and increasing its research capacity.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Gender balance has not yet been achieved.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
The Team collaborates with CEITEC.	

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**
The Team cooperates with many universities on national and international level.	
D3.2	**Effectiveness of joint research centres**
The international cooperation of the group is rated as excellent, the number of international and national cooperations is even increasing. The group is strongly connected to CEITEC (Central European Institute of Technology) which is a unique research centre focusing primarily on the fields of life sciences, advanced materials and nanotechnologies.	
D3.3	**Success rate in supervision of PhD students**
6 doctoral theses were defended in the evaluation period.	
D3.4	**Participation of PhD students in the outputs**
Strong participation of PhD students in the performed research is typical for the group. This is documented by the publication record of the Team. PhD students are broadly involved as co-authors of papers or they are the main authors.	
D3.5	**Participation of the team in master or bachelor studies**
The team members are strongly involved in semestrial lectures, seminars and courses.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Group members presented 22 semestrial lectures, seminars and courses, which indicates excellent involvement of group members in teaching at universities.	

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

D4.1	**Sufficiency of media strategy and activities in the area of research popularisation**

The group widely involved in all kinds of science and research popularisation activities such as in schools, by expositions, street exhibitions, science festivals, engineering fairs, open houses and science-popular lectures for schools and the general public.

The exposition of the IPM was prepared under the guidance of L. Náhlík in cooperation with other group members. It was a good opportunity to acquaint representatives of industrial enterprises, professionals, public and students of secondary schools and universities with the IPM research infrastructure, instrumentation, possibilities of professional cooperation and open access to research and development, as well as the program framework of the AV21 Strategy.

The group presented science-popular lectures for schools and the general public. The lectures aimed at introducing of topics related to the research focus of the Institute. The lecturers presented mechanisms of material's failure as well as physics of mechanical, electrical and magnetic properties in an understandable way. For example, popular lectures in the frame of Science Academy were at: High school Šlapanice, Secondary School of Art and Design Brno, Grammar School Novolíšeňská, Secondary Technical and Agricultural School Nový Jičín, Brno Observatory and Planetarium, Science & Technology Club z. s., British Council, High school Vsetín, Palacký University Olomouc, Book store Academia, etc

D4.2	Publishing activities and its quality

See D4.1.

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

Team members are members of many advisory boards and government working groups. Group member J.Klusák is a member of the Board of Popularisers of the Czech Academy of Sciences and, together with other members of group, he organizes these kind of events. The group regularly participates in the organisation of the biggest annual science festival in the Czech Republic – Veletrh vědy in Prague.

Other comments of the commission:

The impression of the commission regarding the Team "High Cycle Fatigue" is very positive. The Team is world leading and internationally excellent in the field. It is well established on both the national and international level.

3. Low Cycle Fatigue Group

Strengths:
Well established long-term basic research topics, very strong international reputation (mainly thanks to Prof. J. Polák) resulting in wide international cooperation, access to materials under development and invitation to H2020 project consortia. Continuously upgraded equipment (versatile servohydraulic testing systems). High quality young researchers with international experiences. High publication activity in the best scientific journals in the field. Research cooperation with numerous Czech industrial partners. Good relations with the two main universities in Brno, access to master students and students for PhD study.

Weaknesses:
Research topics often depend on partially random success of projects, not necessarily on the preferred research direction of the Team. Recently lower success rate in project applications

Opportunities:
The group has the potential to acquire more financial support for its research from projects.

Threats:
Similar to Team 2 – there is a need to upgrade testing facilities to maintain growing research activities.

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

H1.1	Quality of selected outputs of Phase I
High quality of selected outputs with an average rating of is 2.21.	
H1.2	**Contribution of workers on the outputs reached**
Significant contribution of workers.	
H1.3	**Quality of all outputs and results**
The total number of publications with impact factor were 59, and only 4 articles in other journals in the evaluation period. The quality of publications are very good.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Research activity and characterization of the main scientific results: Fatigue crack growth rate of short cracks; Properties of Ni-based superalloy with thermal barrier coating; Development of TiAl alloy with increased ductility; Reason for excellent high temperature behaviour of Sanicro 25; Multiaxial fatigue of austenitic stainless steel; Mechanical properties of new UFG 301LN austenitic stainless steel.	
H1.5	**Contribution of the participation of the authors in large collaborations**
Not relevant.	

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

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The Team works on extremely important topics for safety, because fatigue and creep are involved in 85% of premature failures of structural components. Understanding the physical processes in cyclic plasticity is a necessity for further development of structural materials.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
Contribution to the general knowledge in materials science.	
H2.3	**Relation to practice**
The group cooperates with several companies on the following topics: Development of TiAl intermetallic alloy for high temperature applications; Testing new experimental techniques in electron microscopy; Fatigue of materials for aircraft engines; Low cycle fatigue of material for car industry; Project TAČR on welded structure for engine bed.	
H2.4	**Participation in AV21 strategy**
Not explicitly addressed.	
H2.5	**Cooperation with regions of the Czech Republic**
The Institute participates in the CEITEC (Central European Institute of Technology) project. The specific profit for the group lies in the possibility to access experimental equipment at CEITEC Nano laboratories. Team members were very successful in acquiring of national projects.	

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

D1.1	Comparison of the team with similar international and national institutes
The group can compete with the best groups at international institutions working in similar fields.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The group members have a lot of international cooperations all over the world. The group has frequent collaborations with several international research teams.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
The team members are widely involved in a broad range of community activities.	

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 main focus will continue to be the investigation of physical mechanisms of fatigue damage of high temperature materials in different loading conditions. The preference of the Team is to go deeper in fewer topics. There are some new intended research areas. They have an activity plan exists for the next period concerning research topics, financing, staff and lab testing capacities.	
D2.2	**Assessment of the previous research objectives and their achievement**
All the principal subjects of the research planned for the period of 2015-2019 and recommended in the previous evaluation were pursued and the results obtained were published in impacted scientific journals.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The personnel of the Team has been substantially strengthened by accepting young colleagues. The experimental equipment has been expanded.	
D2.4	**Success in receiving grants**
The team member received several grants.	
D2.5	**Adequacy of instrumental equipment**
New computer controlled biaxial testing machine was purchased, which allows both ambient and high temperature tests. New fast heating/cooling system enables thermomechanical testing of advanced materials.	
D2.6	**Effectiveness of management**
Good and efficient team work.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
Adequate HR policy is in place.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Gender balance has not yet been achieved.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
The Team collaborates with CEITEC.	

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
The Team cooperates with Paul Scherrer Institute, Viligen, Switzerland; Ohio State University, USA; Sandvik Materials Technology and Linköping University, Sweden; Bergakademie TU Freiberg, Germany; University of Kaiserslautern, Germany; Cooperation with Karlsruhe Institute of Technology (KIT), Germany; Cooperation with University of Siegen, Germany; Technical University in Oulu, Finland and Technical University Aachen, Germany on the international level, and with Masaryk University and Brno University of Technology on the national level.	
D3.2	**Effectiveness of joint research centres**
Cooperation in joint research centres resulted in a number of papers in good journals as well as other research outputs.	
D3.3	**Success rate in supervision of PhD students**
3 PhD theses were defended.	
D3.4	**Participation of PhD students in the outputs**
In the group, there are continuously several PhD students. The topics of the theses are related to the running research projects. The PhD students thus participate substantially in the experiments, both involving mechanical testing and investigation of material structure by advanced microscopy. PhD students are co-authors of resulting papers in scientific journals and they present their research results on international conferences.	
D3.5	**Participation of the team in master or bachelor studies**
One master thesis was defended.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
The group members presented many semestrial lectures, seminars and courses on the Master study level. They do not seem to have any pedagogical activity on the Bachelor and Doctoral level.	

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

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The Team participated in the activity of the Academy of Science called “Open Science”.	
D4.2	**Publishing activities and its quality**
Team members provided several interviews to the popularizing journal “Věda a výzkum“ (Science and Research) on the possibility of increasing of aircraft engine efficiency „Jak zaručit bezpečný let“ (Ways how to ensure safe flight).	
D4.3	**Participation in professional organisations in the area of research and development**
Members of the group together with the High Cycle Fatigue group participated in organizing of two colloquia in 2015 and 2019.	

Other comments of the commission:
The impression of the commission regarding the Team “Low Cycle Fatigue” is very positive. The Team is world leading and internationally excellent in the field.

4. Brittle Fracture Group

Strengths:
Attractive fields of research; High success rate in acquiring competitive grants; Team members are experienced scientists; Unique laboratory test machines and other facilities.

Weaknesses:
The high number of projects could develop into a weakness point in the mid-term because of fragmentising the investigation efforts; Limitations in working space.

Opportunities:
The Team has plenty of potential for further focused expansion of research topics.

Threats:
There is a need to upgrade testing facilities to maintain growing research activities.

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

H1.1	Quality of selected outputs of Phase I
The quality of selected outputs is very good, the outputs are in first three quality groups. The average rating of the Team is 2.16.	
H1.2	**Contribution of workers on the outputs reached**
Workers widely contributed to outputs.	
H1.3	**Quality of all outputs and results**
Group published 104 articles in journals with impact factor and 3 articles in other journals. 20 journal papers are in the first decile. The scientific output is excellent.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Research focused on ceramic matrix composites. Activities in this field included glass and ceramic matrices reinforced by nano-objects like nanotubes, nano-sheets, and high temperature ceramic matrix composites., New perspective topics are bioglass based composite biomaterials and geopolymer based composites, ceramic layered ceramics structures and development of innovative material formed by amorphous matrix reinforced by basalt fibers. In the field of metallic materials problems associated with transferability issues were investigated, such as evaluation of crack resistance curves by small compact tension specimens. Investigation of steels strengthened by fine oxide dispersion. Investigation of the fracture toughness of ODS materials, high entropy alloys including their high temperature properties, materials with internal architecture. Micromechanical modelling of twinning in Mg alloys.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The European Virtual Institute on Knowledge-based Multifunctional Materials AISBL (KMM-VIN, http://kmm-vin.eu/) is a self-sustainable organisation which promotes and facilitates cooperative research and development activities of its members in advanced structural and functional materials. Its has 27 core members and 27 associate members. Activities	

developed in networking with European peer groups in advanced materials, participation in internal KMM-VIN research projects, preparation of EU project proposals**.**

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

H2.1	**Societal relevance of outputs and results pursuant to CAS and institute mission**
The Team works on the extremely important topic for safety. Fracture mechanics is highly involved of premature failures of structural components. Understanding the physical processes in fracture is a necessity for further development of structural materials.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
Contribution to the general physical understanding of fracture of complex and inhomogeneous materials.	
H2.3	**Relation to practice**
Contractual research with 33 companies.	
H2.4	**Participation in AV21 strategy**
Not explicitly addressed.	
H2.5	**Cooperation with regions of the Czech Republic**
Team cooperates with ME BUT Brno, toughening micromechanics, architectured materials, ceramics IRSM CAS Prague, CMC composite fabrications, IMC CAS Prague, preparation of precursors, FCE BUT Brno, laminate modelling, IPP CAS Prague, spark plasma sintering in region.	

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

D1.1	**Comparison of the team with similar international and national institutes**
The Team is outstanding on national level and it is comparable with the best international institutes in the research field.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The Team has large number of national (13) and international cooperations (3 EU programs).	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Team members were active in organized workshops and invited lectures.	

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 has a well-established research plan including a perspective for future research by utilizing the strong capabilities of the group, such as micromechanisms and micromechanics as a feedback in materials design. The Team aims at concentration of the research on a smaller number of particular topics, but this depends on project calls and success rate in acquiring funds. Possible topics include: Inclusion of materials chemistry into materials design of ceramic-based materials, composites and laminates, hybrid composites and laminates prepared by pyrolysis, tunable shrinkage and stiffness, novel ceramic processing methods, hydro-pressure densification, alkali silicate-cellulosic systems, in situ nanocomposites, small specimen techniques/scale-up methods.	
D2.2	**Assessment of the previous research objectives and their achievement**
The topics included in the activity plan 2015-2019 were found as excellent during previous evaluation of the group and were continued.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
Increasing number of high-quality publications, the number of citations has also been increased substantially.	
D2.4	**Success in receiving grants**
The Team is very successful in receiving grants on national and international level.	
D2.5	**Adequacy of instrumental equipment**
Experimental facilities of the Team are good. The Laboratories of Mechanical Properties, Ceramography, Confocal Microscopy, Powder Metallurgy and Fracture Mechanics allow tensile, compressive, shear tests at temperatures from liquid nitrogen temperature up to 1600°C, fracture mechanical tests from miniature to standard CT and 3PB specimens, impact tests at loading rates up to 6 m/s (high speed camera), Young's modulus measurement at temperatures up to 1600°C. The Team has a HP ProLiant DL 360 work station for computer simulations.	
D2.6	**Effectiveness of management**
Good and efficient team work.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The Team has a documented HR policy.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Gender balance has not yet been achieved.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
The Team collaborates with CEITEC.	

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
The Team cooperates with Brno University of Technology on the national level and with Yokohama National University, Friedrich-Alexander Universität Erlangen-Nürnberg, Montanuniversität Leoben, Karlsruhe Institute of Technology, Deakin University, Australia, Institute for Metal Physics Kiev, Politecnico di Torino, Institute of Materials Research SAS, Kosice, Institute of Inorganic Chemistry, Mines ParisTech, Centre des Matériaux, Evry, Nanoforce Ltd UK, CEA Saclay, Ciemat Madrid, Fraunhofer IWM and Slovak University of Technology of Bratislava on the international level.	
D3.2	**Effectiveness of joint research centres**
The research output is reflected in many papers in good journals.	
D3.3	**Success rate in supervision of PhD students**
7 PhD students defended theses.	
D3.4	**Participation of PhD students in the outputs**
PhD students successfully finished their theses under leadership of group members working on subtasks of projects solved by the group.	
D3.5	**Participation of the team in master or bachelor studies**
11 master degree students.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Group members were involved in 10 bachelors, 15 masters and 5 doctorals semestrial lectures, seminars and courses at Brno University of Technology.	

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

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The Team reports several activities, special practical exercises, excursions and lectures.	
D4.2	**Publishing activities and its quality**
No data available.	
D4.3	**Participation in professional organisations in the area of research and development**
The team members were active in 17 professional organisations.	

Other comments of the commission:

The impression of the Commission regarding the Team “Brittle Fracture” is very positive. The Team is world leading and internationally excellent in the field. As a minor recommendation, the Team is suggested to increase outreach activities. The Team might consider changing the name of the group from “Brittle Fracture“ to “Fracture Mechanics“ or “Fracture...“.

5. Structure of Phases and Thermodynamics Group

Strengths:
Broad expertise, both theoretically and experimentally, in the study of interrelations between diffusion and thermodynamics, phase and phase equilibrium properties of materials on one side and microscopic structure on the other. Clear and focused ideas for future research projects. Very good international contacts. The Team provides scientific and technical support (SEM, TEM, sample preparation) for the Institute.

Weaknesses:
The age structure is problematic, more than half of the team members are over 55.

Opportunities:
Assuming a successful transfer of expertise and assuming a moderate modernisation of the experimental equipment, the Team has the potential to produce excellent scientific results also in the future.

Threats:
If the Team does not manage to recruit young colleagues soon, the excellent and unique expertise is in danger to be lost.

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

H1.1	Quality of selected outputs of Phase I
The quality of selected results (excellent output 1+2) is above the national average in the field of Materials Engineering.	
H1.2	**Contribution of workers on the outputs reached**
Members of the group contributed to the output; however, the productivity per FTE and FC is below the average.	
H1.3	**Quality of all outputs and results**
The Team consists of experimentalists and theoreticians (modelling) addressing basic questions in condensed matter physics; the main output ase publications: 77 articles in journals with impact factor (some of excellent quality), 31 conference proceedings.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The main research topic is the study of phase diagrams and thermodynamic properties of multicomponent alloy systems and functional materials for hydrogen storage (diffusion processes in solids), both experimentally and theoretically. The group operates a portfolio of instruments (e.g. three different electron microscopes, devices for TEM samples preparation) and has expertise in electron microscopy. The Team reports the following results to be the most important: (1) modelling of the particle size influence on the thermodynamic properties and phase equilibria in complex systems, (2) development of advanced materials like Mg-based materials doped with Sb for hydrogen storage, (3) nanostructured half-Heusler thermoelectric materials, (4) local microstructural changes induced by static and dynamic indentation in nanostructured and nanolaminate coatings and (5) description of the Al–Zn phase diagrams using CALPHAD method, including novel definition of pure elements thermodynamics and new original model for the description of mutual interactions. The results are relevant for the field.	

H1.5	Contribution of the participation of the authors in large collaborations
Not applicable	

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

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The results concerning lead-free solders, hard coatings and hydrogen storage are highly relevant for society.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
Contribution to the general knowledge about materials.	
H2.3	**Relation to practice**
Several collaborations with industry.	
H2.4	**Participation in AV21 strategy**
Not explicitly addressed.	
H2.5	**Cooperation with regions of the Czech Republic**
Collaborations with local universities.	

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

D1.1	Comparison of the team with similar international and national institutes
Because of the quality of the publications, the list of ongoing projects and the collaborating partners, the Team has a high standing in the community.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The Team is embedded in active national and international networks where team members play a crucial role.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Members of the Team were organizers of an international conference and a symposium; one invited talk.	

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 major research direction is the study of relations between thermodynamic and diffusion properties of multicomponent systems and their microscopic structure. The planned future activities mostly follow this direction.	
D2.2	**Assessment of the previous research objectives and their achievement**
The previous research objectives were well focused, following the major research direction, and good, even excellent results were achieved.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The age structure of the Team was identified as the main weakness in the previous evaluation. The Team tried to improve the situation by increasing the involvement in teaching at the local universities and by involving more students in the research.	
D2.4	**Success in receiving grants**
Partners in internationally funded projects, some national funding.	
D2.5	**Adequacy of instrumental equipment**
The Team operates seven instruments, including three electron microscopes, devices for the preparation of TEM samples and a calorimeter; the equipment is adequate.	
D2.6	**Effectiveness of management**
Good and efficient team work.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The Team seems to be well structured, with well defined responsibilities. The age structure is problematic, more than half of the team members are over 55. Gender balance has not yet been achieved.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
See D2.7	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
The Team collaborates with CEITEC.	

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
Strong collaboration with universities on both a national (5) and international (7) level.	

D3.2	Effectiveness of joint research centres
Effective collaboration with CEITEC and collaborations with other international research centers (e.g. Swerea, Sweden; Institute for Materials Research SAS, Košice, Slovakia; National Physical Laboratory/Hampton Thermodynamics, UK).	
D3.3	**Success rate in supervision of PhD students**
Co-supervision of one PhD student. It is recommended to expand supervision of PhD students in view of recruting young researchers.	
D3.4	**Participation of PhD students in the outputs**
The PhD student participates in the project on advanced thermoelectric Ag-Pb-Sn-Te and Pb-Se-Sn-Te systems.	
D3.5	**Participation of the team in master or bachelor studies**
Some involvement of bachelor and master students, which should be extended.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Members of the Team taught 4 courses at master level at local universities.	

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

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Some lectures and practical demonstrations on TEM at the biennial Autumn School of Electron Microscopy.	
D4.2	**Publishing activities and its quality**
None documented.	
D4.3	**Participation in professional organisations in the area of research and development**
Team members serve on various research and science foundation committees and boards and are reviewers for several scientific journals.	

Other comments of the commission:

The Commission has a very positive impression of the “Structure of Phases and Thermodynamics Group”, however, as stated in D2.7, the age structure of the Team is problematic, more than half of the team members are over 55. Recruiting several young colleagues is therefore of great importance for the Team in order to ensure that the expertise, both experimental and modeling, is transferred. If the recruitment fails, the Institute might consider merging the Team with other teams of the Institute (e.g. team 6).

6. Electrical and Magnetic Properties Group

Strengths:
Broad expertise, both theoretically and experimentally, ranging from quantum-mechanical electronic structure calculations to the continuum scale on the modeling side, and covering experimental techniques from the atomic scale and nano-level (e.g. TEM) to macroscopic tools (e.g. magnometers). Clear and focused ideas for future research projects.

Weaknesses:
Almost all projects are funded by national agencies, minimal funding from EU and international projects.

Opportunities:
Based on the expertise in the group and assuming a moderate modernisation of the experimental equipment, the Team has the potential to produce excellent scientific results also in the future.

Threats:
Loss of expertise due to the retirement of experienced scientists in the coming years.

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

H1.1	Quality of selected outputs of Phase I
The quality of selected results (excellent output 1+2) is above the national average in the field of Materials Engineering.	
H1.2	**Contribution of workers on the outputs reached**
Members of the group contributed significantly to the output; high productivity per FTE, FC above average.	
H1.3	**Quality of all outputs and results**
The Team consists of experimentalists and theoreticians addressing basic questions in solid state physics; the main output is publications: 164 articles in journals with impact factor, some of excellent quality.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The main research topic are defects and extended defects impacting the electrical and magnetic (and other bulk) properties of materials, both experimentally and theoretically. The group operates a portfolio of instruments (e.g. Mössbauer spectrometer) and has expertise in electron microscopy. The theoretical effort focuses on atomistic simulations of dislocations. The Team reports the following results to be the most important: (1) Experimental evidence of magnetization bias due to field cooling in high entropy alloys, (2) Ab initio study of the impact of antiphase boundaries on magnetism in Fe-Al-Ti, (3) Molecular statics simulations of stability of dislocation loops close to surfaces and (4) 3D phase field crystal model coupling structural transition with dislocations. The results are relevant for the field.	

H1.5	Contribution of the participation of the authors in large collaborations
Not applicable	

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

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Several studies are directly relevant for society: nanoparticles for medical applications, environmental and public health issues due to friction materials in brakes.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
Contribution to the general knowledge about materials	
H2.3	**Relation to practice**
Some contacts to industry.	
H2.4	**Participation in AV21 strategy**
Not explicitly addressed	
H2.5	**Cooperation with regions of the Czech Republic**
Collaborations with local universities	

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

D1.1	Comparison of the team with similar international and national institutes
Because of the quality of the publications, the list of ongoing projects and the collaborating partners, the Team has a high standing in the community.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The Team is embedded in active national and international networks where team members play a crucial role.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Members of the Team were organizers, co-organisers or members of the programme committees of several international conferences; they presented 10 invited talks.	

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 major research direction is to “identify intricate connections between defects in materials on one hand and materials properties on the other hand“. The planned future activities mostly follow this direction; Starting new fields like quantum computers and applications of neural networks and machine learning should, however, not take away the focus and resources from ongoing studies.	
D2.2	**Assessment of the previous research objectives and their achievement**
The previous research objectives were well focused, following the major research direction, and good, even excellent results were achieved.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The Team has addressed most of the assessments or the previous evaluation and have implemented further improvements.	
D2.4	**Success in receiving grants**
The Team seems to be very successful in attracting national grants from MEYS, TACR, CAS and CSF.	
D2.5	**Adequacy of instrumental equipment**
The equipment is adequate, consisting of 8 instruments, including a Mössbauer spectrometer and X-ray diffractometer, and there is access to electron microscopes.	
D2.6	**Effectiveness of management**
Good and efficient team work.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The Team seems to be well structured, with well defined responsibilities. The age structure is OK, with ongoing efforts of knowledge transfer from more senior to younger team members and recruiting young colleagues. Gender balance has not yet been achieved (6 female and 15 male researchers), but seems to be improving.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
See D2.7	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
The Team is tightly connected to and partly integrated into CEITEC.	

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
Intensive collaboration with universities on national (4) and international (17) level.	
D3.2	**Effectiveness of joint research centres**
Tight and effective collaboration with CEITEC and collaborations with other national (Institute of Physics in Prague, Nuclear Physics Institute in Řež) and international (Los Alamos National Laboratory (USA), Max Planck for Iron Research in Düsseldorf (Germany), Culham Centre for Fusion Energy (United Kingdom)) research centres	
D3.3	**Success rate in supervision of PhD students**
8 active PhD students, two have defended their theses during the evaluation period.	
D3.4	**Participation of PhD students in the outputs**
6 Phd students contributed significantly to publications.	
D3.5	**Participation of the team in master or bachelor studies**
Supervision of two bachelor and one master student, their results led to publications.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Members of the Team taught 9 courses at bachelor and master level at local universities	

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

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Team members participated actively in the “Day of open doors“ at IPM in 2019, several presentations for the general public.	
D4.2	**Publishing activities and its quality**
One publication for the general public is documented.	
D4.3	**Participation in professional organisations in the area of research and development**
Team members serve on various research and science foundation committees and boards and are guest editors for several scientific journals.	

Other comments of the commission:

The Commission has a very positive impression of the “Electrical and Magnetic Properties Group”.

Final report was elaborated by:

Commission 7.2 - Engineering and technology
Evaluated teams No.: 1, 2, 3, 4, 5, 6

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