Annual Activity Report
Faculty of Chemical Technology
University of Pardubice

2019

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University of Pardubice

2019

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Introduction

Dear Readers, this publication is the Annual Report for 2019 presented to the general public by the Faculty of Chemical Technology, University of Pardubice in compliance with Act No. 111/1998 Coll. on Higher Education Institutions and on amendment to some acts. In this Report, the Management of the Faculty presents significant activities and results of the Faculty in the context of the University of Pardubice, in the framework of Czech and international education, and in terms of scientific and research activities.

1. Structure of the Faculty Bodies

1.1 Faculty Management

Dean: Prof. Ing. Petr Kalenda, CSc.

Vice-Deans: Prof. Ing. Petr Němec, Ph.D.
Vice-Dean for Education, First Deputy Dean

Prof. Ing. Petr Mošner, Dr.
Vice-Dean for Science and Creative Activity (until 2 April 2019)
Vice-Dean for Internal Affairs (from 4 April 2019)

Prof. Ing. Karel Ventura, CSc.
Vice-Dean for Internal Affairs and External Relations (until 2 April 2019)

Prof. Ing. Libor Čapek, Ph.D.
Vice-Dean for Science and Creative Activity (from 4 April 2019)

Mgr. Lucie Stříbrná, Ph.D.
Vice-Dean for External Relations and Promotion (from 4 April 2019)

Secretary of the Faculty: Ing. Martin Šprync

1.2 Departments and Institutes of the Faculty

Departments and Institutes

Department of General and Inorganic Chemistry (KOAnCh)
Head of Department: Prof. Ing. Zdeněk Černošek, CSc.

Institute of Organic Chemistry and Technology (ÚOChT)
Head of Institute: Prof. Ing. Miloš Sedlák, DrSc.

Department of Analytical Chemistry (KAlCh)
Head of Department: Prof. Ing. Karel Ventura, CSc.

Department of Biological and Biochemical Sciences (KBBV)
Head of Department: Prof. Ing. Alexander Čegan, CSc. *(until 2 1. 2019)*
Prof. Mgr. Roman Kanďár, Ph.D. *(from 3 1. 2019)*

Department of Physical Chemistry (KFCh)
Head of Department: Prof. Ing. Libor Čapek, Ph.D.

Institute of Chemistry and Technology of Macromolecular Materials (ÚChTML)
Head of Institute: Ing. David Veselý, Ph.D.

Institute of Environmental and Chemical Engineering (ÚEnviChI)
Head of Institute: Prof. Ing. Petr Mikulášek, CSc.

Department of Economy and Management of Chemical and Food Industry (KEMCh)
Head of Department: Ing. Jan Vávra, Ph.D.

Department of Inorganic Technology (KAnT)
Head of Department: Prof. Ing. Petra Šulcová, Ph.D.

Institute of Applied Physics and Mathematics (ÚAFM)
Head of Institute: Prof. Ing. Čestmír Drašar, Dr.

Department of Graphic Arts and Photophysics (KP)
Head of Department: Prof. Ing. Petr Němec, Ph.D.

Institute of Energetic Materials (ÚEnM)
Head of Institute: Doc. Ing. Miloš Ferjenčík, Ph.D.

Centre of Materials and Nanotechnologies (CEMNAT)
Head of Centre: Prof. Ing. Miroslav Vlček, CSc.

Joint Laboratory of Solid State Chemistry (SLChPL)
Head of Laboratory: Doc. Ing. Eva Černošková, CSc.

Centres

University Environmental Centre
Head of Centre: Prof. Ing. Petr Mikulášek, CSc.

1.3 Academic Senate of FChT

Chairman: Doc. Ing. Martin Adam, Ph.D.

Presidium:
Doc. Ing. Martin Adam, Ph.D.
Ing. Aleš Eisner, Ph.D.
Ing. Lada Dubnová

Members:
Doc. Ing. Martin Adam, Ph.D.
Ing. Marek Bouška, Ph.D. *(from 1 December 2019)*
Prof. Ing. Libor Čapek, Ph.D. *(until 21 January 2019)*
Prof. Ing. Čestmír Drašar, Dr.
Ing. Lada Dubnová
Ing. Aleš Eisner, Ph.D.
Doc. RNDr. Jana Holubová, Ph.D. *(until 30 November 2019)*
Ing. Karolína Hošková *(from 1 June 2019 until 30 November 2019)*
Bc. Jan Hrabovský *(until 3 June 2019)*
Prof. Ing. Roman Jambor, Ph.D.
Ing. Karolína Jastřembská *(from 4 June 2019 until 30 November 2019)*
Doc. Ing. Alena Komersová, Ph.D. *(from 1 December 2019)*
Petr Leinweber *(from 1 December 2019)*
Ing. Patrik Pařík, Ph.D.
Ing. Marek Smolný *(until 30 November 2019)*
Bc. Martin Šimek *(from 1 December 2019)*
Ing. Pavel Šimon
Ing. Martina Špryncová *(until 30 May 2019)*
Ing. Diego Alejandro Valdés Mitchell *(from 1 December 2019)*
Ing. Jan Vávra, Ph.D. *(from 21 January 2019 until 30 November 2019)*
Ing. David Veselý, Ph.D.
Prof. Ing. Jaromír Vinklárek, Dr.
Doc. Ing. Tomáš Weidlich, Ph.D.

1.4 Scientific Board of FChT

Until 2 April 2019

Chairman: Prof. Ing. Petr Kalenda, CSc., Dean of the Faculty of Chemical Technology

Internal Members:
Prof. RNDr. Zuzana Bílková, Ph.D.
Prof. Ing. Alexander Čegan, CSc.
Prof. Ing. Zdeněk Černošek, CSc.
Prof. Ing. Čestmír Drašar, Dr.
Prof. Ing. Radim Hrdina, CSc.
Prof. Ing. Pavel Jandera, DrSc.
Prof. Ing. Jiří Kulhánek, Ph.D.
Prof. Ing. Petr Lošťák, DrSc.
Prof. Ing. Hana Lošťáková, CSc.
Prof. Ing. Jiří Málek, DrSc.
Prof. Ing. Petr Mikulášek, CSc.
Prof. Ing. Petr Mošner, Dr.
Prof. Ing. Petr Němec, Ph.D.
Prof. Ing. Aleš Růžička, Ph.D.
Prof. Ing. Miloš Sedlák, DrSc.
Doc. Ing. Ladislav Svoboda, CSc.
Prof. Ing. Ladislav Tichý, DrSc.
Prof. Ing. Karel Ventura, CSc.
Prof. Ing. Svatopluk Zeman, DrSc.

External Members:

Dr. Ing. Petr Antoš, Ph.D., EURING, EurChem.	UCT Technopark in Kralupy, Kralupy nad Vltavou
Ing. Jana Bludská, CSc.	Institute of Inorganic Chemistry of the Czech Academy of Sciences
Doc. RNDr. Jiří Dostál, CSc.	Faculty of Logistics and Crisis Management, TBU Zlín
Prof. Ing. Jiří Hanika, DrSc.	Institute of Chemical Process Fundamentals of the Czech Academy of Sciences
Prof. Ing. Jaromír Havlica, DrSc.	Faculty of Chemistry, BUT Brno
Prof. Ing. Aleš Helebrant, CSc.	Vice-Dean, Faculty of Chemical Technology, UCT Prague
Ing. Josef Liška	CEO, Synthesia a.s., Pardubice
Prof. Ing. Ján Šajbidor, DrSc.	Dean, Faculty of Chemical and Food Technology, SUT Bratislava
Prof. Ing. Václav Švorčík, DrSc.	Faculty of Chemical Technology, UCT Prague
Ing. Josef Tichý, CSc.	CEO, Explosia, a. s., Pardubice

From 4 April 2019

Chairman: Prof. Ing. Petr Kalenda, CSc., Dean of the Faculty of Chemical Technology

Internal Members:
Prof. Ing. Libor Čapek, Ph.D.
Prof. Ing. Zdeněk Černošek, CSc.
Prof. Ing. Čestmír Drašar, Dr.
Prof. Ing. Radim Hrdina, CSc.
Prof. Ing. Jaromíra Chýlková, CSc.
Prof. Ing. Roman Jambor, Ph.D.
Prof. Ing. Pavel Jandera, DrSc.
Prof. Mgr. Roman Kanďár, Ph.D.
Prof. Ing. Jiří Kulhánek, Ph.D.
Prof. Ing. Jiří Málek, DrSc.
Prof. Ing. Petr Mikulášek, CSc.
Prof. Ing. Petr Mošner, Dr.
Prof. Ing. Petr Němec, Ph.D.
Prof. Ing. Aleš Růžička, Ph.D.
Prof. Ing. Miloš Sedlák, DrSc.
Prof. Ing. Petra Šulcová, Ph.D.
Doc. Ing. Liběna Tetřevová, Ph.D.
Prof. Ing. Ladislav Tichý, DrSc.
Prof. Ing. Karel Ventura, CSc.
Prof. Ing. Jaromír Vinklárek, Dr.
Prof. Ing. Svatopluk Zeman, DrSc.

External Members:

Prof. RNDr. Jiří Barek, CSc.	Faculty of Science, CU, Prague
Doc. Ing. Roman Čermák, Ph.D.	Dean, Faculty of Technology, TBU Zlín
Prof. Ing. Anton Gatial, DrSc.	Dean, Faculty of Chemical and Food Technology, SUT Bratislava
Mgr. Karolína Gondková	Director of the Higher Education Department, Ministry of Education Prague
Prof. Ing. Jiří Hanika, DrSc.	Institute of Microbiology of the Czech Academy of Sciences Prague
Prof. Ing. Kamila Kočí, Ph.D.	Faculty of Metallurgy and Material Engineering, Institute of Environmental Technology, VSB-TU Ostrava
Doc. Ing. Zdeňka Kolská, Ph.D.	Faculty of Science, JEPU Ústí nad Labem
Ing. Josef Liška	CEO, Synthesia, a.s., Pardubice
Ing. David Pohl, Ph.D.	Managing Director, Synthos, a.s., Kralupy nad Vltavou
Prof. Ing. Václav Švorčík, DrSc.	Faculty of Chemical Technology, UCT Prague
Prof. Ing. Martin Weiter, Ph.D.	Dean, Faculty of Chemistry, BUT Brno

1.5 Study Programme Board

Chairman: Prof. Ing. Petr Němec, Ph.D.

Deputy Chair: Prof. Ing. Petr Mikulášek, CSc.

Members:
Prof. RNDr. Zuzana Bílková, Ph.D.
Prof. Ing. Libor Čapek, Ph.D.
Doc. Ing. Libor Červenka, Ph.D.
Doc. RNDr. Jana Holubová, Ph.D.
Doc. Ing. Aleš Imramovský, Ph.D.
Doc. Ing. Zdeněk Jalový, Ph.D.
Prof. Ing. Andréa Kalendová, Dr.
Prof. Mgr. Roman Kanďár, Ph.D.
Doc. Ing. Anna Krejčová, Ph.D.
Doc. Ing. Marcela Pejchalová, Ph.D.
Prof. Ing. Petra Šulcová, Ph.D.
Doc. Ing. Liběna Tetřevová, Ph.D.
Ing. David Veselý, Ph.D.

1.6 Advisory Bodies of the Faculty Management

Education Commission

Until 30 April 2019

Chairman: Prof. Ing. Petr Němec, Ph.D., Vice-Dean for Education

Secretary: Ing. David Veselý, Ph.D., Authorized Director of ÚChTML

Members: Doc. Ing. Petra Bajerová, Ph.D., KAlCh
Prof. Ing. Alexander Čegan, CSc., Authorized Director of KBBV
Prof. Ing. Čestmír Drašar, Dr., Head of ÚAFM
Doc. Ing. Roman Jambor, Ph.D., KOAnCh
Ing. Bohumil Jašúrek, Ph.D., KPF
Prof. Ing. Petr Mikulášek, CSc., Head of ÚEnviChI
Prof. Ing. Miloš Sedlák, DrSc., Head of ÚOChT
Ing. Jan Vávra, Ph.D., KEMCh

Disciplinary Commission

Until 30 April 2019

Chairman: Prof. Ing. Petr Němec, Ph.D., Vice-Dean for Education

Members: Prof. Ing. Alexander Čegan, CSc., Authorized Director of KBBV
Ing. David Veselý, Ph.D., Authorized Director of ÚChTML
Lada Dubnová, student
Pavla Palhounová, student
Ing. Jitka Klikarová, student

From 1 May 2019

Chairman: Prof. Ing. Petr Němec, Ph.D., Vice-Dean for Education

Members: Prof. Ing. Petr Mikulášek, CSc., Head of ÚEnviChI
Ing. David Veselý, Ph.D., Head of ÚChTML
Ing. Barbora Kamenická, doctoral degree student
Ing. Jakub Šulc, doctoral degree student
Ondřej Kovář, bachelor's degree student

Investment Commission

Chairman: Prof. Ing. Petr Mošner, Dr., Vice-Dean for Internal Affairs

Members: Representatives of all departments/institutes

Commission for Handling Surplus and Useless Property of FChT and for Precious Metal Write-Off

Chairman: Ing. Martin Šprync, Secretary

Members: Doc. Ing. Petra Bajerová, Ph.D., KAlCh
Ing. David Veselý, Ph.D., Head of ÚChTML

2. Study and Educational Activity

2.1 Full-time and Part-time Study Programmes (Fields of Study)

The current study programmes at FChT include 15 bachelor's degree programmes (of which 7 are newly accredited), 11 follow-up master's degree programmes (of which 5 are newly accredited), and 8 doctoral degree programmes (of which 1 is newly accredited). In total, the Faculty has 41 fields of study.

In the academic years 2018/2019 and 2019/2020, the following accredited study programmes were available:

Study programme		**Field of study**	**Standard length of study (years)**			**CBBE Code**
			Bc.	F-Mgr.	Ph.D.	
B3912	Special chemical and biological programmes	Clinical biology and chemistry	3			3901R017
		Laboratory assistant	3			5345R020
B3441	Graphic arts and printing technology	Graphic arts and printing technology	3			3441R001
B2807	Chemical and process engineering	Environmental protection	3			1604R007
		Economy and management of chemical and food industry	3			2807R015
B2802	Chemistry and technical chemistry	Chemistry and technical chemistry	3			2802R011
B2901	Chemistry and technology of foodstuffs	Evaluation and analysis of foodstuffs	3			2901R003
B2829	Inorganic and polymeric materials	Inorganic materials	3			2808R023
		Polymeric materials and composites	3			2808R024
B2830	Pharmacochemistry and medicinal materials	Pharmacochemistry and medicinal materials	3			2801R021
B2831	Surface protection of building and construction materials	Surface protection of building and construction materials	3			2808R025
N3441	Graphic arts and printing technology	Graphic arts and printing technology		2		3441T001
N3912	Special chemical and biological programmes	Analysis of biological materials		2		3901T001
		Bioanalyst		2		1406T011
N2901	Chemistry and technology of foodstuffs	Evaluation and analysis of foodstuffs		2		2901T003
N2807	Chemical and process engineering	Economy and management of chemical and food industry		2		2807T015
		Chemical engineering		2		2807T004
		Environment protection		2		1604T007
N2808	Chemistry and technology of materials	Inorganic technology		2		2801T001
		Chemistry and technology of paper and pulp		2		2808T015
		Material engineering		2		3911T011
		Organic coatings and paints		2		2808T022
		Technology of organic specialities		2		2801T007
		Technology of Polymers Manufacturing and Processing		2		2801T009
		Theory and technology of explosives		2		2801T010
		Fibres and textile chemistry		2		2806T003
N1407	Chemistry	Analytical chemistry		2		1403T001
		Inorganic and bioinorganic chemistry		2		1401T001
		Organic chemistry		2		2802T003
		Technical physical chemistry		2		2802T010

P1418	Inorganic chemistry	Inorganic chemistry			4	1401V002
P1421	Organic chemistry	Organic chemistry			4	1402V001
P1419	Analytical chemistry	Analytical chemistry			4	1403V001
P1420	Physical chemistry	Physical chemistry			4	1404V001
P2832	Chemistry and chemical technology	Inorganic technology			4	2801V001
		Organic technology			4	2801V003
P2833	Chemistry and technology of materials	Surface engineering			4	2808V027
		Chemistry and technology of inorganic materials			4	2808V003
		Engineering of energetic materials			4	2808V035
P2837	Chemical and process engineering	Chemical engineering			4	2807V004
		Environmental engineering			4	3904V005

Newly accredited study programs from academic year 2019/2020

Accredited study programme		**Standard length of study** (years)		
		Bc.	**F-Mgr.**	**Ph.D.**
B0488A050003	Economy and management of chemical industry enterprises	3		
B0512A130006	Analysis of biological materials	3		
B0531A130012	Pharmacochemistry and medicinal materials	3		
B0531A130013	Surface protection of building and construction materials	3		
B0531A130014	Graphic arts and printing technology	3		
B0588A130001	Chemistry and Technology of Environment Protection	3		
B0531A130017	Polymeric materials and composites	3		
N0413A050010	Economy and management of chemical industry enterprises		2	
N0512A130006	Analysis of biological materials		2	
N0531A130013	Graphic arts and printing technology		2	
N0711A130008	Engineering of Energetic Materials		2	
N0914P360001	Bioanalytical Laboratory Diagnostics in Medicine		2	
P0711D130001	Organic technology			4

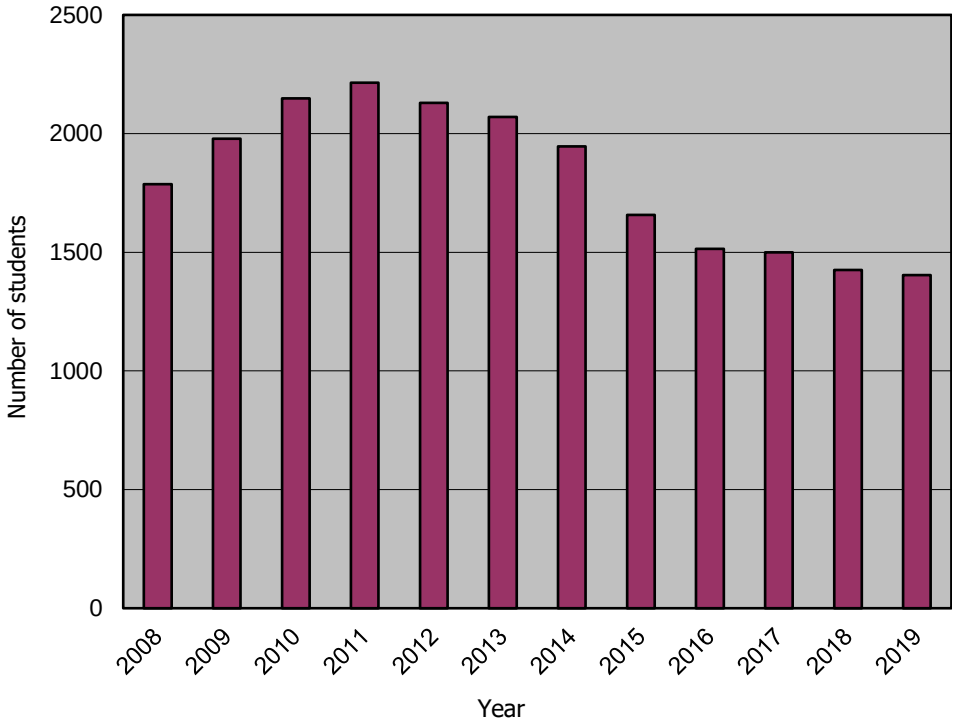
2.2 Numbers of Students in Bachelor's, Master's and Doctoral Degree Programmes

The numbers of students of the Faculty (always as of 31 October of the relevant year) are shown in the tables and graphs below. The letter *c* indicates international students.

Development of the overall number of students at FChT

Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Number of students	1718+69c	1895+83c	2058+91c	2124+91c	2047+82c	1975+95c

Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Number of students	1840+106c	1542+115c	1377+137c	1353+147c	1276+150c	1262+142c



Development of the overall number of students at FChT between 2008 and 2019

Numbers of students by type of study

Form and type of study	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Czech students	1840	1542	1377	1353	1276	1262
Foreign students	106c	115c	137c	147c	150	142
Students total	**1946**	**1657**	**1514**	**1500**	**1426**	**1404**
Full-time study						
Bachelor's degree programmes	1226+62c	1040+80c	875+95c	857+99c	841+99c	866+95c
Follow-up master's programmes	381+9c	315+5c	326+14c	332+22c	278+27c	268+26c
Full-time total	**1607+71c**	**1355+85c**	**1201+109c**	**1189+121c**	**1189+121c**	**1134+121c**
Part-time study						
Bachelor's degree programmes	34+1c	4+0c	2+0c	1+0c	1+0c	-
Follow-up master's programmes	0	0	0	0	0	-
Part-time total	**34+1c**	**4+0c**	**2+0c**	**1+0c**	**1+0c**	**-**
Doctoral degree programmes	**199+34c**	**183+30c**	**174+28c**	**163+26c**	**156+24c**	**128+21c**

Number of full-time students by study programmes

Study Programme	2017/2018		2018/2019		2019/2020	
	Bc.	N	Bc.	N	Bc.	N
Chemistry and technical chemistry	124+3c	-	116+4c	-	123+7c	-
Chemistry and technology of foodstuffs	85+13c	35+0c	104+14c	24+2c	96+11c	28+4c
Graphic arts	45+1c	20+9c	44+3c	21+5c	14+1c	12+2c
Special chemical-biological fields	353+41c	82+6c	360+44c	65+6c	342+27c	30+2c
Chemical and process engineering	74+3c	-	64+3c	-	29+1c	-
Ecology and environmental protection	-	-	-	-	-	-
Pharmacochemistry and medicinal materials	127+37c	-	96+30c	-	55+11c	-
Surface protection of building and construction materials	11+0c	-	16+0c	-	10+0c	-
Inorganic and polymeric materials	38+1c	-	41+1c	-	35+3c	-
Chemical and process engineering - N2807	-	43+1c	-	38+2c	-	24+3c
Chemistry and technology of materials - N2808	-	77+5c	-	64+6c	-	57+5c
Chemistry - N1407	-	75+1c	-	66+6c	-	58+7c
Economy and management of chemical industry enterprises*	-	-	-	-	22+2c	7+0c
Analysis of biological materials	-	-	-	-	31+11c	13+2c
Pharmacochemistry and medicinal materials	-	-	-	-	55+17c	-
Surface protection of building and construction materials	-	-	-	-	1+0c	-
Graphic arts and printing technology*	-	-	-	-	16+2c	11+0c
Chemistry and Technology of Environment Protection*	-	-	-	-	26+1c	-
Polymeric materials and composites*	-	-	-	-	11+1c	-
Engineering of Energetic Materials*	-	-	-	-	-	2+0c
Bioanalytical Laboratory Diagnostics in Medicine*	-	-	-	-	-	26+1c
Total	**1189+121c**		**1119+126c**		**1134+121c**	

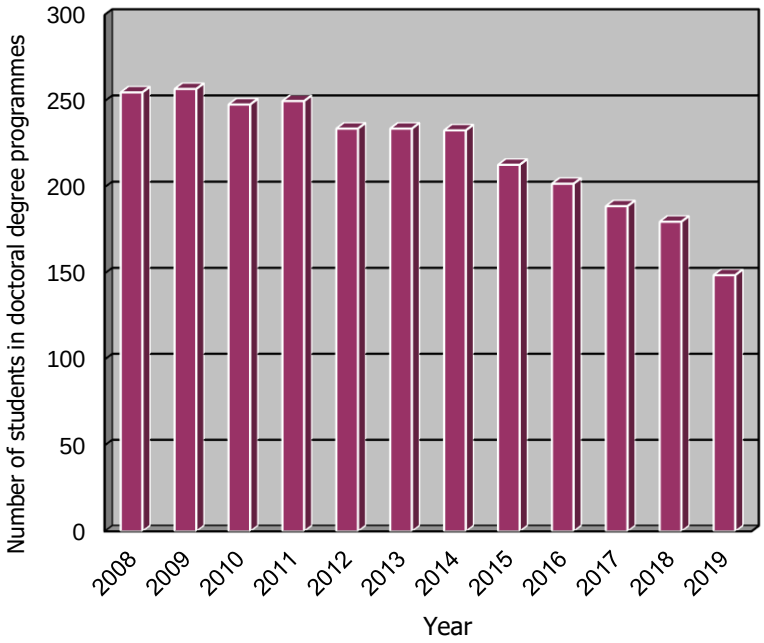
* Newly accredited programmes

Development of the number of students in doctoral degree programmes at FChT

Year	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Number of students	255	260	248	250	234	234
Proportion of the overall number of students at (%)	14.3	13.1	11.5	11.3	11.0	11.3

Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Number of students	233	213	202	189	180	149
Proportion of the overall number of students at (%)	11.9	12.8	13.3	12.6	12.6	10.6

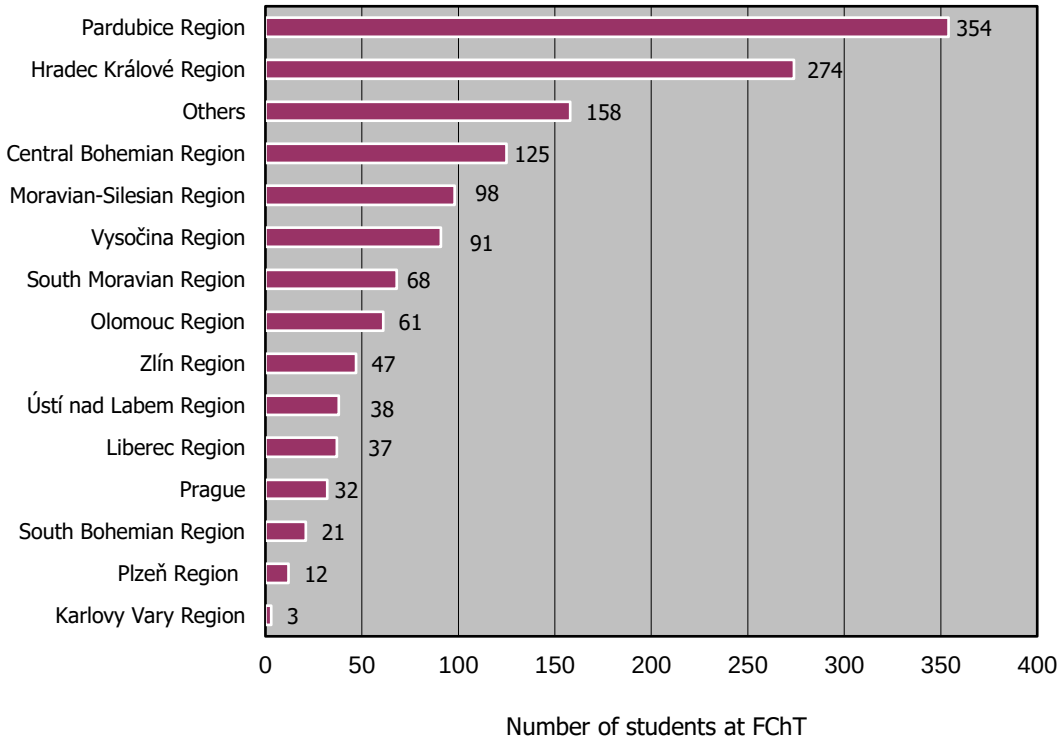
In 2019 the proportion of doctoral degree students was above 10% of the total number of students at FChT. The current proportion is 10.6%.



Development of the number of students in doctoral degree programmes at FChT between 2008 and 2019

Number of students at FChT by regions

The largest number of students are from Pardubice and Hradec Králové Regions. A positive fact is that FChT is also chosen by students from the Vysočina and Central Bohemian Regions, in addition to the traditional catchment area of Moravia. A significant proportion of the total number of students is represented by foreigners (column Others). The following figure shows the geographical distribution of students at FChT by regions.



Number of students at FChT by regions (as of 31 October 2019)

2.3 Newly Admitted Students

In 2019 the Faculty was active in attracting secondary school students. The Faculty addressed the potential applicants at various events, in the radio, press, internet (higher education exhibitions Gaudeamus in Brno and Prague, international education exhibitions in Kiev and Odessa (Ukraine), Open Days, Chemical Olympiad, Science and technology festival AMAVET, Chemical competition Chemiklání, advertisements in press, promotion through the radio, information on web pages and social networks, presentations in secondary schools, etc.)

Open Days

On 30 January 2019, a total of 149 secondary school students gathered in room C1 in the Faculty building in Studentská 573. The Dean of the Faculty provided the applicants with the basic information about the study, study programmes and fields of study offered by the Faculty, and about the conditions of the admission procedure and opportunities for international study under the ERASMUS+ Programme. Short presentations were also given by the representatives of the departments located outside the main building. After the joint session the students had a chance to visit selected departments and institutes; some of them took the opportunity to talk to teachers specialized in fields that they wanted to pursue at FChT.

This Open Day was attended by 54 students from grammar schools and 95 students from other secondary schools. The second Open Day took place on 13 February 2019. This Open Day was attended by 48 students from grammar schools and 98 students from other secondary schools.

Search for talented students

The Faculty has in place a long-term programme aimed at searching for talented students and secondary school applicants. In 2019 FChT supported the **Festival of science and technology for children and youth in the Pardubice Region called AMAVET** by awarding the best achievements in chemistry and promise of scholarship for the award-winning secondary school students. The district round of the competition took place on 20 February 2019 at the High School of Chemistry Pardubice. The regional round of the competition took place from 13 to 14 March 2019 at the IDEON Exhibition Centre in Pardubice. The awards were presented by the Dean of the Faculty of Chemical Technology Prof. Ing. Petr Kalenda, CSc. The aim and mission of the AMAVET festival is to encourage talented elementary school children and especially secondary school students to discover and develop their creative skills through specific scientific and technical projects. FChT has in place a long-term programme focused on identifying and acquiring these talented students for study of chemistry at FChT.

The Dean's award in the Secondary school student category was presented to:

1st place

Vlastimil Němec
SPŠCH Pardubice

2nd place

Karolína Kovářová, Terezie Rubková
Gymnázium A. Jiráska, Litomyšl

3rd place

Marcela Horáčková
SPŠCH Pardubice

Magdalena Hynková
Gymnázium A. Jiráska, Litomyšl

Vladimíra Hricová, Jakub Uličný
Gymnázium Krompachy, Slovak Republic

The Dean's award in the Junior category was presented to:

Nela Širšová, Marie Schauerová
ZŠ npor. Eliáše Pardubice

Aneta Dvořáková
Gymnázium Vysoké Mýto

Eliška Bublová
ZŠ Vítějeves

Monika Králová
ZŠ Holice

Nikol Dvořáková, Agáta Martínková
ZŠ npor. Eliáše Pardubice

Another important promotional event organized by the Faculty aimed at attracting talented students for study at FChT is the **Chemical Olympiad.** The Chemical Olympiad is a traditional competition for grammar school students and students of chemical vocational schools who in addition to curricular chemistry want to improve in the field that they want to study after graduation from secondary school. In 2019 the Faculty hosted the regional rounds of the Chemical Olympiad for the Pardubice and Hradec Králové Regions. On 4 May 2019 the competition was held for category B (intended for penultimate years of secondary schools), involving 38 competitors; on 6 December 2019 the competition was held for category A (last years of grammar schools), involving 19 competitors.

In 2019 the Faculty supported the fourth year of the chemical competition **Chemiklání.** This is a one-day competition for 3 to 5-member teams of secondary school students interested in chemistry. Regarding the huge interest the competition was divided into two categories — category B for younger contestants (secondary school students in grades 1 and 2) and the top category A for secondary school students from all grades. The teams solve a set of theoretical tasks during a specific time period. The team that resolves the highest number of tasks during two hours is the winner. The fourth year of the competition (8 February 2019) involved over 60 teams from secondary schools not only from the Czech Republic but also Slovakia. The winner in category A was the team of students from Gymnázium Brno, třída Kapitána Jaroše (Fakt silnej pufr), while the team of students from Gymnázium Jana Keplera, Prague (Zuktor team) was the winner in category B. The winning teams received awards from the Dean of FChT including presents and scholarship, which will be granted if they enrol for study at the Faculty.

In the long-term, the Faculty has supported the **Students' Professional Activities (SPA)**. Teachers from the Faculty have led a number of students' SPA projects that were among the best both in regional and national rounds. Academic staff and postgraduate students from the Faculty have been actively involved in scientific training of secondary school students, who work on their competition projects using modern instrumentation. In this way, young researchers are involved in scientific activities. The interest of secondary school students in developing their projects at FChT is increasing.

The Faculty of Chemical Technology together with other faculties of the University of Pardubice organize the educational scientific road-show called **Science and technology in school yards**. For several years, employees and students have visited numerous school yards with this extremely popular event. Students are involved in experiential workshops, the purpose of which is to show the world of modern technology and present technical and scientific disciplines in a playful and entertaining form and encourage or improve the interest of young people in technical and scientific disciplines. In 2019, the employees of the Faculty visited elementary schools in Lanškroun and grammar schools in Hlinsko and Holice.

The staff and students of the Faculty were actively involved in the **Young Researchers' Night** (16 April 2019), which was prepared by the University of Pardubice in cooperation with other partners. A mysterious night with curiosities from the world of science, full of alchemy, magic and play, various experiments and experiential workshops took place in the ABC Club and lasted until midnight. An interesting programme with various experiential workshops and stops showed the world of modern science and technology in an interactive, popular and educative way. The event was intended for all those who are curious irrespective of their age — children, young people, parents, grandparents, citizens, but also schools, interest groups, and other people.

The Faculty of Chemical Technology also took part in the traditional **Science and technology fair** which took place in the centre of Pardubice on 13 June 2019. Scientists and university students organized their scientific festival including educative and experiential stands and demonstrations at Pernštýnské Square in the historical centre of the city. All participants irrespective of age had the opportunity to experience science, technology, and various scientific experiments and principles.

In the week from 26 August to 30 August 2019, a total of twenty children from Pardubice and its surroundings became university students and by means of **Day camps** took a special holiday programme at selected faculties of the University of Pardubice. The Faculty of Chemical Technology prepared an interesting and entertaining programme for the participants. The children had the opportunity to experience the atmosphere of the laboratories, lecture rooms, try out the work of scientists and experts, and learn about a number of interesting tasks and experiments.

The Faculty of Chemical Technology is a traditional participant in the higher education and lifelong learning exhibition **Gaudeamus** in Brno (22 October to 25 October 2019) and in Prague (22 January to 24 January 2019). The purpose of the exhibition is to provide the maximum possible amount of information about university education to students and graduates from secondary schools, higher vocational schools, students and graduates from bachelor's degree programmes, and those who are interested in lifelong learning. The representatives of the Faculty at the University of Pardubice stand provided detailed information about the study and admission exams, handed out a number of printed materials relating to the study, and informed about the Faculty by means of presentations. The University stand was attended by thousands of secondary school students including their teachers, educational counsellors, and representatives of other universities. In addition to providing information about the study, the University had several interactive stands. Through specific practical examples, enthusiastic employees and students persuaded potential applicants that the study of chemical fields is more than interesting.

For the first time, the Faculty was presented at international education exhibitions in Ukraine as part of the presentation of the Czech Centre (12 to 14 April 2019 in Kiev and Odessa, 15 to 16 November 2019 again in Kiev). The representatives of the Faculty provided secondary school students and their parents with information about the Faculty, admission procedure, accommodation, boarding, and student life in Pardubice.

In 2019 the Faculty was significantly involved the 12th year of **Search for the best young chemist**, and is the traditional sponsor of this event. The awards were presented at a ceremony on 20 March 2019 by the Dean of the Faculty of Chemical Technology Prof. Ing. Petr Kalenda, CSc. As in previous years, the 2019 competition took place in four categories. The best young chemist was the one with the best results in the test part consisting of two rounds. The second category was the project part, which was intended for the whole classes. The task for the competitors was to develop a project according to the instructions given by the High School of Chemistry Pardubice. The winning project was announced at the ceremony on 20 March 2019. The best chemistry teacher was also announced. This was the teacher whose students achieved the best results in the test part. The next category was the best elementary school with the most successful young chemists. The organizer of the competition "Search for the best young chemist" is the High school of Chemistry Pardubice and the Pardubice Region. The general partner of the competition is the Faculty of Chemical Technology, University of Pardubice.

In 2019, the Faculty of Chemical Technology, University of Pardubice in cooperation with the Association of Chemical Industry of the Czech Republic and the Ministry of Education, Youth and

Sports of the Czech Republic hosted the **7th year of the national final of the competition Search for the best young chemist of CR**. The final involved the best 39 competitors from all regions of the Czech Republic. These were finalists who succeeded in the school, district and regional rounds of the competition. In total, the competition involved more than 18,000 ninth graders. The national round took place on 11 June 2019 at FChT in Pardubice. The Dean of FChT awarded the best five young chemists with scholarships, which they will be granted if they enrol for study at the Faculty.

The Dean's award in the **national final of the competition Search for the best young chemist of CR** was presented to competitors in the 1st to 5th place.

1st place
Robin Dočekal, ZŠ Letovice.

2nd place
Michal Jílek, ZŠ Masarykova, Polička.

3rd place
Jonathan Sandtner, ZŠ Otická, Opava.

4th place
Pavel Provazník, ZŠ Štefánikova, Pardubice.

5th place
Vojtěch Ondrák, ZŠ Heyrovského, Olomouc.

Regarding the fact that students' success is largely affected by those who teach them, the teachers of the first three students were awarded as well: RNDr. Hana Nečasová from ZŠ Letovice, RNDr. Eva Spilková from ZŠ Masarykova, Polička and Mgr. Lucie Lyková from ZŠ Otická, Opava.

Part of the finals was an exhibition of children's chemical visual arts (ICEFA Lidice), during which the teachers watched a series of short films on chemistry and selected the best film, which received a special award of the Dean of FChT "Chemical Oscar". The heart-shaped glass casting symbolizes the Faculty's motto "Life is Chemistry". It was designed by Oldřich Jiskra and made by students of SUPŠ in Železný Brod.

In 2019 the Faculty was again the partner of the **Children's Super Day** (1 June 2019), whose 18th year took place on the Pardubice racecourse. The employees of the Faculty prepared a varied and interesting programme with demonstrations of chemical magic.

Examples of chemical experiments with a focus on everyday chemistry were presented during the **Researchers' Night** (27 September 2019) at the University of Pardubice. The Researchers' Night is one of the biggest Europe-wide projects the purpose of which is to present science and scientific issues to the general public.

The University of Pardubice again enriched the programme of the Sports Park Pardubice (11 to 19 August 2019). The visitors enjoyed a special popular educational programme with attractive and interactive scientific and technical demonstrations. At the experiential **SCIENCE POINT** young scientists and students showed the visitors the world of modern science and through playful and educative demonstrations presented various world curiosities, and gave the visitors chemical quizzes.

Students' scientific professional activities at the Faculty of Chemical Technology

Students' scientific professional activities (SSPA) are intended for students in bachelor's and follow-up master's degree programmes at the Faculty of Chemical Technology, the purpose of which is to engage students in research and scientific activities beyond the scope of their study. The departments and institutes offered positions of assistant researchers and organized a students' scientific conference.

SSPA is a significant form of students' preparation through which they learn to present the results of their work, develop scientific and professional skills and improve their argumentation abilities, presentation skills, and scientific writing. The obligation of students involved in SSPA is participation in a students' scientific conference and publication of a 6-page paper in the conference proceedings. The fifth year involved 37 students from 12 departments of the Faculty. The works were presented on 10 June 2019 by means of a short presentation. The presentation also included a scientific debate.

The members of the board who judged the quality of the presentations were satisfied both in terms of content and formal aspects of the presentations. The students demonstrated their unquestionable qualities for their current and future scientific work. Another positive aspect was the involvement of students from nearly all grades. This fact contributed to the diverse nature and attractiveness of the whole event.

Admission Procedure

The admission procedure for study in bachelor's degree programmes for the academic year 2019/2020 took place in two rounds. The application submission date was 31 March 2019. The deadline was then postponed to 31 May 2019.

Regarding the fact that during the first round of the admission procedure the capacity of some bachelor's degree programmes was not achieved, the second round was announced with the application submission date 11 August 2019. The second round of the admission procedure was based on the evaluation of the applicants' academic achievement in secondary school — the applicants were ranked in order and admitted for study according to available capacity.

The application submission date for the follow-up master's degree programmes was 31 July 2019. The admission procedure was held from 3 September 2019 to 4 September 2019. The admission exam was carried out by means of an oral interview or written test with the applicants. The application submission date for the doctoral degree programmes was 30 April 2019. The admission exam was carried out by means of an oral interview on 11 June 2019. The deadline for the submission of the applications in the second round was 31 August 2019 and the admission procedure took place between 7 and 16 September 2019. The results of the admission procedure are summarized in the following table.

Full-time form of study — bachelor's degree programmes

Study Programme	Number of applicants	Accepted 1st round	Accepted 2nd round	Total accepted	Enrolled
Chemistry and technical chemistry	146	83	21	104	**74**
Chemistry and technology of foodstuffs	142	70	22	92	**52**
Special chemical and biological programmes - laboratory assistant	319	242	-	242	**128**
Inorganic and polymeric materials - inorganic materials	37	19	3	22	**11**
Graphic arts and printing technology*	34	19	8	27	**19**

Pharmacochemistry and medicinal materials*	233	138	29	167	**79**
Surface protection of building and construction materials*	6	2	-	2	**1**
Economy and management of chemical industry enterprises*	49	24	8	32	**26**
Analysis of biological materials*	125	87		87	**44**
Chemistry and technology of environment protection*	63	33	10	43	**29**
Polymeric materials and composites*	25	14	3	17	**12**
Total	**1179**	**731**	**104**	**835**	**475**

* Newly accredited programmes

Full-time form of study — follow-up master's degree programmes

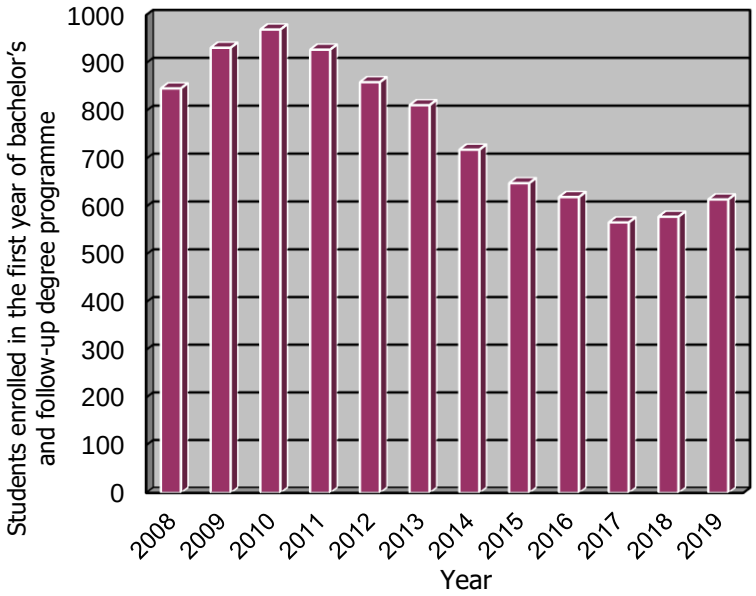
Study Programme	Number of applicants	Accepted without admission exam	Accepted with admission exam	Total accepted	Enrolled
Chemistry	34	16	15	31	27
Chemical and process engineering	8	6	-	6	5
Chemistry and technology of materials	42	27	10	37	26
Chemistry and technology of foodstuffs	30	-	23	23	20
Analysis of biological materials*	41	39	-	39	15
Graphic arts and printing technology*	11	-	11	11	11
Economy and management of chemical industry enterprises*	13	-	8	8	7
Bioanalytical laboratory diagnostics in medicine*	48	3	27	30	27
Engineering of energetic materials*	4	2	-	2	2
Total	**231**	**93**	**94**	**187**	**140**

* Newly accredited programmes

Development of the number of newly enrolled students in the first year of bachelor's and follow-up master's degree programme

Year	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Applicants	1541+32c	1744+57c	1888+58c	1829+50c	1674+66c	1610+72c
Accepted	1304+31c	1489+53c	1174+11c	1284+29c	1245+49c	1176+55c
Newly enrolled	**829+18c**	**897+35c**	**938+32c**	**910+18c**	**830+30c**	**777+35c**

Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Applicants	1466+91c	1317+121c	**1262+164c**	1151+132c	1107+149c	1233+177c
Accepted	1115+64c	1005+89c	916+116c	858+89c	838+110c	898+124c
Newly enrolled	**682+37c**	**601+48c**	**563+57c**	**516+51c**	**521+58c**	**550+65c**



Development of the number of newly enrolled students in the first year of bachelor's and follow-up master's degree programme between 2008 and 2019

Registered and newly enrolled students in full-time doctoral degree programmes

Study Programme	Number of applicants	Accepted with admission exam	Total accepted	Enrolled
Analytical chemistry	13	9	12	10
Physical chemistry	2	1	2	1
Organic chemistry	2	2	2	1
Chemical and process engineering	3	-	-	-
Chemistry and chemical technology	-	-	-	-
Chemistry and technology of materials	11	6	8	8
Organic technology*	5	2	3	2
Total	**36**	**20**	**27**	**22**

* Newly accredited programme

Registered and newly enrolled students in part-time doctoral degree programmes

Study Programme	Number of applicants	Accepted with admission exam	Total accepted	Enrolled
Analytical chemistry	1	1	1	1
Physical chemistry	-	-	-	-
Organic chemistry	-	-	-	-
Chemical and process engineering	4	4	4	4
Chemistry and chemical technology	-	-	-	-
Chemistry and technology of materials	1	1	1	1
Organic technology*	2	2	2	2
Total	**8**	**8**	**8**	**8**

* Newly accredited programme

835 applicants were admitted in full-time bachelor's degree programmes. 187 applicants (total 1,022) were admitted in follow-up master's degree programmes. A total of 35 students were admitted in both full-time and part-time doctoral degree programmes. **In the academic year 2019/2020, a total of 1,057 students were admitted, of whom 645 enrolled in study.**

Preparatory courses

Before the beginning of regular classes in the winter semester of the first year of the bachelor's degree the Department of General and Inorganic Chemistry holds the "General and inorganic chemistry" course. The course focuses on acquiring and maintaining the basic chemical skills, such as the chemical nomenclature, solution of chemical equations, amount of substance, and preparation of solutions with defined concentration. The level and difficulty of the course is designed in a way to allow students to cope with the learning content in theoretical as well as laboratory exercises. Between 16 and 20 September 2019 this course was organized for students of the Faculty of Chemical Technology in the first year.

2.4 Numbers of Graduates from Bachelor's, Master's and Doctoral Degree Programmes

Numbers of graduates by type of study in previous years

Type of study	2008	2009	2010	2011	2012	2013
Bc.	200	166	191	243	250	260
Mgr.	25	36	35	34	47	36
Ing.	129	139	104	103	106	114
Ph.D.	36	28	41	17	21	29
Total	**390**	**369**	**371**	**397**	**424**	**439**

Type of study	2014	2015	2016	2017	2018	2019
Bc.	223	209	232	208	176	172
Mgr.	30	38	23	24	43	36
Ing.	149	146	116	98	121	89
Ph.D.	29	27	19	26	32	29
Total	**431**	**420**	**390**	**356**	**372**	**326**

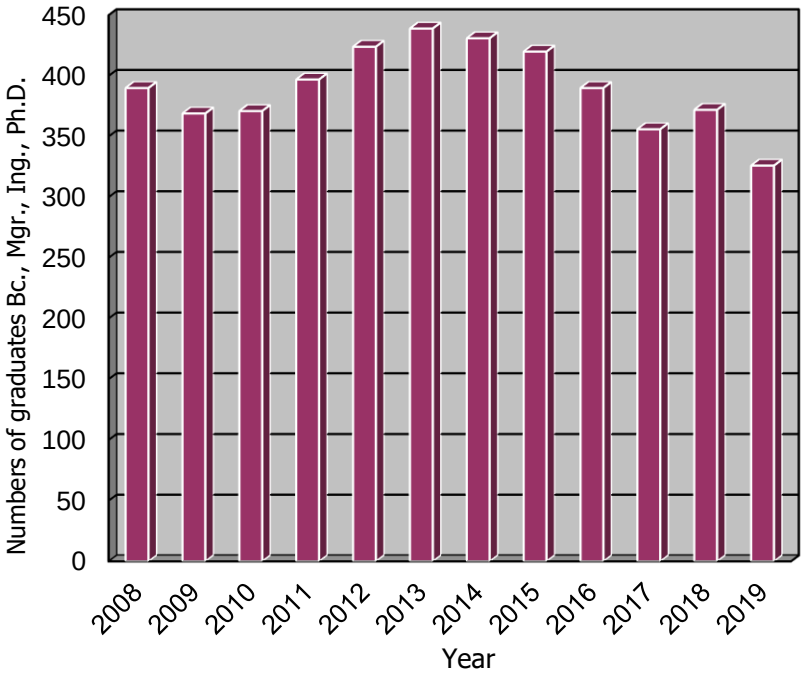
The numbers in the table correspond with the V 12-01 Statement for 1 January to 31 December of the relevant year

Numbers of graduates from doctoral degree programmes by year

Doctoral degree graduates	2008	2009	2010	2011	2012	2013
Number	35	34	37	22	23	26

Doctoral degree graduates	2014	2015	2016	2017	2018	2019
Number	24	31	20	23	35	29

The numbers of graduates are specified for the period from 1 November to 31 October of the relevant year

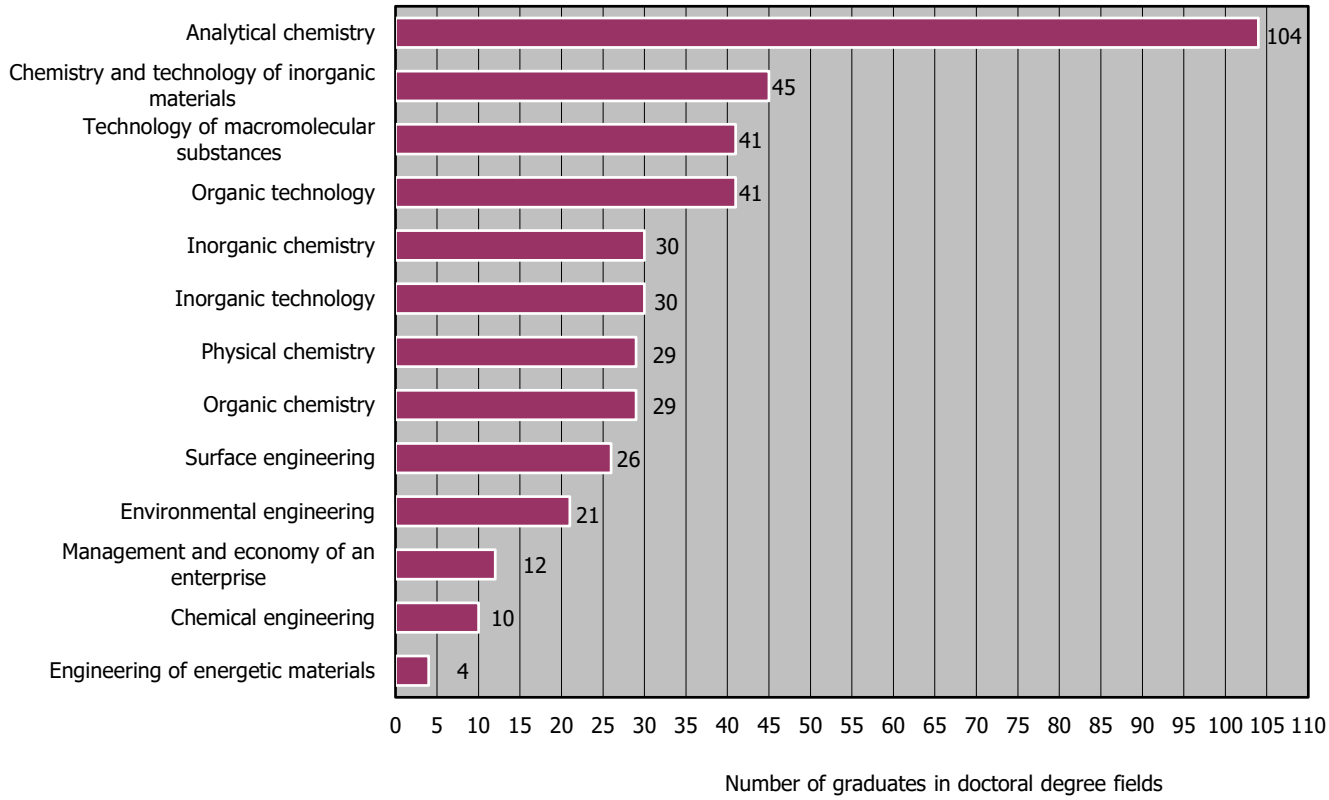


Numbers of graduates Bc., Mgr., Ing. and Ph.D. between 2008 and 2019

Graduates from doctoral degree programmes in the period from 1 November to 31 October of the following year

Study Programme	Number of graduates				
	2014/15	2015/2016	2016/2017	2017/18	2018/19
Inorganic chemistry	1	4	3	1	3
Organic chemistry	1	1	4	2	2
Analytical chemistry	11	7	5	9	3
Physical chemistry	-	-	2	1	3
Chemistry and chemical technology	4	4	3	-	3
Chemistry and technology of environment protection	-	-	-	-	-
Chemical and process engineering	5	2	1	9	7
Chemistry and technology of materials	9	2	5	13	8
Total	**31**	**20**	**23**	**35**	**29**

The research projects of the departments and institutes also involved a number of postgraduate students as the topics of their dissertations were related to issues addressed at these departments and institutes. Postgraduate students are included in research teams and actively contribute to the scientific and research results of the Faculty. Between 2005 and 2019, a total of 422 postgraduate students defended their dissertations closely related to the issues addressed at the departments and institutes of the Faculty. The following figure shows in which doctoral degree programmes and fields the dissertations were defended.



Overview of doctoral degree fields and number of dissertations between 2005 and 2019 corresponding with the scientific and research focus of FChT departments and institutes

Award-winning papers of FChT students

In 2019 a number of dissertations, master's diploma theses and bachelor's diploma theses were awarded for their outstanding theoretical and experimental level. Many students were awarded for the presentation of their scientific and research achievements at scientific conferences and seminars.

Award of the Dean of the Faculty of Chemical Technology, University of Pardubice for outstanding dissertations

Ing. Ondřej Mrózek, Ph.D.
Impact of intramolecular coordination on the hapticity of indenyl ligand
Supervisor: prof. Ing. Jaromír Vinklárek, Dr.
Department of General and Inorganic Chemistry

Mgr. Adam Kostelník, Ph.D.
Advanced analytical procedures using cholinesterases
Supervisor: prof. Ing. Alexander Čegan, CSc.
Department of Biological and Biochemical Sciences

Ing. Petr Hejda, Ph.D.
The impact of selected transition metals on the structure and properties of phosphate glasses
Supervisor: Doc. RNDr. Jana Holubová, Ph.D.
Department of General and Inorganic Chemistry

Ing. Kateřina Hrdá, Ph.D.
The factors affecting ecotoxicity of engineered nanomaterials
Supervisor: Doc. Ing. Miloslav Pouzar, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Jan Patočka, Ph.D.
The use of ICP-MS in the connection to ETV for analysis of environmental samples
Supervisor: Doc. Ing. Anna Krejčová, Ph.D.
Institute of Environmental and Chemical Engineering

Level 1 Award of the Rector for master's diploma theses defended in 2019

Ing. Blanka Kyralová
Toxigenic Fusarium species in barley
Supervisor: Ing. Iveta Brožková, Ph.D.
Department of Biological and Biochemical Sciences

Level 2 Award of the Rector for master's diploma theses defended in 2019

Mgr. Martina Peřinová
Cultivation of Neural Stem Cells for the Neurogenesis Study
Supervisor: Doc. RNDr. Tomáš Roušar, Ph.D.
Department of Biological and Biochemical Sciences

Ing. Klára Krejčíková
Analysis of fruit spitits
Supervisor: Ing. Tomáš Bajer, Ph.D.
Department of Analytical Chemistry

Mgr. Zuzana Dvořáková
Chromatographic Isolation and Fractionation of Phosphopeptides Using Titanium Dioxide Stationary Phase
Supervisor: Prof. RNDr. Zuzana Bílková, Ph.D.
Department of Biological and Biochemical Sciences

Award of the Dean of the Faculty of Chemical Technology, University of Pardubice for outstanding level and defence of master's diploma theses

Ing. Martin Lelek
Modern technologies for tracking and tracing of products in the supply chain
Supervisor: Ing. Simona Munzarová, Ph.D.
Department of Economy and Management of Chemical and Food Industry

Ing. Adéla Puškáčová
The influence of selected photocatalyzator on heterogenous photocatalysis efficiency
Supervisor: Ing. Jiří Palarčík, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Michal Kurka
Structuring of $As_{50}Se_{50}$ chalcogenide glass thin films by electron beam lithography
Supervisor: Ing. Karel Pálka, Ph.D.
Department of General and Inorganic Chemistry

Devro, s.r.o. Award for the best dissertation in the area of chemistry and biochemistry in 2019

1st place

Ing. Julie Holubová
Voltammetric determination of vitamin D3 at glassy carbon electrode performed in water ethanol mixture
Supervisor: Ing. Radovan Metelka, Ph.D.
Department of Analytical Chemistry

2nd place

Mgr. Vilém Charvát
Possibilities of Lipotoxicity Induction in Primary Culture of Hepatocytes
Supervisor: MUDr. Vladimíra Nováková Mužáková, Ph.D.
Department of Biological and Biochemical Sciences

3rd place

Ing. Zuzana Vaňková
Isolation of bacteria of the genus Arcobacter and their identification
Supervisor: Ing. David Šilha, Ph.D.
Department of Biological and Biochemical Sciences

Synthesia, a.s. CEO Award for the most interesting content of master's diploma thesis defended in 2019 *in the area of organic pigments and technologies, processes, materials and technologies with a significant impact on industrial production*

Ing. Eliška Nečasová
Pyridinium Functionalized Carbonyl Compounds for Redox Flow Batteries
Supervisor: Prof. Ing. Filip Bureš, Ph.D.
Institute of Organic Chemistry and Technology

Ing. Hana Odehnalová
Synthesis of biological active sulfamoylbenzamides with benzothiazole block
Supervisor: Doc. Ing. Vladimír Pejchal, Ph.D.
Institute of Organic Chemistry and Technology

Precheza, a.s. Award for outstanding master's diploma thesis defended in 2019 *in the area of inorganic pigments, their applications and technologies*

Ing. Marie Trpkošová
Properties of protective latex coatings on low carbon steel in relation to the content of polypyrrole particles and chemical composition of pigment
Supervisor: Ing. Jana Machotová, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

Ing. Alena Jaegerová
Spinel pigments of Mg_2SnO_4 type
Supervisor: Doc. Ing. Žaneta Dohnalová, Ph.D.
Department of Inorganic Technology

Award of the Chairman of the Board of JUTA, a.s. for the best master's diploma thesis defended in 2019 in the area of polymeric and textile chemistry

1st place

Ing. Ondřej Ctibor
Influence of textile auxiliary agents on acid dye encapsulation
Supervisor: Ing. Michal Černý, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

2nd place

Ing. Nikola Soukupová
Study of the influence of various composite systems made by hand lay-up lamination on mechanical properties
Supervisor: Ing. Luboš Prokůpek, Dr.
Institute of Chemistry and Technology of Macromolecular Materials

3rd place

Ing. Kateřina Horešovská
Binding of biologically active substances to hyaluronic acid wound dressings
Supervisor: Prof. Ing. Radim Hrdina, CSc.
Institute of Organic Chemistry and Technology

Czech Glass Society Award for the best master's diploma thesis defended in 2019 in the area of glass and amorphous materials

Ing. Jan Hrabovský
Synthesis and properties of undoped and ER^{3+} doped TEO_2-ZnO-BaO glasses for optical applications
Supervisor: Ing. Lukáš Střižík, Ph.D.
Department of General and Inorganic Chemistry

S&K LABEL, spol. s r.o. Award for the best content of master's diploma thesis of the academic year 2018/2019 in the area of graphic arts

Ing. Štěpánka Kosová
Printing and characterisation of conductive paths on 3D shaped objects and on 3D surfaces
Supervisor: Doc. Ing. Tomáš Syrový, Ph.D.
Department of Graphic Arts and Photophysics

Pfizer s.r.o. Award for the best master's diploma thesis defended in 2019 in the area of pharmacochemistry

Ing. Jan Jirmásek
Matrix tablets based on sodium alginate with extended release tramadol hydrochloride
Supervisor: Ing. Martin Bartoš, CSc.
Department of Analytical Chemistry

Mgr. Petra Behančínová
Development of Chitosan Nanomaterials With Ligand for Regenerative Medicine
Supervisor: Mgr. Marcela Slováková, Ph.D.
Department of Biological and Biochemical Sciences

Ing. Lukáš Marek
Synthesis of kinase inhibitors containing 3-[amino(aryl)methylidene]-1,3-dihydro-2H-indol-2-one skeleton
Supervisor: Prof. Ing. Jiří Hanusek, Ph.D.
Institute of Organic Chemistry and Technology

Lanxess s.r.o. Award for the best content of master's diploma thesis of the academic year 2018/2019 in the area of organometallic compounds

Ing. Eliška Matušková
Study of siccativating activity of manganese complex in oxopolymerization-drying paints
Supervisor: Ing. Jan Honzíček, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

Lanxess s.r.o. Award for the best content of master's diploma thesis of the academic year 2018/2019 in the area of polymer chemistry

Ing. Markéta Hašková
Corrosion resistance of zinc of pigmented coating materials relating to the content of replacing sulfid/conductive polymer ingredients
Supervisor: Prof. Ing. Andréa Kalendová, Dr.
Institute of Chemistry and Technology of Macromolecular Materials

Award of the Dean of the Faculty of Chemical Technology, University of Pardubice for outstanding level and defence of bachelor's diploma thesis

Bc. Jana Macháčková
Dissolution study of matrix tablets with indometacin
Supervisor: Ing. Václav Lochař, Ph.D.
Department of Physical Chemistry

Bc. Petr Listík
Modern analytical techniques in analysis of mycotoxins in cereals
Supervisor: Doc. Ing. Lenka Česlová, Ph.D.
Department of Analytical Chemistry

Bc. Michaela Houdková
Evaluation of perlescent coatings using goniospectrophotometric equipment
Supervisor: Ing. Ondrej Panák, Ph.D.
Department of Graphic Arts and Photophysics

Bc. Josef Sedláček
Polymeric insulation materials for building industry
Supervisor: Ing. Miroslav Večeřa, CSc.
Institute of Chemistry and Technology of Macromolecular Materials

Bc. Tereza Rubešová
Determination of selected chemical properties of plant beverages
Supervisor: Ing. Tomáš Hájek, Ph.D.
Department of Analytical Chemistry

Bc. Jan Helán
Synthesis of organoboron cations as new Lewis acids
Supervisor: Doc. Ing. Libor Dostál, Ph.D.
Department of General and Inorganic Chemistry

Bc. Martina Žabenská
OBN chromophores with condensed aromatic motif
Supervisor: Doc. Ing. Petr Šimůnek, Ph.D.
Institute of Organic Chemistry and Technology

Bc. Daniel Kouba
Preparation and characterization of doped TiO_2 photocatalysts
Supervisor: Prof. Ing. Libor Čapek, Ph.D.
Department of Physical Chemistry

Synthesia a.s. CEO Award for outstanding bachelor's diploma thesis defended in 2019

Bc. Kamila Prouzová
Foodstuff colouring change over time
Supervisor: Doc. Ing. Jan Fischer, CSc.
Department of Analytical Chemistry

Bc. Veronika Jandová
Heterocyclic precursors for photoredox catalysts
Supervisor: Prof. Ing. Filip Bureš, Ph.D.
Institute of Organic Chemistry and Technology

Pfizer s.r.o. Award for outstanding bachelor's diploma thesis defended in 2019

Bc. Daniela Nováčková
Dissolution Study Of Matrix Tablets Based on Chitosan And Kollidons
Supervisor: Doc. Ing. Alena Komersová, Ph.D.
Department of Physical Chemistry

Bc. Marcela Chrtková
Synthesis and properties of ionic push-pull imidazole derivatives
Supervisor: Ing. Patrik Pařík, Ph.D.
Institute of Organic Chemistry and Technology

Bc. Miriam Syková
Synthesis of new Pt complexes with $SnCl_3$ ligand
Supervisor: Prof. Ing. Roman Jambor, Ph.D.
Department of General and Inorganic Chemistry

Awarded students other than from FChT in 2019

Ing. Tomáš Halenkovič, Ph.D.
Award of the Minister for education, youth and sports in the area of higher education, science, and research for 2019
Supervisors: Doc. Dr. Virginie Nazabal, Prof. Ing. Petr Němec, Ph.D.
Department of Graphic Arts and Photophysics

Ing. Michaela Chocholoušková
Control of the quality of body fluids based on lipidomic analysis using LC-MS
Travel grant awarded by Jan Marek Marci Spectroscopic Society (SSJMM) and Chromatography and Electrophoresis Expert Group (OSCHE) of the Czech Chemical Society
Supervisor: prof. Ing. Michal Holčapek, Ph.D.
Department of Analytical Chemistry

Ing. Barbora Kamenická
Removal of chlorinated organic acids from contaminated aqueous solutions: Comparison of separation efficiency of drug Diclofenac and anionic dye Mordant Blue 9.
HELAGO-CZ Award for the 3rd place in the competition for the best students' plenary talk at the 66th International Congress of Chemical and Process Engineering CHISA 2019, 21–24 October 2019, Seč.
Supervisor: Doc. Ing. Tomáš Weidlich, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Barbora Kamenická
Application of quaternary ammonium salts for removal of chlorinated azo dyes in adsorption columns.
ACESR Award for the best student paper at the 21st Student Scientific Conference with International Participation — Chemistry and Technology for Life, 6 November 2019, Bratislava, Slovakia.
Supervisor: Doc. Ing. Tomáš Weidlich, Ph.D.
Institute of Environmental and Chemical Engineering

Mgr. Eliška Konopáčová
Coal mine reclamation — The effect of periphyton on productivity and phosphorus cycling in oligotrophic post-mining lakes.
Excellent poster presentation prize sponsored by PROTEOMASS Scientific Society, 3rd International Caparica Conference on Pollutant Toxic Ions and Molecules 2019 (PTIM 2019), 4–7 November 2019, Caparica, Portugal.
Supervisor: Doc. Ing. Miloslav Pouzar, Ph.D.
Institute of Environmental and Chemical Engineering

Bc. Kateřina Krejčová
Study of voltammetric behaviour of fungicide tebuconazole and development of method for its determination.
Award for the 3rd place at the 21st Student Scientific Conference with International Participation — Chemistry and Technology for Life, 6 November 2019, Bratislava, Slovakia.
Supervisor: Doc. Ing. Renáta Šelešovská, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Lucie Michalcová
Biofilms of pathogenic yeasts on hydrogel contact lens
21st Year of Werner von Siemens Award, top 10.
Supervisor: Ing. Miroslav Večeřa, CSc. and RNDr. Olga Heidingsfeld, CSc.
Institute of Chemistry and Technology of Macromolecular Materials and Department of Biological and Biochemical Sciences

Bc. Frederika Mišíková
Determination of selected elemental composition of wines using ICP-OES and ICP-MS method.
Award for the 2nd place at the 21st Student Scientific Conference with International Participation — Chemistry and Technology for Life, 6 November 2019, Bratislava, Slovakia.
Supervisor: Doc. Ing. Anna Krejčová, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Ondřej Peterka
Lipidomic comparison of exosomes and human plasma by mass spectrometry
Best Poster Award at the School of Mass Spectrometry, Špindlerův Mlýn, Czech Republic, 8–13 September 2019
Supervisor: prof. Ing. Michal Holčapek, Ph.D.
Department of Analytical Chemistry

Md. Mostafizur Rahman, MSc.
Effect of Temperature upon Pulp Bed Characteristics and Washing Efficiency.
Award of the Slovak Association of Wood Processors for the 1st place in PhD Section at the 60th International Student Scientific Conference, 6 May 2019, Technical University in Zvolen, Slovakia.
Supervisor: prof. Ing. František Potůček, CSc.
Institute of Chemistry and Technology of Macromolecular Materials

Ing. Barbora Slezáková
Best Poster Presentation Award ICCT 2019, Mikulov, 15–17 April 2019
Supervisor: Doc. Ing. Alena Komersová, Ph.D.
Department of Physical Chemistry

Ing. Lenka Šimková
The hydroxyapatite and its anti-corrosion properties.
Best Poster Award at the 13th International Conference on Preparation of Ceramic Materials, 25–27 June 2019, Košice, Slovakia.
Supervisor: prof. Ing. Petra Šulcová, Ph.D.
Department of Inorganic Technology

2.5 Credit System

The principles of the credit system correspond with the international ECTS system. The use of the credit system for the evaluation of academic achievement at the Faculty is defined by the "Study and Examination Code of the University of Pardubice".

2.6 Lifelong Learning

The licence study **"Rock disintegration by explosion"** is intended for further education and retraining of employees in the area of explosion techniques. Based on decision ČBÚ 3501/II/08 as of 16 January 2009, the learning content and texts of the licence study are approved as preparation courses for blasting technical managers before a qualification exam. This qualification exam can also be taken by licence study participants who meet other conditions for obtaining the blasting technical manager qualification.

The licence study **"Modern technology in graphic arts and printing technology"** is intended for further education and retraining of employees who work in the printing industry, are involved in trading of printing products, or are suppliers of raw materials for the printing industry. The course participants will gain a broad range of knowledge in all areas of printing production and applications of printing techniques, printing materials and state-of-the-art technologies, quality assessment procedures, and the requirements of the applicable ISO standards for printing production.

The licence study **"Fundamentals of the technology of the production of fibres, paper, paperboard and their processing"** is intended for further education and retraining of employees with a university degree who work in the cellulose-paper processing industry, are involved in trading paper products, or are suppliers of raw materials and equipment for the cellulose and paper industry. The purpose of the licence study is to present the basic theoretical principles of the production technology of fibres, paper and paperboard, including ecological aspects and processing aspects.

The licence study **"Theory and technology of explosives"** is intended for further education and retraining of employees in explosives, ammunition, processing and delaboration plants, including employees who use, store or trade explosives and explosion hazardous substances. This study provides the basic information about the protection of various structures from explosion of gases, vapours or flammable dust dispersions (chemical and food-processing plants, power engineering, etc.) The study also includes the issue of testing and special analyses of explosives, lectures on the fundamentals of ballistics and designing of ammunition and weapons.

Lifelong learning courses at FChT in 2019

Name of lifelong study programme	Number of participants	Length of study	Form of study	Number of sessions
Commenced in 2019				
Rock disintegration by explosion - organized by ÚEnM	9	4 semesters	Licence	400
Modern technology in graphic arts and printing technology - organized by KPF	10	2 semesters	Licence	224
Ongoing				
The basic technological principles of the production of fibres, paper, paperboard and their processing - organized by ÚChTML	21	3 semesters	Licence	200
Theory and technology of explosives - organized by ÚEnM	9	4 semesters	Licence	345

2.7 University Textbooks and Monographs Issued at FChT in 2019

An integral part of educational activity is the preparation of study materials — university textbooks and monographs. In 2019, the following university textbooks and monographs were issued at FChT:

University textbooks

1. Komers K., Čegan A.: Physical chemistry for clinical-chemical fields, Vol. 1, 1st ed., 113 copies, 210 pages.
2. Handlíř K., Nádvorník M., Vinklárek J., Vlček M.: Laboratory exercises in general and inorganic chemistry II, 2nd ed., 417 copies, 138 pages.
3. Handlíř K., Nádvorník M., Vlček M.: Calculations and exercises in general and inorganic chemistry I, 3rd ed., 415 copies, 180 pages.
4. Čičmanec P., Hájek M., Drobná H., Frolich K.: Physical chemistry for BS, 2nd ed., 417 copies, 398 pages.
5. Košťálová J.: Corporate information system II, 1st ed., 300 CD-ROM copies, 58 pages.
6. Cakl J., Žáková A., Hemer J.: Chemical-engineering calculations I, 6th ed., 515 copies, 170 pages.
7. Zeman S., Jungová M.: Technology of Explosives - a textbook, 1st ed., 200 copies, 142 pages.
8. Švancara I.: Electrical analysis: selected chapters, 1st ed., on-line, 260 pages.
9. Hel K.: Basic theory of shock and detonation waves (learning text), 2nd ed., online, 300 pages.
10. Kostra J., Zajac V.: Mathematics I, 1st ed., online, 55 pages.

2,377 copies and 1,911 pages of text in total.

Monographs

1. Dohnal M.: Colour perception / Colorimetry, 1st ed., 1000 copies, 288 pages.
2. Branská L., Paták M., Pecinová Z.: Preference of logistic services in supply systems of fast-moving products, 1st ed., 70 copies, 112 pages.
3. Milichovský M.: Paper — Problems with production and use, 1st ed., 136 copies, 240 pages.

1,206 copies and 640 pages of text in total.

3. Research and Development

3.1 Scientific and Research Focus of Departments and Institutes

The scientific and research activity of the Faculty focuses primarily on high-quality basic and applied research in accordance with the Long-term plan of educational, scientific, research, developmental, artistic and other creative activities of the Faculty for 2019.

Research, experimental development and innovations (referred to as "RDI") are based on specific chemical sciences and fields that the Faculty has developed in the long term and in which the Faculty has achieved significant outcomes in a national as well as international context. FChT focuses on RDI in the following fields: FORD 1 Natural Sciences, 2 Engineering and Technology, and 3 Medical and Health Sciences.

The scientific and research activities are performed by work groups established at the Faculty's departments and institutes, which are actively involved in projects supported especially by the Czech Science Foundation, Technology Agency of the Czech Republic, or departmental support providers. An important aspect in the development of scientific and research activities of the Faculty are the resources acquired as a result of collaboration with industrial entities and as a result of international cooperation. This is also related to the extensive publication activity including papers in scientific impacted periodicals, monographs, patents, etc. In terms of finance, the amount of creative activity focusing on science, research, and innovations represented a significant part of FChT's budget in 2019.

Dominant focus of FChT in basic and applied research:

- Inorganic pigments for ceramics and paints,
- Analyses and separations of bio-analytical and food compounds,
- Analyses of diagnostically relevant substances for the study of metabolism and oxidative stress in patients with various types of diseases,
- Biologically active compounds for human and veterinary medicine applications,
- Detection of microorganisms by culturing and molecular biological methods,
- Electrochemistry, interphase chemistry and methods of preparation and subsequent element analysis of samples with a focus on the development and application of separation, analytical, detection and diagnostic techniques, instrumentation and sensors in the area of human protection, environmental protection and material analysis,
- Energetic materials for applications in the automotive, aerospace, mining, construction and defence sectors,
- Photonics, optics and optoelectronics,
- Environmental processes (e.g. technologies in pre-treatment and treatment of process, waste and municipal water),
- Chemical processes with high added value; this particularly applies to the research of new and highly selective adsorbents, catalysts (homogeneous and heterogeneous catalysis) and photocatalysts,
- Identification/detection of biomarkers in patients with neurodegenerative and neoplastic diseases, including early detection of cancer,
- Volume glass and amorphous thin layers,
- Organic dyes for colouring and printing,
- Organic materials for optoelectronics,
- Organic pigments for the automotive industry and construction,
- Organic coatings and paints,
- Organometallic and coordination compounds with subsequent applications in catalytic processes as precursors of advanced materials or compounds with biological effects,
- Advanced low-dimensional nanomaterials (nanoparticles, nanotubes, nanofibres, nanofilms) using modern synthesis methods including applications (e.g. batteries, catalysts, water degradation, solar cells, etc.),
- Nanobiomedical technologies,

- Semiconductors and materials for thermoelectric applications,
- Polymeric materials, fibres, composites and organic coatings,
- Material printing,
- Membrane separation processes,
- Safety engineering methods and risk analyses in the chemical industry,
- Glass producing materials (amorphous/crystalline form, bulk materials/thin layers), advanced viscous and kinetic phenomena and physical-chemical processes associated with the use of these materials,
- Determination of the sensitivity of different cell types to genotoxic agents;
- Fibres based on new polysaccharides with biological properties.

Below is an overview of the scientific and research focus of the departments and institutes of the Faculty and their basic activities in 2019.

Department of Analytical Chemistry (KAlCh)

The scientific and research activities of the Department of Analytical Chemistry focus on both basic and applied research. The Department focuses on analyses of organic and inorganic compounds using modern approaches. Special-purpose instrumentation allows the application of analytical procedures suitable for materials of different origin (biological and vegetable matrices, samples of food, water, soil air, etc.), not only in terms of the content of usual components but also in terms of trace analysis or toxicological analysis.

The group of separation methods in the liquid phase focused on the development of liquid chromatography methods for the separation of natural antioxidants and porphyrin dyes — the testing examined the effects of the composition of solvents used in the preparation of samples on separation efficiency and selectivity in hydrophilic interaction chromatography and in the reverse-phase system. In the two-dimensional arrangement, a combination of two reverse-phase systems was used — octadecyl silica gel phase in the first dimension and biphenyl phase in the second dimension for the separation of porphyrin dyes. Focus was also on the three-loop arrangement for fraction transfer and the procedures of electromigration zone focusing were developed for the application in the mode of two-dimensional liquid chromatography using sufobetaine monolithic columns in the first dimension and silica gel monoliths in the second dimension. For the purposes of electromigration focusing optimization, procedures were developed to perform concentration from large volumes and the effects of the presence of acetonitrile on focusing efficiency were characterized. A method was developed for the derivatization of amino acid-based surfactants (glutamic acid, glycine, threonine) after their conversion to p-bromphenacylesters of acids that provide appropriate separation selectivity in the reverse-phase system for surfactants containing different hydrocarbon residues of fatty acid. For derivatization reactions, the effects of reaction temperature and reaction time on the yield of p-bromphenacylesters were tested. The separation and identification of the derivatives of oxyethylenated glycerol with coconut oil were tested. Based on a comparison of the separation process in the reverse-phase system and in the hydrophilic interaction chromatography (both in conjunction with mass-spectrometric detection), a method was developed to characterize this type of non-ionic surfactant.

In the area of application outcomes, attention was on the analysis of natural antioxidants in different types of matrices. HPLC/MS conditions were optimized for monitoring the content of biologically active substances in nasturtium depending on sample processing. In addition, the content of phenolic substances in buckwheat during germination was monitored using an optimized HPLC/MS/MS method. In cooperation with Synthesia, a.s. a study was carried out to evaluate the effect of the application of different types of rosin in the finalization of pigment production. Using the HPLC method, the type of rosin was identified, which had been impossible before using traditional methods. Attention was also on the analysis of the trace amount of oestrogens in water.

The mass spectrometry group continued to search for biomarkers in selected types of cancer, particularly cancer of the pancreas, kidney, breast, and prostate. The Department continued the development of new methods for the analysis of biological samples using UHPLC/MS and UHPSFC/MS,

and the application of these methods for analysing the sample of patients with these types of cancer and healthy participants. The data obtained were statistically analysed and used for the development of models that will with a high degree of reliability distinguish patients from healthy participants. Further efforts will include works on transferring these methods from the academic laboratory to clinical use. A methodology is being developed to test the quality of samples from clinical departments based on the measurement of the concentration of sphingosine-1-phosphate, which significantly increases in the case of incorrect sample processing. In order to protect the methodology, European patent applications have been submitted. This approach for early cancer diagnosis is brand new in the world and has higher selectivity and specificity compared with all previously known screening procedures for high-capacity screening carried out on samples of body fluids. The group also works on automated sample processing using a robotic device for automated lipidomical liquid to liquid extraction with subsequent automated lipidomic quantification using the shotgun approach.

The group of extraction methods continued their research focused on a comparison between dry-hop beers and traditional beers. Focus was also on the optimization and practical verification of the HS-SPME method in conjunction with GC-FID and GC-MS for the isolation and analysis of volatile components and the solvent assisted SBSE method with subsequent HPLC-DAD analysis of bitter substances in beer. Both methods can be used to distinguish between traditional beers and dry-hop beers. The group continued the study of volatile compounds emitted from wood in order to distinguish between larch wood from European localities and from Siberia. The study also focused on volatile substances released from Chinese herbs and betel nut and volatile substances released from different types of spirits using SPME-GC-FID/MS. Based on statistical data processing, different types of spirit were distinguished by type of fruit.

In the field of chemistry and food analysis, cooperation was established with the University of Agriculture in Krakow to test the sorption and thermodynamic properties of carob powder and the effect of the sorption properties on the rheology of modified starch.

The group of atomic spectrometry developed and validated a simple, fast and environmentally friendly method for the determination of lead in bones by means of atomic absorption spectrometry with electrothermal atomization, continuum source of radiation, and high resolution (HR-CS-ETAAS). Using the tools of fractional factor planning the group optimized the method of analysing real samples by direct suspension dosing. Mathematical correction was designed and applied to correct spectral interference caused by absorption of structured PO molecule bands resulting from thermal sample degradation.

The electroanalytical group continued their systematic development and application of sensors based on carbon electrode materials, where the traditional carbon paste electrodes (CPE) in conjunction with a voltammetric approach proved to be efficient in monitoring the residues of the Diclofenac drug during its targeted removal from natural waters by special ion-exchanger sorbents (in cooperation with the Institute of Environmental and Chemical Engineering, FChT). Chemically modified CPE or related carbon printed electrodes were used to determine certain alkaloids (e.g. berbine, thebromine and theophylline), stimulants (taurine and caffeine), or lipophilic vitamins (pyridoxine) in relevant real samples. In these cases, analyses were also performed in the flow-through arrangement with amperometric detection. Potentiometric titrations with ion-selective electrodes were used to study new types of non-ion surfactants.

In collaboration with Masaryk University and the University of Amsterdam, titanium multi-channel separation chips were 3D printed. After integration of miniaturized electrochemical detectors, this device was successfully used for simultaneous separation and detection of dopamine and related substances in urine samples. Together with partners from the University of Łódź, the interactions of the profluralin herbicide with double-chain DNA were examined. To determine this contaminant in water and soil, a sensitive electrochemical method using a renewable silver amalgam electrode was developed. In the area of sensors, various configurations of enzyme biosensors were prepared and tested for electrochemical detection of some biogenic amines (putrescine, cadaverine, spermine and spermidine).

In the area of isotachophoretic analysis, methods were developed to determine selected antidiabetics and taurine, and works were commenced on the determination of Valproate antiepileptic and certain antidepressants. A pharmacokinetic research study was performed on hydrophilic matrix tablets containing Verapamil hydrochloride.

The chemometric group studied the protonation balances together with analytical and physical-chemical constants of selected cytostatics Nilotinib and Valsartan by regression analysis of spectra and potentiometric titration data (commissioned by Zentiva Group, a.s.) Moreover, the analytical and biochemical data were subjected to a multi-dimensional statistical analysis, which revealed the effect of 20 fatty acids in erythrocyte membranes on the extent of inflammatory response and oxidative stress of cells in patients suffering from ischaemic heart disease and undergoing percutaneous coronary intervention with coronary stent implantation. A systemic inflammatory response was indicated by an increase in C-reactive protein, serum amyloid A and ceruloplasmin after stent implantation and an increase in interleukin-6 24 hours after the intervention.

Department of General and Inorganic Chemistry (KOAnCh)

The scientific and research activity of the Department focuses on the chemistry of organometallic and coordination compounds, non-crystalline oxidic and chalcogenide glasses, thin layers and nanomaterials, and thermoelectric materials.

The organometallic and coordination compounds group studied the compounds of metals from almost the whole periodic table with a special focus on chelating, bulky, or other modern ligands in order to understand their structure, bond properties, and applications as molecular precursors of new materials, transformation catalysts in organic chemistry, and markers or therapeutic substances in medicine. The group studied the reactivity of borane, thiaborane, and carborane compounds with *N*-heterocyclic carbenes. In this class of compounds the group discovered a possibility for the development of new porous materials (borane-organic-frameworks) constituted using weak dispersion interactions — σ holes. These compounds are capable of selective adsorption of a significant amount of CO_2. As part of the ongoing study of coordination compounds, the group synthesised compounds with multidental ligands with *N*-donors such as amidinates and guanidinates. For aurous compounds containing hybrid *N*-heterocyclic carbene, for the first time the hydrogen bond to the metal atom was described specifically as N-H…Au. The most voluminous anilines were synthesized. In the area of applied research, the group studied the preparation and use of lactyl lactates as surfactants, cosmetic ingredients, and the synthesis of polyglycerines or pigments for security printing. The research also focused on the reactivity of unconventional monomers of organogermanium hydrides coordinated on $ZnCl_2$ substrate. This compound was a very active catalyst in ring-opening polymerization reactions (ROP). The activity of this catalytic converter outmatched the commercially available catalyst by several orders. Focus was also on the study of the chemistry of bidental P,Sn(II) ligands. The portfolio of compounds was extended by Y,E-chelating ligands (Y = P, B; E = Ge, Sn, Pb). This series was used to examine the effect of the substituents on the redox potential of the central atom E using CV. These measurements showed that one of the prepared compounds was a very strong reducing agent, which was subsequently used in redox reactions with Ru(III) complexes with selective reduction to Ru(II). The prepared P,Sn-chelated Ru complexes were further studied as potential catalysts in aerobic oxidation of alcohol and amine. Focus was also on reversible activation of C=C bonds using low-valency compounds of group 15 in the periodic table, where the dependence on the pentel and ligand system applied was clearly demonstrated. The group also studied the possibility of oxidative addition of the bonds between C-X (X=polar group, e.g. I or OTf) and organobismuth compounds. This type of reaction is virtually absent in literature. Last but not least, a series of *N,N*-chelated tetrylene derivatives of 2,2'-dipyridylamide skeleton was synthesized. Ferrocene derivatives of diazarsol and diazaphosphol were prepared and their ability to coordinate transition metals investigated. The group synthesized new *N*-acyl and *N*-sulphonyl hydrazons of acetylferrocene and 1,1'-diacetylferrocene as precursors of heterocyclic compound containing heavier group 15 elements. Focus was also on the study of benzo(f)indenyl molybdene complexes of the [(η^5-Ind')(η^3-allyl)$Mo(CO)_2$] type, where Ind' is the derivative of benzo(f)indenyl carrying a rigid chinolyl substituent in position 1. Experimental methods and quantum-chemical calculations were applied to describe the stabilization of these compounds using $\eta^5 \leftrightarrow \eta^3$ haptotropic shift. The key outcome is that the rotation of the indenyl ligand

has a major impact on the activation energy of the haptotropic shift. A strong irreversible intramolecular interaction may block the hemilability of indenyl by preventing rotation, which appears to be a general phenomenon that should be taken into account in designing potential Ind ligand-based catalysts.

In the area of oxidic non-crystalline materials, barium phosphate glasses modified by tungsten trioxide were prepared and the changes in the structure of selected physical and chemical properties with an increasing content of tungsten trioxide were studied. Focus was also on the process of crystallization of glass-producing melts of these glasses and on the identification of crystalline products. The structure of all prepared materials was studied using Raman spectroscopy and MAS NMR ^{31}P core spectroscopy. The study showed a positive effect of the addition of WO_3 to these glasses, resulting in increased temperature of glass transformation and higher chemical resistance. Glass making capability was observed in the ternary system $BaO\text{-}P_2O_5\text{-}WO_3$ and five compositional rows were studied to detect content-based structural changes. According to the results, in most glasses tungsten trioxide makes WO_6 octahedrons and in glasses with high WO_3 content these octaedrons make clusters by means of the W-O-W bonds. In glasses with a small content of P_2O_5 a change in tungsten coordination from WO_6 to WO_4 takes place near the $BaO\text{-}WO_3$ link. Cooperation with the Ruđer Bošković Institute in Zagreb continued on materials with ion-polaron conductivity on glasses of the binary $P_2O_5\text{-}MoO_3$ and $P_2O_5\text{-}WO_3$ systems. The group continued to study the effect of transition metals on some physical characteristics and especially the structure of phosphate glasses. For the description of the structure a chemical model proposed and published in the previous year was used. The model is based on ^{31}P MAS and static NMR with additional structural information from vibration spectroscopy and x-ray diffraction. The study of glass structure of the $xMoO_3\text{-}50ZnO\text{-}(50\text{-}x)P_2O_5$ and $Na_2O\text{-}ZnO\text{-}TiO_2\text{-}P_2O_5$ systems was completed. A new study was commenced on phosphate glasses based on copper(II) phosphate and the effect of zinc and calcium on the properties of these glasses. Their physical and chemical characteristics were determined together with the basic information about the structure of the glass phosphate network using ^{31}P MAS NMR, Raman variation and EPR. The group continued the study of melt decay to non-miscible solutions with different copper, zinc or calcium content. In addition, the data obtained by the study of water solubility and by means of optical microscopy were used to perform a detailed computer analysis of EPR spectra. The group continued to cooperate with Alexander Dubček University in Trenčín, Slovakia on the study of phosphate glasses in order to understand and model various procedures monitored by means of dielectric spectroscopy. Works also continued on thermodynamic modelling of the chemical composition of phosphate glasses using the proposed chemical model. Cooperation was developed with Laboratoire de Spectrochimie Infrarouge et Raman, Université de Lille 1 in the area of 1 and 2D NMR spectroscopy. The study of the glasses of the $PbO\text{-}ZnO\text{-}TeO_2$ system showed that the basic structural change associated with the substitution of ZnO by lead monoxide is the transformation of the trigonal bipyramids (tbp TeO_4) to tetragonal pyramids ($tpTeO_{3+1}$ to TeO_3). This process is associated with an increase in the concentration of non-bonding oxygen atoms and a decrease in the optical width of the forbidden band and in the softening temperature.

In the area of chalcogenide glass, a physical correlation was observed between photoinduced changes in the direction of Urbach edge and optical width of the forbidden band and the direction of "Tauc edge". The kinetics of these changes can be described by a single "Master curve" in the form of a power function. Focus was on the study of the effect of the chemical composition of the host matrix on upconversion dynamics in Er^{3+} doped glasses of the $GeS_2\text{-}Ga_2S_3$ and $GeS_2\text{-}Ga_2S_3\text{-}As_2S_3$ systems using quadrature frequency resolved spectroscopy (QFRS), photoluminescent and absorption spectroscopy combined with the calculations of oscillator force $4f \leftrightarrow 4f$ of electron transitions in Er^{3+} ions. The study revealed a negative effect of reabsorption of excitation and emission radiation by the host matrix on the intensity of upconversion emission and of the determination of the energy transfer experimental parameter. In addition, the effect of the chemical nature of the input dopant (elementary Er+S or $ErCl_3$) on the resulting luminescence properties in glass $(GeS_2)_{90}(Ga_2S_3)_{10}$ was confirmed. The new methodology allows the determination of the energy transfer parameter and evaluation of the contribution of reabsorption processes by the host matrix, which are the key aspects in the construction of functional devices in photonics. Thin layers of chalcogenides containing Ga and lanthanide ions were prepared using baseline non-doped chalcogenide glass and lanthanide chelates dissolved in hydrazine monohydrate. These solutions were used to prepare Er^{3+} and Er^{3+}/Yb^{3+} doped thin layers of Ge-Ga-Sb-S by means of spin coating, which were thoroughly characterized and where

photoluminescent Er^{3+} emission was observed at wavelength $\lambda \approx 1.5$ μm. After optimization, these materials may be used in printed optoelectronics and photonics. The photoluminescent emission spectra of these materials were measured using the newly acquired modular photoluminescent spectrometer FLS1000-SSS-sm (Edinburgh Instruments Ltd.)

In collaboration with Harbin Engineering University (Harbin, China), the group studied broad-spectrum photoluminescent emission in the central infrared region caused by Cr^{2+} ions in glass-ceramic $Ge_{15}As_{20}S_{65}$-$Zn_{50}Se_{50}$. Moreover, focus was on the study of the distribution of Tm^{3+} and Ni^{2+} ions in glass and glass-ceramic host material $(GeS_2)_{80}(Ga_2S_3)_{20}$ with an emphasis of photoluminescent properties.

The combustion method was used to prepare and characterize by Tb^{3+}/Yb^{3+} doped nano-crystalline Gd_2O_3, where relatively rare cooperative upconversion photoluminescence was observed. The exposure of Tb^{3+}/Yb^{3+} doped Gd_2O_3 in sulphur vapours led to the formation of phase-clean nano-crystalline Gd_2O_2S, where a higher absorption scatter cross-section of Yb^{3+} was observed: ${}^2F_{7/2} \rightarrow {}^2F_{5/2}$ including higher-intensity cooperative upconversion emission. The group studied the effect of the composition and structure of glass on thin layers prepared by the solution method doped by semiconducting nanoparticles.

In the study of thin chalcogenide glass layers focus was also on the possibilities of their structuring, particularly by using electron lithography with subsequent wet etching in alkaline bath. The results were used for the preparation of micro- and nano-structures in thin layers of the As-Se system. Focus was also on the study of photoassisted etching in the process of structuring thin layers prepared by vacuum steaming and spin-coating.

The study of thermoelectric materials focused on the potential use of chalcopyrite $CuFeS_2$ as an available, cheap, and environmentally friendly material with n-type conductivity. In this context, focus was on the study of non-stoichiometry in the cationic and anionic sub-lattice and on the optimization of the so-called "Power Factor" by means of appropriate doping that would improve its thermoelectric properties. In cooperation with the Institute of Physics of the Czech Academy of Sciences low-temperature characterization of the samples mentioned above was performed (2 to 300 K) including magnetic measurements and Mössbauer spectroscopy. The group also started to prepare and characterize selenium and tellurium copper-chromium spinels as a suitable p-type thermoelectric material for the samples above based on chalcopyrite. The preparation of the $CuCr_2Se_4$ compound was performed by means of mechanosynthesis in a spherical mill in cooperation with the Institute of Geotechnics of the Slovak Academy of Sciences in Košice. In the research of "traditional" low-temperature thermoelectric materials, the characterization of Bi_2Se_3 monocrystals with addition of group 6 metals (specifically tungsten) was completed. Similarly to Cr or Mo, tungsten decreases the concentration of natural defects at very low concentrations in the Bi_2Se_3 crystalline structure. However, unlike chromium or molybdenum doping, the increase in the movement ability of free charge carriers is not so significant and therefore the addition of W does not appear suitable for TE applications of Bi_2Se_3.

Institute of Organic Chemistry and Technology (ÚOChT)

The research and development activities of the employees and students of the Institute focused on the study of organic reaction mechanisms, new catalysts, biologically active compounds, compounds with defined electronic properties, and new technologies of organic intermediates and dyes.

In an original way, a series of new substituted oxindoles containing primary, secondary, and tertiary amino groups was synthesised in order to further explore their physical, chemical, and biological properties. Selected nitrogen and oxygen heterocycles containing boron atoms were prepared and subjected to spectroscopic characterization in view of their luminescent properties. Palladium catalysts were prepared and characterized. The catalysts were successfully applied for Suzuki cross-coupling reactions in an aquatic environment. Regioselective C-H functionalization reaction of pyridine and aniline derivatives was studied. Enantioselective catalysts based on imidazole were proposed, prepared, and applied in new synthesis strategies of enantiomer-pure selected drugs such as

Clavaminol A, Xestoaminol and Rivaroxaban. Recyclable catalysts for Sharpless allylic alcohol epoxidation were prepared and characterized. Monolithic columns were prepared for asymmetric nitroaldolization reactions as catalytic flow reactors.

In addition, compounds were prepared for applications in the area of non-linear optics, emission materials, organic electrolytes, heterocyclic monomers, photoredox catalysis, and organometallic precursors for layer deposition. A systematic study of heterocyclic push-pull derivatives based on selected heterocycles was performed. Triazine derivatives were studied, especially as acceptor units of push-pull chromophores and as part of polymers. Derivatives of thiophene, tetrathienothiophene and bicyclic thienothiophen derivatives were used for the preparation of new electron donors. In the area of photoredox catalysis, the synthesis providing an original catalyst derived from pyrazine-1,3-dicarbonitrile was optimized. Focus was also on structural variations of pyrazine and imidazole catalysts. The team developed a simple synthesis of volatile organic derivatives of selenium, which appeared to be suitable precursors for atomic depositions of selenium layers.

In the field of pharmaceutical speciality technology, a number of optically pure substances based on Corey alcohol were synthesised serving as intermediates of prostaglandin analogues and other natural compounds or drugs. New amides of salicylic acid and their derivatives were synthesized and characterized. Focus was on their antiproliferative activity and their ability to inhibit the proteasome activity of neoplastic cells. New biologically active derivatives based on 6-fluoro-1,3-benzothiazolyl alkylamines were synthesized and characterized, including the determination and evaluation of their biological activities. New photochromic dyes were synthesized and characterized and their photophysical characteristics and application possibilities were studied. As far as the development of new organic pigments is concerned, laboratory procedures were transformed into technological production practice.

Department of Physical Chemistry (KFCh)

In 2019, research on advanced porous materials and fundamental adsorption studies focused on the interactions of hydrocarbons (propane, propene) with cation centres of high-silicate FER-type zeolites. It was demonstrated that the presence of bridge complexes in the so-called dual cationic centres significantly increased separation selectivity of these two hydrocarbons. It was also demonstrated that the population of these centres is significant only in the case of the potassium form of FER zeolite. As part of the study of the adsorption properties of pure silicate forms of the hardly preparable ADOR zeolites, the extremely high adsorption enthalpy of carbon dioxide was experimentally observed as this material is a potential adsorbent in the process of removing CO_2 from waste gases. In addition to zeolitic materials, in 2019 focus was also on the study of graphene-based thiosemicarbazide-modified nanomaterials, which showed high efficiency in removing lead cations from waste water. The study of the structure and adsorption properties of zirconium-based porous coordination polymers (MOFs) continued.

In 2019, part of the group's research activity focused on the study of the kinetics of H/D isotopic exchange between deuterated zeolitic material and ethane at temperatures around 400°C monitored by means of time-differentiated IR spectroscopy. Significant industrial zeolitic materials (MFI, FAU, FER, MWW) were systematically studied. Significant differences in the H/D exchange rate of different types of zeolitic materials were observed, which suggests that the primary activation of the C-H bonds in the hydrocarbon molecule is sensitive to the acidity of the active centre. This experimental finding is now studied in detail and in cooperation with theoretical chemists focus is on the relationship with the transition state energy and the basic characteristics of Brønsted acid centres (deprotonation energy, length of O-H bond, angle between Si-(O-H)-Al, etc.)

In the area of heterogeneously catalysed oxidation reactions, attention was on streamlining the preparation of catalysts based on cobalt-modified BEA zeolites. An impregnation technique was designed that introduces $[Co(NH_3)_6]^{2+}$ cations into the zeolite carrier, which resulted in a synthesis of a highly active and selective catalyst for ethane amoxidation to acetonitrile. This active catalyst was characterized in great detail including the description of the processes that take place in the material during the preparation stage and the identification of the cobalt complex responsible for the high

activity and selectivity. Furthermore, Fenton oxidation of nicotine in waste water was investigated using magnetite nanoparticles prepared by using polyvinylpyrrolidone. By systematic study of the effects of the conditions of preparation, pH of the solutions, concentration of hydrogen peroxide, and the temperature of nicotine oxidation, optimal conditions were determined for fast and efficient degradation of nicotine from waste water using these nanoparticles.

Research in the area of basic heterogeneous catalysis focused on layered double hydroxides (LDH) of different composition (Ca^{2+}, Mg^{2+}, Zn^{2+} and Al^{3+}, Fe^{3+}), mixed oxides formed by LDH heat treatment, and the so-called "reconstructed" LDH and their use in aldol condensation of furfural and transesterification of vegetable oil. Attention was on (a) acid-base properties of the materials studied and (b) analysis of the relationship between their structure/composition/basicity and activity/selectivity of the reactions. The research was conducted in cooperation with the Unipetrol research and educational centre in Litvínov (transesterification of vegetable oil) and Technopark in Kralupy of the University of Chemical Technology (aldol condensation of furfural).

In the area of glass forming systems, the group continued the study of kinetic processes in amorphous chalcogenide materials of different forms (volume samples, thin layers). The research focused on the study of physical properties (viscosity, heat capacity, etc.) and their association with kinetic processes (structural relaxation, formation and growth of crystals) in the amorphous materials. Viscosity and its temperature dependence were studied in glass, supercooled melt and melt of the respective chalcogenide systems. The knowledge and description of viscosity behaviour in a wide range of temperatures (from the temperature of glass transformation to the melting temperature) was then used to describe the structural relaxation and the formation and growth of crystals in the systems studied. Structural relaxation and its correlation with the structure and composition of the prepared chalcogenide glasses was studied using experimental data obtained by combining thermoanalytical methods (DSC, TMA) and infrared spectroscopy. The kinetics of nucleation and growth of crystals in chalcogenide glass forming materials was studied using a wide range of experimental techniques using both direct observation of the formation and growth of crystals (optical and electron microscopy) and indirect observation of the changes in physical properties (DSC, TMA, electrical measurements). By combining the direct and indirect approach it was possible to obtain detailed information about the formation and growth of crystals in the materials studied; this information is applicable in further modelling of the crystallization process in a broad temperature range. Long-term attention is on the study of nucleation and growth and their correlation with viscosity in a number of chalcogenide systems. The deviations from the Stokes-Einstein relation between viscosity and diffusivity can be used to modify the nucleation-growth models for a more accurate description and prediction of the formation and growth of crystals. This can also be achieved by studying the so-called self-diffusion of structural units in glass-forming materials, which was commenced in 2019. The determination and comparison of viscosity flow with the self-diffusion process, especially in thin layers of chalcogenide materials, appears to be vital information to clarify the deviations from standard nucleation-growth models in the surface of volume samples and thin layers of the materials studied.

In 2019, the research on solid pharmaceuticals primarily focused on the preparation and development of mixed fibres for 3D printing of matrix tablets. Research also continued in the area of dissolution kinetics of lipophilic matrix tablets. In the area of fibre development, focus was on the optimization of the extrusion process and setting of suitable parameters of 3D printers for the preparation of matrix tablets. Both synthetic (Kollidon) and natural (chitosan, alginate) fibres were used in the process of fibre preparation. The new fibres were characterized by EDX, SEM and FTIR, and fibre disintegration was studied in various media that simulate the GIT environment. The method of 3D printing of polyvinyl alcohol-based tablets was developed. Tablets containing tramadol hydrochloride were prepared by combining 3D printing and pressing. A dissolution test was performed on these tablets. In the area of lipophilic matrix tablets the group focused on the study of the kinetic and thermodynamic aspects of the release of the active substance and the degradation of these tablets using various active substances (tramadol hydrochloride, pentoxifylline, indomethacin).

In the area of photocatalysis, attention was on lanthanides and/or nitrogen doped TiO_2 photocatalysts, where these materials were studied in the photocatalytic decomposition of the methanol-water

solution. Attention was on the description of the effect of optical and electron properties of these materials on the achieved value of hydrogen production.

The group continued research on the preparation of esters in homogeneous basic catalysis (KOH), where attention was on the use of butanol (i) as a reaction component in transesterification and (ii) as a solvent. The advantage of using butanol is that it also dissolves methanol and oil and produces a single phase, and at the same time works as a reaction component. Focus was also on a detailed description of the course of transesterification by monitoring different quantities including absorbance, pH, conductivity, and viscosity.

Institute of Environmental and Chemical Engineering (ÚEnviChI)

In the area of membrane processes, the activity of the Institute focused on acquiring further experimental and theoretical knowledge in order to extend their application potential. In this context, the use of pressure membrane processes focused on the disposal of contaminated waste water and treatment of technological water including drinking water. The main activity in the area of nanofiltration was the study of the effect of significant parameters on the separation of heavy metals and selected drugs, such as the concentration of a heavy metal (drug) in a solution, pressure difference above and below the membrane, ion strength of the solution, membrane type, etc. on the selected characteristics of this pressure membrane process (intensity of permeate flow and system component rejection).

The method of separation of selected organic substances from water-based solutions using reverse osmosis was tested. In the experiments, a total of three RO membranes were used; the measurements were performed in a recirculation arrangement with a constant retentate flow. Based on the results of the RO experiments, the effect of physical-chemical factors (viscosity, molar mass, substance-membrane interaction) on the course of separation of binary alcohol-water mixtures was assessed.

Experimental data on the neutralization dialysis of oxalic acid using the Neosepta-AHA anion exchange membrane were processed. The results helped clarify mass transport in the system.

In cooperation with MEGA, a.s. and Membrain, s.r.o. the following project funded by the Ministry of Trade was commenced: FV 40062 *"Zero liquid discharge of industrial waste water using electrodialysis"*. A diploma thesis was elaborated on the study of the maximum concentration of saline solutions and further experiments were conducted to determine membrane selectivity.

The analytical method of high-performance liquid chromatography was developed, optimized and validated for the determination of the model caffeine substance and penetration of this substance through skin or membrane under different test conditions was observed. Static vertical diffusion chambers according to Franz (Copley Scientific, UK and custom made, CR), skin preparations (pig and human skin), and their substitutes (Strat-M membranes) were compared.

The rheology group focused on the measurement of rheological properties of new samples of commercial as well as developmental polyurethane adhesives used in the automotive industry and their components with respect to the effect of temperature (temperature interval 25 to 80 °C), and mechanical properties during the process of hardening in cooperation with SYNPO, a.s. The measurements focused on the course of flow and viscosity curves, possible thixotropy of samples, viscoelastic behaviour, or adhesive power using tack tests. The results of the tests were used for the description of the rheological behaviour of the tested substances.

The group focused on the environmental aspects of chemical technologies and addressed the issue of removing industrially significant chlorinated and fluorinated aromatic compounds (pharmaceuticals, herbicides, azo dyes and azo pigment production by-products) from model and/or real technological and waste water using the best available techniques such as sorption, ion exchange, and coagulation and flocculation. In cooperation with VÚOS, a.s. and Synthesia, a.s., the group performed applied research and experimental development funded by the Technology Agency of the Czech Republic

under the Epsilon project: "*Effective removal of aromatic halogenated derivatives (AOX) from local industrial sources"* and Zeta project *"Removal of polyfluorinated acids from contaminated materials using chemical degradation"*. The removal of halogenated derivatives from water was tested using the application of ion liquids on a suitable carrier, for example on saturated adsorption charge of activated carbon in adsorption columns in order to increase the sorption capacity of the column without replacing the charge according to a modified patent of the University of Pardubice (Weidlich T.: CZ307282 (B6)); the procedure was finalized by means of a verified technology. The procedure allows the concentration of halogenated organic acids and regeneration of the sorption charge using suitable surfactants. The developed ion exchange technology using ionic liquids applied to a saturated sorbent carrier for AOX capture and subsequent regeneration of used ionic liquids by reductive dehalogenation was submitted to the Industrial Property Office as a patent application. By means of licence, the know-how patented by the University of Pardubice was used (Weidlich T.: CZ 305586 (PV 2014-367)). In the framework of further cooperation with industrial enterprises, contract research was performed with ASIO, s.r.o. and Geotest, a.s. The research focused on the issue of decreasing the emissions of organic halogenated derivatives in waste water using the destruction of organic halogenated derivatives by chemical reduction. Contract research with Bochemie, a.s. focused on the issue of technological water treatment with the aim of reducing phosphorus content while allowing the use of separated phosphorus salt for the production of fertilizers. As part of contract research with PLEAS, a.s., in collaboration with Geotest, a.s. semi-operational recycling of dye baths was successfully verified

In cooperation with VÚOS, a.s. and K2pharm, s.r.o., the group performed applied research and experimental development funded by the Technology Agency of the Czech Republic under the Epsilon project: "*Supplements for the positive effects on the human microbiome"* which was completed in December 2019 by awarding utility model CZ 33526 U1. The purpose of the utility model is the formulation of a food supplement in the form of two-part hard capsules with higher antimicrobial efficiency and monolaurin bioavailability as a result of their self-emulsifying capacity.

In the field of ecotoxicology and environmental chemistry, the group performed ecotoxicological testing of glyphosate and Roundup herbicide using tests applicable in the European Union, specifically the daphnia acute immobilization test, green and blue-green algal growth inhibition test, and activated sludge respiration inhibition test. Based on the results of these tests, the ecotoxicological values were determined and the substances tested for environmental hazards.

Cooperation continued with the Institute of Electronics and Photonics FEI STU Bratislava in order to test and use new electrode materials, especially BDD electrodes. In this context, a higher-life BDD flow cell was developed and will be tested on model and real waste water. This was the third year of operation of a house waste water treatment unit, for which an electrochemical final cleaning module was prepared. Cooperation was established by means of contract research with Glanzstoff Bohemia, s.r.o. in the area of zinc separation and regeneration in waste and industrial water using electrodeposition. This cooperation continues and focuses on increasing the effectiveness of using new cathode materials based on Pt, Au or Pd plated titanium. Focus is also on the application of these electrodes in suppressing AOX produced during electro-oxidation of organic compounds in the chloride ion environment.

Together with the Forest and Game Management Research Institute and TERAMED, s.r.o., the following project continued under the 2nd public competition of the Epsilon scheme announced by the Technology Agency of the Czech Republic: TH02030823 *"Development of methodological-technical procedures minimizing the impacts of forest management on the quality of groundwater as a result of the migration of excess reactive nitrogen and phosphorus."* The activity focused on continued monitoring of rainwater, subsurface water, groundwater, and forest soils of Městské lesy Hradec Králové in Běleč nad Orlicí.

Under the Epsilon scheme of the Technology Agency of the Czech Republic the group cooperated with TERAMED, s.r.o. and the Potato Research Institute Havlíčkův Brod on the following project: *"Biocomposite component for slow release of active minerals in soil for plant nutrition"*.

As a result of the completed TACR project No. TA04020258 *"Advanced technology of lithotrophic immobilization and anaerobic bioremediation for the remediation and prevention of environmental damage"* the Industrial Property Office of the Slovak Republic awarded patent No. 288738 "Device for capture of metal ions from waste water by biological immobilization, water treatment by biological immobilization using this device and its use".

For Ecocoal s.r.o. Ostrava the group implemented the so-called Innovative Voucher (OP EIC) *"Development of new technological processes to obtain usable substances from dust leaches from metallurgical production."*

The GaBi software was purchased to assess product lifecycle. This software was used to conduct a comparative study of the environmental effects of two catalysts (Ni-alumina and V-alumina) used in ethylene production. The software was also used to assess the lifecycle of biomass preparation for biofuel conversion.
Focus was on the development of sample preparation methodology together with statistical methods of experiment planning and subsequent element analysis of samples in the form of solutions and suspensions using ICP-OES, ICP-MS and ICP-MS with electrothermal vaporization (ETV). The ETV-ICP-MS method was developed for determining thallium and gold in suspension samples, which is a significant step towards a comprehensive ICP-MS analysis of microsamples at the Institute. Focus was also on the transport of anthropogenic gadolinium in soil and plants. The group evaluated gadolinium anomalies in wine and prepared an experimental plan to monitor the transfer of anthropogenic gadolinium from soil to grapevine. An element analysis of tattoo inks and a questionnaire survey were used as data sources in a study focused on the perception of the risks associated with tattoo inks.

In their new laboratory, the ecotoxicology group focused especially on the study of the ecotoxic effects of plastic nanoparticles and microparticles, both on their own and in combination with other pollutants (for example gadolinium-based contrast substances). The group also established cooperation with the Institute of Hydrobiology of the Czech Academy of Sciences and participated in a project addressing the effect of periphyton on the movement of phosphorus in oligotrophic lakes formed as part of surface brown coal mine reclamation.

The study of Zn separation in selected types of industrial solutions containing about 100 mg/L $ZnSO_4$ continued by data processing using a proposed model that provides more accurate information and characteristics concerning the time-drop of *c* zinc concentrations in the solution. Based on the data it was possible to determine the degree of Zn separation according to time (t) for different values of current densities (i) between 1 and 25 mA/cm2 at specific solution conductivities (for example between 4 and 5 mS/cm) and pH (for example between 2 and 4). These data are of great importance in the assessment of practical applicability and for example suggested that for example at i = 1 mA/cm2 the stable condition of c vs. t was not achieved even long after 5 hours of electrolysis, while at 8–16 mA/cm2 the time period was close to 5 hours and at 25 mA/cm2 it was even 4 to 5 hours.

In testing of the potentiometric indication of the procedure of cleaning power plant waters based on the measurement of the potentiometric response of silver amalgam electrode (AgAE) with a special interface, an experimental model was used to achieve a significant partial improvement (by about 30%) in data repeatability. The procedure was based on the detection of a series of discrete potentiometric signals in time (not just signals at a certain time after immersion of electrode Et_i), including the determination of their quasi-stationary values Et_{ki} after each series of cleaning operations O_i and plotting of diagrams Et_{ki} vs. O_i (unlike the previous Et_i vs. O_i).

Research also focused on the development of new voltammetric methods for the determination of selected bioactive substances important to human health and the environment by using prospective electrode materials. The group completed and evaluated studies focused on the voltammetric behaviour of anti-inflammatory drugs of the oxicam group, specifically meloxicam and lornoxicam, and developed methods of their determination using the boron doped diamond electrode (BDDE). Research on other oxicam drugs was initiated (piroxicam and lornoxicam). Focus was also on the study of azole fungicides, where methods were proposed for the determination of difenoconazole and tebuconazole. At the same time, research was initiated on BDDE modification in order to improve its electrochemical properties (for example sensitivity and selectivity).

In the area of voltammetric methods for the determination of plant stimulators, focus was on the development of the reaction mechanism of the oxidation of naphthaleneacetic acid (NAA) in a strong acidic environment. This knowledge was used for the development of a selective method for the determination of this substance in real preparations to strengthen plant growing and rooting.

In the area of remote sensing and monitoring of surface water, further samples were taken (using the developed floating sampling device) to expand the database of water quality parameter models based on the remote monitoring approach. Focus was also on continued development of models and optimization of satellite data processing.

Institute of Chemistry and Technology of Macromolecular Materials (ÚChTML)

The Institute of Chemistry and Technology of Macromolecular Materials performed research in areas that are unique in the Czech Republic. The Institute has three departments with long-term scientific-research focus: Department of paints and organic coatings, Department of synthetic polymers, fibres and textile chemistry, and Department of wood, pulp and paper.

The scientific activity in the area of organic coatings and paints includes comprehensive research of these materials with an emphasis on the binder as well as chemically or physically active coating components, i.e. pigments, fillers, and numerous functional additives. Research focuses on the development of polymeric and composite coatings, nanomaterials and special polymers. Attention is on cross-linking reactions on polycondensation and polyaddition resins, binders made of renewable sources, and environmentally friendly materials. At present, strict focus is on ecological and toxicological safety of paint and organic surface components. Therefore, attention is on organometals potentially applicable in the area of paints. Detailed focus is on organometallic derivatives for oxopolymerization drying of alkyd paints, whose Cp ligand carries electron acceptor substituents. The mechanism of their effect in autooxidation reactions was studied by means of spectroscopic methods. Focus was on searching and studying new antioxidants for paints and optimization of their application. Another research area was synthesis of ecological and highly efficient anti-corrosion pigments and corrosion inhibitors and study of the mechanisms of their effect in the protection of metal materials. A promising solution seems to be the use of the synergic effect of compounds that limit the speed of corrosion reactions — corrosion inhibitors with other components of protective organic or inorganic coatings. The Institute focuses on synthesising oxide nanoparticles and morphologically interesting pigment particles intended for efficient interconnection of the polymer network of the protective film. Core-shell particles with an active nanolayer inhibiting the course of a certain corrosion reaction are developed. Conductive polymers and carbon nanomaterials as active inhibitors of corrosion reactions are studied. Focus is also on the formulation of organic coatings containing conductive polymers, where a very promising alternative seems to be composite particles of conductive polymers and their suitable carriers. For the preparation of nanodispersions with zinc oxide in organic solvents, dispersion techniques including appropriate conditions and additives that facilitate these technologies are developed. The prepared nanosuspensions are used as anti-corrosive and anti-microbial agents in paints.

In the area of anti-corrosion coatings for heavy corrosion protection, focus was on investigating the properties of paints with a high content of zinc and the aim was to decrease the content of this metal using other electrically and electrochemically conductive materials. Research is carried out in the area of syntheses and application of anti-corrosion pigments with various chemical structures and particle morphologies. Pigment modification by conductive polymers is performed to increase the anti-corrosion efficiency of anti-corrosion pigments or corrosion inhibitors, reduce the amount in paints, and improve the mechanical properties of binders. Focus is also on the formulation of thermally and chemically stable coatings and layers containing metal particles or nanoparticles of ferritic pigments.

In the area of polymeric and textile chemistry, research focuses on chemical technology, the automotive industry, textile chemistry, design and composite materials and processing industry, medicinal materials, energy materials, etc. Scientific activity includes the study of polymerization and polycondensation reactions. Material research is performed in the area of composite materials and

construction adhesives for the automotive industry. Focus is also on the study of biodegradable polymers on the basis of polymerable sugars and biodegradable auxiliaries in textile chemistry. In the area of reactoplastic materials, research focuses on the modification of epoxy resins, adhesives, and sealants. Important thermoplastic polymers include polyethylene and resilient polystyrene, whose macromolecules contain polymeric-bound light stabilisers and antioxidants. The purpose of these polymeric carriers is to improve UV stabilisation and decrease the oxidative degradation of for example polyurethanes and other polymers. Research also focuses on other additives (antistatics, flame retardants and fluorescent markers), covalent-bound to plasma-treated polymer carriers. The main area of current research is the synthesis of reactive microgel particles using the technique of emulsion polymerization, their properties and applications, particularly in the area of surface treatment. Another area of study includes heterogeneous ion-exchange membranes on the basis of emulsion polyelectrolytes as polymer carriers and functionalized styrene-divinylbenzen resin. The Institute also focuses on the synthesis and study of hyper-branched polymers as precursors of organic coatings. Research also focuses on the synthesis of reactive microgels, acrylate and styren-acrylate co-polymers using the technique of emulsion polymerization, their properties and applications, particularly as binders in water-soluble paints. Textile dyes are developed including microencapsulation. In the area of wound covering research, a new method was proposed that uses a stable iodine complex in the polymer covering in order to achieve antiseptic wound covering.

Scientific and research activity in the field of wood, pulp and paper focuses on biomaterials, both on the theoretical and practical level. Attention is on environmental issues related to the production and use of these materials, in particular waste water and its recirculation. Traditional focus is on the study of the principles of paper processing technology and the properties and behaviour of paper-based materials. Research focuses on the development of pulp production, especially from annual plants and biowaste. Another important programme in the upcoming period is research on the properties of pulp-based fibres in the process of ageing with respect to their life, recycling, and protection of written heritage. Research also focuses on surface treatment in paper refining and use of paper as a bioremediative and bioactive foil for intensification of plant activity in agriculture. Explorational activity focuses especially on better characterization of epimolecular structure of lignocellulosic mass and other materials, particularly at a hypermolecular level, which is the key aspect in all molecular-surface, chemical and biochemical processes, as it is the first when molecules enter its core.

Institute of Energetic Materials (ÚEnM)

The scientific and research activity of the Institute of Energetic Materials focused on several traditional areas.

Research and development focused on energy composition based on explosive mixtures and co-crystals high energy volume. Based on international cooperation (CR, PRC, Egypt), research continued in the area of initiation reactivity of energetic materials and its correlation with the energy content in energetic materials.

Research focused on the properties of various coordination compounds containing the cyanide group as an alternative non-metallic fuel applicable in pyrotechnic compounds. Research was initiated in the area of reactivity of selected explosive compounds to electrostatic discharge and influencing ESD sensitivity using various additives.

In cooperation with Explosia, a.s., the project entitled "Advanced chemical gas generators, not only for the automotive industry" (MIT FV10332) continued, the purpose of which was to develop gas-producing mixtures applicable in emergency systems in the automotive and aircraft industry. This year, another joint project funded by TA CR was started with Explosia, a.s. focusing on the development and characterization of heterogeneous rocket fuels. Another project with Explosia, a.s. was implemented by means of contract research focusing on waste water treatment in the production of nitro compounds and on new substances applicable as additives in nitrocellulose propellant materials.

Research activity continued in the area of improvised explosives in order to obtain further information on the possibilities of abuse by "home synthesis" using available materials for the purposes of criminal activity, their detection and description of their hazardous properties.

In the area of explosion physics, direct and indirect measurement was performed to monitor detonation and its effects on the near environment using both traditional pressure sensors and prospective optical methods. Part of the experiments was numerically simulated using the LS-DYNA software.

Applied research in the area of safety engineering and risk analysis focused on improving the ability to analyse hazardous situations associated with exothermic reactions. An example of safety training using educational games was developed.

Department of Inorganic Technology (KAnT)

Scientific and research activity of the Department of Inorganic Technology focuses on the following three main areas: inorganic pigments, industrial fertilizers and soil improvers, and the study of the properties of chalcogenide materials by calorimetric methods.

In the area of inorganic pigments, attention is on the synthesis of new oxide materials with ecological composition, high thermal stability, and appropriate optical properties. These materials can be used as inorganic pigments and applied in commercial ceramic glazes and also organic binding systems. Research focuses on compounds, especially those of a pyrochlore, perovskite, tungstate, cassiterite, and spinel structure, and phosphates. The composition of these oxide materials is affected by rare earth elements and transitional elements, which can have a positive effect especially on optical properties of synthesised compounds. The prepared substances are characterized in terms of their phase composition, optical and physical-chemical properties, thermal and chemical resistance, light stability, and applicability in various binders. In the case of perovskite compounds, focus is also on their capability of reflection in the near-infrared region, which depends on the composition and type of perovskite structure. The objective is to test the possibilities of various optical properties of these materials in both the visible and near-infrared regions. The focus of further research is on the testing of various conditions of hydroxyapatite precipitation in terms of its corrosive-inhibitory effects with applications in various binders and subsequent evaluation of corrosion tests. The synthesis of new oxide materials is based on solid phase reactions, precipitation, sol-gel method, suspension mixing of raw materials and also mechanoactivation. Focus is also on testing of various input materials in order to achieve a positive effect on reactivity. In the process of synthesis, focus is on the application of various types of mineralizers and a defined atmosphere in order to achieve a positive effect on the course of synthesis.

In the area of special agrochemicals, research focused on further optimization of the conditions of synthesising hydrogels on the basis of copolymers of acrylic acid and acrylamide grafted cornstarch in order to prepare materials that could be used as biodegradable superabsorbents that act as soil moisture regulators and nutrient carriers and that could at least partially replace fully synthetic soil improvers that leave undesirable residues. Focus was also on the determination of the content of residual monomers in both prepared and commercial hydrogels by means of high-performance liquid reversed-phase chromatography. The group also studied and optimized the conditions of isocratic separation of substances on the column with C18 phase in eluents formed by water-methanol and water-acetonitrile systems. Subsequently, methanol extracts of hydrogels were analysed under these conditions and the content of extractable residual monomers and the networking agents were evaluated. Complete removal of these undesirable impurities from the products can be achieved by rinsing in ethanol or methanol. In the prepared starch superabsorbent with expanding ratio of 500g of water/1g of dry matter, focus was on the study of the effect of its presence in soil on its maximum capillary water capacity (MCWC) and drying speed. In the first case, the content of 1% of hydrogel in soil resulted in a more than three times increase in MCWC, the time of complete drying extended by approximately 50%. The following parameters were achieved with several times lower content of potentially hazardous acrylamide in hydrogel. As a result, starch copolymer hydrogels may be a suitable ecological alternative to commercial fully synthetic polyacrylamide products.

Research on chalcogenide materials focused on thermal capacity of these materials. The primary objective was to increase the measurement accuracy and to develop a methodology for experiments conducted in an inert atmosphere, and to achieve an acceptable experimental error rate under these conditions. Focus was also on viscosity behaviour of chalcogenides. In this area, research focused especially on refinement of experimental data previously published in multiple literary resources, which are not always consistent. In terms of theory, focus was especially on suitable viscosity theories with regard to experimental data extrapolation in the case of missing melt values. The Sb-Se system, where a new model had previously been developed for the description of isothermal crystallization curves based on experimental data for antimony content of 0.5%, was further tested for crystallization behaviour of glasses with a higher antimony content under non-isothermal conditions and mainly the difference between the course of crystallization of samples kept in a protective argon atmosphere and samples exposed to air. The effect of mechanical activation (grinding) on crystalline to amorphous phase change for selenium was investigated. In the area of testing substances suitable for heat accumulation, testing of various carbon forms for the suppression of supercooling in magnesium nitrate hexahydrate was completed. At the same time, research was initiated on the effect of inorganic fibres on the inhibition of phase separation in magnesium nitrate hexahydrate, either pure or with nucleating agents. The prepared mixtures were characterized by means of DSC, and the values of thermal capacity, density, and thermal conductivity at room temperature were determined.

Department of Graphic Arts and Photophysics (KP)

The scientific and research activity of the Department of Graphic Arts and Photophysics focused on several traditional areas.

The first area of research focused on chalcogenide glasses and their thin layers with a special attention on the study of some systems based on tellurium (Ge(Ga)-Sb-Te, (Ge)-As-Te), selenium (Ge(Ga)-Sb-Se), but also other elements. The Department also studied the preparation of thin chalcogenide layers from organometallic precursors. The research of amorphous chalcogenides is largely based in broad cooperation with foreign as well as domestic institutes. A significant stimulus supporting developmental and research activities in this area was broadening of the spectral area of ellipsometric measurements which now includes the UV-VIS-NIR part of the spectrum, as well as the acquisition of spectrophotometers covering the UV-VIS-NIR-MIR-FIR parts of the spectrum.

The second area is the research of UV curable paints and varnishes. The study primarily focuses on two areas: hybrid polymerization systems (radical and cation polymerization) and UV curable systems using UV LED. One of the promising areas in the area of curing of paints and varnishes using UV radiation is the possibility of substituting medium-pressure mercury lamps with UV LED (longer lifetime, lower electricity consumption, environmental aspects, etc.) In this area, the work at the Department of Graphic Arts Photophysics focused especially in the optimization of the initiation system by formulating cation and hybrid polymerization for UV LED with peak emissions at 365 and 395 nm. Project TG02010058 (GAMA02/004) focused on the development of UV curable varnish for digital varnishing machines, which will allow surface as well as partial varnishing including special effects. The developed varnish is cured partially by UV LED and the final mechanical properties are acquired after exposure to a medium-pressure mercury lamp. In the previous period, one functional sample was prepared and a utility model was granted (UV curable ink especially for digital varnishing equipment: CZ 32899 U1) and successful tests of the varnish were performed on a commercially supplied varnishing machine at KOMFI, s.r.o.

In the area of material printing and printed electronics, where attention was on smart packaging, smart labels for autonomous temperature and relative humidity monitoring were developed on a semi-operational level. The smart labels were tested by end users in the field of food processing, healthcare, museum administration, logistics, etc. In the framework of the Flexprint project, research continued on the development of sensor systems such as bandage sensors for the detection of the degree of wound cover saturation, or incontinence sensors used in nappies for long-term lying patients, or sensors for the automotive or logistic industry. In the second year of the OrgBat project, research focused on printed accumulators based on organic compounds. This involved accumulators with electrolytes based on lithium salts as well as sodium salts. The group completed the research and

development of smart security labels including printed WORM and RRAM memory elements for data storage. In cooperation with industrial partners, a mobile memory reader was developed. Research continued on the SmartField project focusing on printed sensors for the detection of soil moisture and temperature in various depths. Data collection from the sensors is performed by means of the IoT module with transition via networks such as LoRa, SigFox, etc. using a module developed as part of the project.

In collaboration with OP papírna, s.r.o. research was initiated on the evaluation of print-through on thin print papers. Standard print-through tests were performed under different printing conditions and for various types of thin print paper. These types of paper were thoroughly analysed for properties that affect print-through. The effect of paper properties and test conditions on the resulting print-through values was assessed.

In the research of thermochromic system, the following project supported by the Ministry of Trade continued: FV30048 "New additives for multifunctional modification of polymer surfaces". The Department of Graphic Arts and Photophysics focused on the testing of thermochromic behaviour of perylene compounds in various polymer matrices, including plastics, polyamide fabrics, silicone matrices and melamine-formaldehyde resin-based varnish. The developed methodology for the analysis of thermochromic behaviour and its reversibility was also used in cooperation with the Institute of Plasma Physics of the Czech Academy of Sciences in a study of Al_2O_3 chromium-doped layers prepared by the plasma spray method.

The traditional research area of the Department of Graphic Arts and Photophysics is the characterization and optimization of polygraphic materials and products. In 2018, this included a proposal for a general and available methodology for the assessment of legibility.

The Department also performs research aimed at the development of new printing forms for flexo printing. Flexo printing is currently a very promising printing technique, which is used primarily for the development of a broad range of packaging. Research focuses on two directions. The main focus is on the development of new rubber printing forms, improvement of their printing properties and methods of direct burning using various types of lasers (in cooperation with Ligum, spol. s r.o., Gravitech, s.r.o.) The Department is also involved in the implementation of new flexo printing forms in practice (Obchodní tiskárny, a.s., OTK GROUP, a.s.) The results of this activity focus on practical applications in the polygraphic industry. The other direction focuses on the application of the knowledge at the Department of Graphic Arts and Photophysics in providing technical support in the development of printed electronics and UV curable systems.

Department of Economy and Management of Chemical and Food Industry (KEMCh)

Research performed by the Department of Economy and Management of Chemical and Food Industry focuses on six main areas.

In the field of marketing management, research was conducted on the criteria for the assessment of the reputation of chemical enterprises in the eyes of their customers. A quantitative research study was performed to identify appropriate assessment criteria as well as the key attributes of the reputation of chemical enterprises as seen by their customers.

In the area of shared economy, the COST project was carried out including searches and analyses of good practice examples in the area of shared and circular economy. The project also included case studies covering purely Czech shared platform initiatives, and the development of criteria defining the forms of shared economy ranging from pure philanthropic form to a genuine business model.

In the area of social responsibility, a qualitative research was performed on financial and non-financial reporting in compliance with the applicable legislation and an analysis was performed on the level of reporting in chemical enterprises. A qualitative and quantitative research study was conducted on the economic and social causes and consequences of the development of the mini-brewing sector in the

Czech Republic and the approach of mini-breweries to social responsibility. Research continued on the communication of socially responsible activities by chemical enterprises in the Czech Republic, Slovakia and Ukraine. The assessment focused on economic, environmental, ethical, social and philanthropic activities.

In the area of Supply Chain Management, an empirical research study was conducted on hierarchical demand forecasting as a tool for corporate management decision-making. The proposed model was tested in practice. A primary qualitative research was conducted to explore modern technologies in the identification and monitoring of products in a selected supply chain. The study focused on the identification of the most important technologies related to Industry 4.0, which are now predominantly based on the Internet of Things concept.

In the area of the impacts of Industry 4.0 on the chemical sector, a research study was performed in connection with the arrival of Industry 4.0 technologies focusing on new business models in the field of product servitization and searching for possible servitization applications across production enterprises in the Czech Republic. Perspective forms of servitization for a selected enterprise were identified.

In the area of HR, controlled interviews with personnel managers in selected chemical enterprises in the Czech Republic were performed to map modern trends in human resources from the perspective of the chemical enterprises involved. The results suggested that chemical enterprises were aware of the issue and that they supported modern trends in human resources.

Department of Biological and Biochemical Sciences (KBBV)

The Department has a total of four research groups, which achieved considerable success. The results included papers in impacted journals, collaboration with national and international research or academic institutions and commercial entities. A significant OP RDE funded project called NanoBio is under way. A project entitled "Strengthening of interdisciplinary cooperation in the research of nanomaterials and their effects on living organisms" allowed the establishment of long-term cooperation with partners from the Hradec Králové and Pardubice region, specifically the Faculty of Medicine, Charles University in Hradec Králové and University Hospital Hradec Králové. The project team also includes members from the Centre of Materials and Nanotechnologies, FChT. The overall funding of the 4-year project is over 115 million CZK (4,525,777 EUR) and the employees of the Department are the principal investigators of this significant investment project.

The immunochemistry and immunology group, specifically its academic employees and doctoral degree students, were involved in several projects in 2019. One of them is the already mentioned NanoBio project, where the group focused on surface modification and biofunctionalization of the developed nanomaterials. The results of the project include valuable publications in renowned journals aimed at the application of nanomaterials in biomedicine. The group continues to cooperate with the Faculty of Medicine, Masaryk University in Brno, specifically with the laboratory run by Doc. Sabina Ševčíková that focuses on research on multiple myeloma. The project also involves the Department of Prof. MUDr. V. Maisnar, Ph.D., the 4th Department of Internal Medicine-Hematology, University Hospital Hradec Králové, where research involves rare samples of patients in remission of this serious disease. The immunochemistry group focuses on the so-called immunoproteomic analysis in order to identify the so-called target molecules required for the determination of the disease prognosis. The group continues to cooperate with the AD Centre in Bohnice, which is the newly established institute of the National Institute of Mental Health in Prague. Specifically, focus is on researching the biomarkers of Alzheimer's disease, which is a serious neurodegenerative disease. The task of the group is to analyse antibody activity in patients with this disease and involvement of different types of kinases in pathological hyperphosphorylation of Tau protein. This research is also linked with a key activity of the IT4Neuro (degradation) project, which addresses the study of protein hyperphosphorylation. Cooperation also continues on the study of post-translation protein modifications with Watson & Son Limited from New Zealand and their subsidiary ManukaMed Limited, which focus on the development of preparations containing manuka honey for wound treatment. Another research focus of the immunochemistry group is on the development of immunosensors with

electrochemical detection based on quantum dots (Qdots), specifically to detect the biomarkers of ovarian cancer or whole bacterial cells. In 2019, work continued on the development of a multiplex immunosensor to detect biomarkers in the amniotic fluid in pregnant women with premature membrane rupture in the framework of the PersonMed project coordinated by the Faculty of Medicine, Charles University in Hradec Králové and University Hospital Hradec Králové. Another important collaborative project on the development of polymeric materials for the preparation of an antiviral vaccine was commenced with the Faculty of Military Health Sciences, University of Defence in Hradec Králové.

Research of both general and clinical biochemistry permanently focuses on the area of clinical diagnosis of cardiovascular diseases, type 2 diabetes, and adrenoleukodystrophy. The research was carried out in cooperation with the Clinical and Biochemical Laboratory, Faculty of Medicine, University of Tübingen (Germany) and the outcome was an innovated diagnostic procedure based on an analysis of plasma lipoproteins. In cooperation with the Department of Cardiology, Internal Clinic, Pardubice Regional Hospital the group identified and analysed samples of patients with cardiovascular disease. The purpose of the study is to specify the correlations between selected markers of the onset of the disease, degree of severity of the disease, and overall short-term and long-term prognosis. Special attention is devoted to patients after percutaneous coronary intervention. In cooperation with the Department of Cardiology of Pardubice Regional Hospital, the group determined the biochemical parameters that affect the inflammatory reaction after percutaneous transluminal angioplasty with implantation of a coronary stent, the prevalence of clinical complications, and patient prognosis. Special focus was on the effect of the content of different fatty acids of cell membranes and oxidative stress. Methods were introduced for the identification of selected aminoacids and fatty acids in breast milk. Cooperation was established with the Department of Obstetrics and Gynaecology of the Pardubice Hospital, which provides samples of colostrum and breast milk. The tests also included acetylcholinesterase biosensors. A new methodology was implemented for the determination of the inhibitory effect of selected cholinesterase biosensors, and the process of immobilization of acetylcholinesterase on the surface of a three-electrode sensor was tested. In this area the group collaborated with the Department of Molecular Pathology and Biology, Faculty of Military Health Sciences in Hradec Králové. In cooperation with the Department of Pharmaceutical Botany and Ecology, Faculty of Pharmacy in Hradec Králové, the group tested the inhibitory effect of selected alkaloids in monocotyledonous plants against cholinesterases. In cooperation with the Department of Organic and Bioorganic Chemistry of the Faculty of Pharmacy in Hradec Králové, salicylanilide derivatives with a carbamic group were primarily tested as potential cholineserase inhibitors. Newly synthesized substances as potential cholinesterase inhibitors were also tested in collaboration with the Regional Centre of Advanced Technologies and Materials and the Laboratory of Growth Regulators of the Faculty of Science, Palacký University Olomouc. In cooperation with all of the above mentioned departments, cholinesterase inhibitors were tested for inhibitory activity IC_{50}, type of inhibition, bonding mechanism between the inhibitor and the bonding location of the enzyme, and their lipophilic properties. Methods were introduced for the determination of cholinesterase activity and the most appropriate reaction conditions were verified. Methods were introduced for the identification of selected aminoacids, oxoacids and fatty acids in a dry drop of blood, sweat and breast milk. This year, cooperation also continued with the 2nd Department of Internal Medicine-Gastroenterology, University Hospital Hradec Králové concerning research on the effect of oxidative stress and lipid peroxidation on the development of Crohn's disease and colon cancer. In these patients, measurements focused on the levels of selected antioxidants and oxidative stress markers in whole blood, plasma, and colon tissue. In these samples, the concentrations of selected aminoacids and fatty acids were determined in order to identify the indicators of these diseases.

The microbiology group focuses on several research directions. In the analysis of waste and surface water the group focuses on isolating selected bacterial genera and identifying the degree of their resistance to antibiotics. Antibiotic susceptibility was also determined in microorganisms present in chronic wounds in patients. The samples were acquired in cooperation with University Hospital in Hradec Králové; a broad spectrum of aerobic and anaerobic bacteria was isolated from chronic wounds. Another monitored agent with zoonotic potential is the *Arcobacter* genus bacteria. The isolates of these bacteria were obtained from various sources in the Czech Republic and were analysed for the presence of 8 virulence factors. In the study, a high prevalence of genera coding potential virulence factors to antibiotics was identified. In cooperation with the Institute of Animal

Science in Kostelec nad Orlicí, the group has implemented a long-term research study on microbial contamination of samples of sperm of breeding boars intended for insemination of sows. Further cooperation with industrial enterprises in the framework of TA CR projects resulted in research on bacteriostatic and bactericidal effects of newly prepared water soluble paint dispersions, and monitoring of antibacterial effects of food supplements and cosmetic products based on monolaurins combined with natural substances. In the area of food microbiology, the quality of raw food consumed by raw food proponents was analysed. Heat treatment at 40 °C is completely insufficient, this type of food treatment causes bacteria to grow exponentially and their numbers mostly increase. In collaboration with the Department of Analytical Chemistry, the group returned to the detection of toxinogenic moulds (*Fusarium*) by means of traditional molecular biological methods. Multiplex PCR was introduced for rapid identification of toxinogenic moulds in food and raw materials. The HPLC/MS method was applied to determine and identify the basic toxins produced by the *Fusarium* genus moulds. The research will continue in order to monitor the presence of moulds in food including possible ways of toxin biodegradation.

In the recently equipped tissue culture laboratory, new tumour cell lines were introduced and are currently cultivated, which will allow *in vitro* study of not only the nephrotoxic and hepatotoxic effect of the substances, but also their possible neurotoxic effect. In addition to *in vitro* study of cytotoxicity of acetanilide compounds in renal cell lines, where focus was on the monitoring of redox and kidney specific functional changes by means intracellular fluorescent probes and immunochemical methods, another important research task was the study of the nephrotoxic effect of cadmium. In this area, a similar research study was started which focused on the mechanisms behind the toxic effect of this heavy metal using molecular and biological methods. In the renal cell lines affected by selected test substances, the group studied mitochondrial activity using highly sensitive respirometry and fluorescent microscopy. In cell culture laboratories, further experiments were performed that focused on the evaluation of cytotoxicity and the effect of selected newly developed nanomaterials on the proliferation and viability of primary and tumour cell lines. Focus was on new potentially antitumour substances isolated from plants of *Amaryllidaceae* and *Papaveraceae* families and newly synthesized acetylcholinesterase and butyrylcholinesterase inhibitors. A significant part of the research focused on the optimization and introduction of protocols for *in vitro* testing of nanotoxicity, for example by means of magnetic nanoparticles for diagnostic and theranostic applications. These substances were analysed for their effect on cell behaviour (growth kinetics, adherence ability, proliferation, etc.) immediately after the effect took place and in real time.

Institute of Applied Physics and Mathematics (ÚAFM)

The Institute of Applied Physics and Mathematics consists of several research groups with different focus.

Examination of the development of polymeric nanoparticles, networks and brush structures using x-ray and synchrotron radiation. In the first case, focus is especially on size characterization and classification by nanoparticle size and shape depending on the method of preparation. The purpose is to study the use of multi-layer micellar nanoparticles to transport drugs in the organism. In the area of polymeric networks, focus is particularly on the study of the local arrangement of interpenetrating networks and its correlation with macroscopic and especially mechanical properties. In the area of brush structures, focus is on the density and length of the chains on the wafer surfaces and their effect on the ability to prevent blood coagulation. A new direction is the study of the correlation between phase transitions of semiconducting polymers and their electrochemical properties. It appears that the behaviour of these systems (e.g. PANI) has suitable properties for the development of supercondensators.

Ellipsometric characterization of physical changes in chalcogenide GST layers induced by pulse laser exposure in order to better understand the processes in phase change memory media. Ellipsometric characterization of thin layers of MoS_2 dichalcogenide topological insulators prepared by various deposition methods in the amorphous and crystalline phases. Cooperation with TOSEDA, s.r.o. in the determination of optical constants of selected co-polymers for space applications in the Earth's orbit.

Preparation and characterization of semiconductors with thermoelectric, magnetic and topological properties. This for example includes the optimization of thermoelectric systems SnSe and SnS, Bi_2O_2Se by means of doping and modification of natural compound stoichiometry. A great emphasis is on the association between the conveyor properties and the defective structure. Research also focuses on examining the possibilities of increasing the efficiency of thermoelectric conversion on the basis of electron energy filtering. The model systems primarily include Bi_2Se_3 single crystals doped with transition metals (Mo, W). Examination of the conveyor properties and magnetism in $CuFeS_2$ chalcopyrite and their correlation with natural defects.

Examination of additive properties of units in real sub-bodies of weakly branched circular bodies. The following hypothesis is tested: in p-th circular body, where p is a prime, there is a maximum of 4 subsequent units x, x+1, x+2, x+3. For p greater than 3, there are always 4 subsequent units. It is also examined which natural numbers can be expressed as the sum of two units in p-th circular body.

Joint Laboratory of Solid State Chemistry (SLChPL)

After closing of SLCHPL of the Czech Academy of Sciences and opening of the new SLChPL, this is the only FChT Department whose structure has changed. From 2016, the number of employees has gradually been reduced, reflecting the completion of projects under the Institute of Macromolecular Chemistry of the Czech Academy of Sciences. This has also resulted in a gradual change of the focus of the laboratory and the staffing of the groups. The scientific and research activity of SLChPL remains divided into three areas — non-crystalline materials, crystalline materials (thermoelectrics), and intercalates. The major part of the activities is based on cooperation with FChT departments and institutes and other workplaces.

As far as non-crystalline materials are concerned, a study of photoinduced interaction in a GeSe-AsS multi-layer system was initiated. The first results show that heat treatment but also exposure to photons with energy of 2.33 eV produces a new interlayer with new Ge-S and As-Se bonds on the interface of the two layers (AsS/GeSe). The study of amorphous thin films of the As-Se systems with Se superstoichiometry continued. The prepared thin films were tested for spontaneous ageing, and changes in wettability were measured after exposure to various wavelengths. These changes were correlated with the film surface roughness and structural misarrangement caused by non-stoichiometry. Focus was also on the effect of the substrate on the properties of the prepared films. Some properties (density, refractive index, structural arrangement, nanohardness) of the prepared thin films were compared with the properties of the corresponding volume samples. Using a thermomechanical analysis with laser exposure (405, 532 and 785 nm) changes in photoinduced viscosity (photo-fluidity) were observed.

These materials were characterized in cooperation with the Institute of Optical Materials and Technologies BAV, Sofia, Bulgaria, where variable-angle ellipsometry was applied to study the degree of reaction (production of interlayer) of two steamed chalcogenide thin films. The resulting sandwich structure was thermally treated and exposed to various exposure sources. The thickness of the initial AsS/GeSe films was altered and the order of steaming was changed (GeSe/AsS).

In cooperation with CEITEC-MUNI, the degree of reaction of the prepared AsS/GeSe double layers was analysed by ablation. The study of ablation of non-stoichiometric volume chalcogenide samples and thin layers of the Ge-Se system continued. The effect of nanophase separation on material heat convection was confirmed, which also suggested increased ablation efficiency for Se super-stoichiometric samples.

In collaboration with the Department of General and Inorganic Chemistry a study was initiated on the preparation of heavy metal oxide glasses based on Ga_2O_3-PbO and ZnO-Ga_2O_3-PbO, which according to the preliminary results are promising materials for optical recording of information associated with the formation of lenses, ablation waves and ablation craters/caverns.

The prepared glasses based on Ga_2O_3-PbO and ZnO-Ga_2O_3-PbO were partially characterized at the Institute of Applied Physics and Mathematics. The ongoing experiments will result in the development

of a thermal model of behaviour of exposed parts (lenses, ablation waves, ablation craters) in the surface of oxide glasses. Atomic force microscopy was applied to study resistive switching in $AgGeSe_2$ solid-state electrolyte and the size of Schottky barrier on metal nanoparticles on Bi_2Se_3 semi-conductor. The study on crystalline materials continued, specifically the effect of the Pd-Cu substitution in the Cu-$PdFeS_2$ system. In Cu substitution, Pd atoms have the function of the donor. In synergy, these effects contribute to an increase in both power factor and thermoelectric efficiency.

In collaboration with the Department of Physical Chemistry, the kinetics of the thermal decomposition of some oxalate hydrates was studied. The data obtained were analysed by a multivariate kinetic analysis and the mechanism and kinetic model of the two-stage decomposition were described.

Cooperation with CEMNAT continued including a study of new methods for the preparation of monodisperse quantum dots based on $Cd_{0.15}Zn_{0.85}S$. The samples were prepared by various methods using di- and tri-substituted thiourea as a new source of sulphur and their optical and thermal properties were observed. It was observed that the method of preparation had a significant effect on the size of the obtained quantum dots, which was also reflected in their temperature stability.

In cooperation with the Institute of Chemistry and Technology of Macromolecular Materials, research on the surface properties of latex films based on acrylic copolymers continued. In the complex framework of latex film development, attention was on the study of film resistance against water. Optical tensiometry was applied to assess the effect of several factors: (1) The chemical nature of the emulsion copolymer determined by the concentrations of fluorine groups in the emulsion copolymer; (2) The application of the traditional non-polymerized and progressive polymerized emulsifier in latex synthesis by emulsion polymerization; (3) The degree and type of crosslinking of latex film (intra-particle vs. inter-particle, covalent vs. ionic); (4) The application of the traditional crosslinking agent and inorganic ZnO nanoparticles to introduce ionic latex film crosslinking. During tensiometric measurements, emphasis was not only on determining contact angles for water but also surface energy, the determination of which required a suitable pair of liquids. The results increased the existing knowledge of the issue, especially in terms of influencing the sensitivity of latex film to the effects of water.

In collaboration with our colleagues from the Faculty of Mathematics and Physics, Charles University, the study of intercalates continued. A series of new layered zirconium phosphates $Zr(PO_4)(H_2PO_4)_{1-2x}(H_2TDP)_x \cdot yH_2O$, where x = 0.15, 0.34, 0.45 was prepared by topotactical reaction of gamma-modification of zirconium hydrogenphosphate (gamma-ZrP) with 2-bis(phosphonomethyl)amino-ethan-1-sulfonic acid. The prepared compounds were characterized by powder X-ray diffraction, EDX and elemental analysis, infrared spectroscopy and NMR in the solid phase. These results confirmed that the structure of these substances was derived from gamma-ZrP. The principle of attachment of the phosphonate anions to the layer was described. The prepared substances are capable of intercalating basic molecules and are proton conductive. The group also prepared and described the intercalates of three mixed zirconium sulfophenylphosphonates-phenylphosphonates $Zr(HO_3SC_6H_4PO_3)_{1.8}(C_6H_5PO_3)_{0.2} \cdot 2.6H_2O$, $Zr(HO_3SC_6H_4PO_3)_{1.3}(C_6H_5PO_3)_{0.7} \cdot 2H_2O$, $Zr(HO_3SC_6H_4PO_3)_{0.7}(C_6H_5PO_3)_{1.3} \cdot 3.6H_2O$ with aminoalcohols and triethylamine. The prepared intercalates were exfoliated in isopropylalcohol using either ultrasound or a high-speed homogenizer. It was found that using the homogenizer is the most effective exfoliation method as it provides plates with the largest surface in the shortest time. The best exfoliation agent was triethylamine; the used aminoalcohols provide roughly the same results regardless of their chain length.

New collaboration was established with the Institute of Rock Structure and Mechanics of the Czech Academy of Sciences. Selected samples of ash mixtures were tested for photoactivity (UV lamp, 360 nm, 10 W/cm) by measuring the change in absorbance of added Rhodamine B. Based on the results and after the methodology is adjusted, the research will be extended to detect photoactivity of selected geopolymers, which are increasingly used in various areas, mainly construction.

Centre of Materials and Nanotechnologies (CEMNAT)

In 2019 CEMNAT, which is the newest FChT department, successfully implemented its research, development and educational activities in material science in all areas of research (photonics, electronics and electrical engineering, renewable energy, chemically active surfaces). In the long term, CEMNAT employees have been known as outstanding experts in the area of physics and chemistry of solid materials, synthesis and deposition techniques of new materials including nanomaterials and metamaterials, and modelling of their structure and properties. In CEMNAT, there are currently four work groups (headed by Prof. Miroslav Vlček, Prof. Tomáš Wágner, Prof. Petr Němec, and Dr. Jan Macák).

Also in 2019 CEMNAT confirmed its status of excellent infrastructure that provides outstanding background for various open-access user groups. On the basis of the evaluation performed by the Ministry of Education, Youth and Sports of the Czech Republic, CEMNAT will continue, at least until 2022, to be on the Roadmap of Large Research Infrastructures.

In 2019 CEMNAT implemented four research projects. Probably the most significant project Towards New Generation of Solid-State Photovoltaic Cell: Harvesting Nanotubular Titania and Hybrid Chromophores was supported by the European Research Council and aimed to develop a new concept of solar cells combining titania nanotubes with suitable inorganic and organic chromophores in order to achieve efficient conversion of solar energy to electrical energy. In 2019, the project "High-sensitivity sensors and low-density materials based on polymeric nanocomposites NANOMAT" continued (supported by MEYS, OP RDE) aiming to develop active and passive innovative materials, specifically high-sensitivity new sensors based on polymeric nanocomposites and new low-density materials based on polymeric nanocomposite materials for the space, aerospace, and automotive industries. A new research study was initiated under project "Amorphous to crystal (3D2D) transition in van der Waals bonded chalcogenide materials" (supported by the Czech Science Foundation). The CEMNAT staff were also significantly involved in the following two projects: (i) "Strengthening of interdisciplinary cooperation in the research of nanomaterials and their effects on living organisms (NANOBIO)" (supported by MEYS, OP RDE) and (ii) "Selenide-based 2D nanomaterials by atomic layer deposition with exciting properties" (supported by GA CR). The purpose of the former project is to build modern infrastructure for the development and characterization of newly prepared nanomaterials, their surface modification and biofunctionalization, and testing of the effect of conventional as well as newly developed nanomaterials on living organisms. The aim of the latter project, as suggested by its title, is to prepare selenide 2D nanomaterials with unique properties by means of atomic layer deposition.

The funding of the above projects together with the funding from the development project Modernization and upgrade of CEMNAT infrastructure, and from infrastructure funds of FChT, University of Pardubice allowed significant upgrade of the instrumentation for the synthesis and characterization of advanced (nano)materials. Several medium-sized laboratory instruments were purchased: atomic force microscope, Raman spectrometer, freeze dryer, supercritical CO_2 reactor, three-zone burning furnace, vacuum furnace with controlled atmosphere, rapid heating instrument. The following instruments were also upgraded: infrared spectroscope, fluorometer, photoelectrochemical setup, X-ray photoelectron spectroscope, and atomic layer deposition (ALD) instrument.

In 2019, CEMNAT participated in a total of 32 original papers published in international impacted journals, 29 active participations (18 lectures, of which 8 invited, plenary lectures and 11 posters) at international conferences, 1 Czech patent was awarded, and 3 scientific seminars were held.

3.2 Involvement in Research and Development Programmes

Funding received in the framework of creative activity

Year	2012	2013	2014	2015	2016	2017	2018	2019
Institutional support for the development of a research organization (thousand EUR)	4,662	4,302	4,343	4,041	4,397	4,730	5,403	5,544
Research intents (thousand EUR)	-	-	-	-	-	-	-	-
Research centres (thousand EUR)	-	-	-	-	-	-	-	-
Foreign grants (thousand EUR)	330	761	236	336	478	523	390	301
Domestic grants (thousand EUR)	2,802	2,753	2,690	2,552	2,764	3,590	9,955	7,159
Student grant competition (thousand EUR)	765	737	754	694	701	712	690	722
Additional activity (thousand EUR)	*139	*131	*194	*103	*170	*214	*217	*207

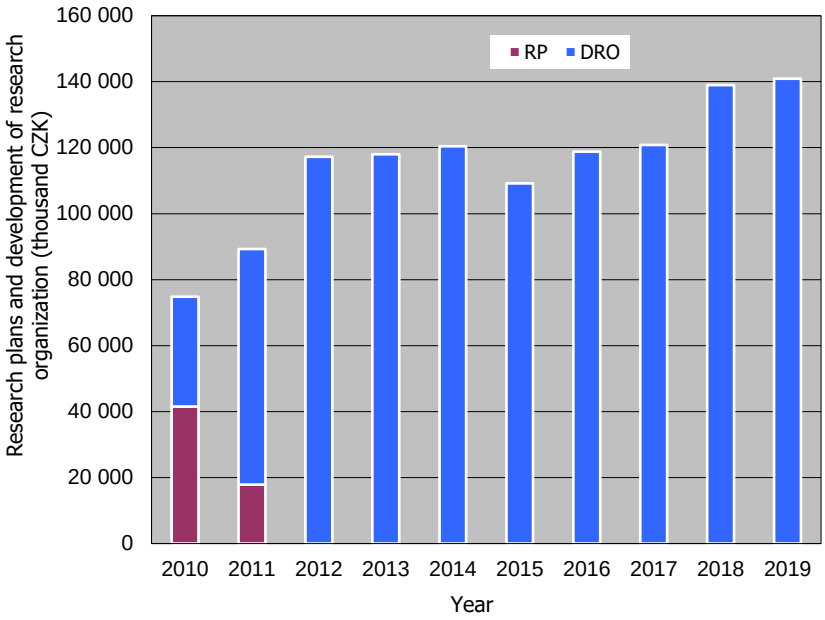
* The amount of additional activity is related to a number of activities in the framework of the main activity.

The amount of 7,159 thousand EUR obtained in the framework of domestic grants and projects in 2019 includes the following:

- National educational grants and projects of 30 thousand EUR (IDC)
- National scientific grants and projects of 3,324 thousand EUR (GA CR 1,979 thousand EUR, TA CR 668 thousand EUR, other projects 677 thousand EUR),
- OP RDE projects 3,805 thousand EUR.

The amount of 207 thousand EUR obtained in the framework of additional activity includes the following incomes:

- Service activity 98 thousand EUR,
- Printing production 3 thousand EUR,
- Contract research above 50 thousand CZK (approx. 1,967 EUR) 101 thousand EUR,
- Licences-inventions 5 thousand EUR.

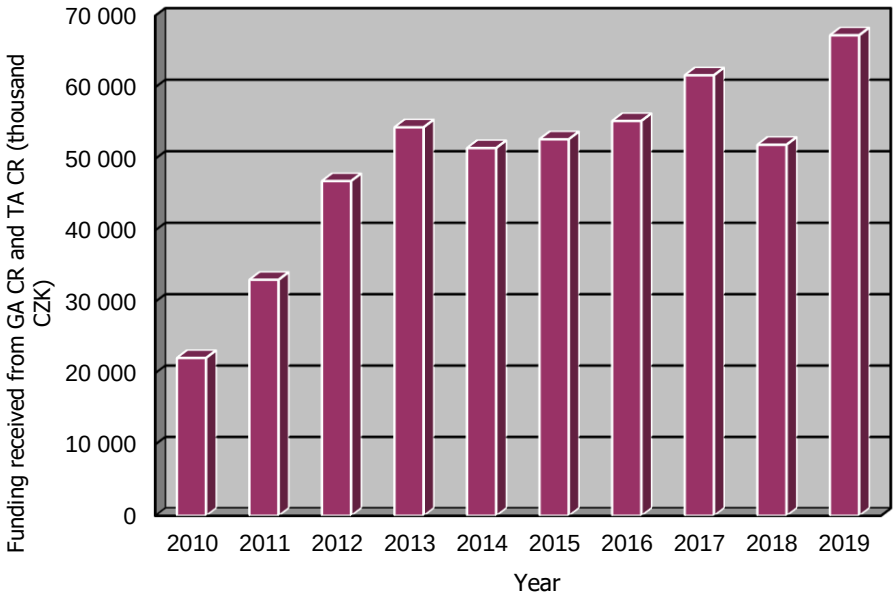


Funding by years of research plans and development of research organization

Grant funds received from GA CR and TA CR in recent years (investigators and participants)

Provider	2014		2015		2016	
	Number of implemented projects	Funding thousand EUR	Number of implemented projects	Funding thousand EUR	Number of implemented projects	Funding thousand EUR
GA CR	24	**1,325**	20	**1,289**	19	**1,306**
TA CR	16	**532**	14	**662**	15	**740**

Provider	2017		2018		2019	
	Number of implemented projects	Funding thousand EUR	Number of implemented projects	Funding thousand EUR	Number of implemented projects	Funding Thousand EUR
GA CR	23	**1,466**	24	**1,491**	29	**1,979**
TA CR	19	**948**	17	**528**	19	**668**
				Total in 2019	48	**2,647**

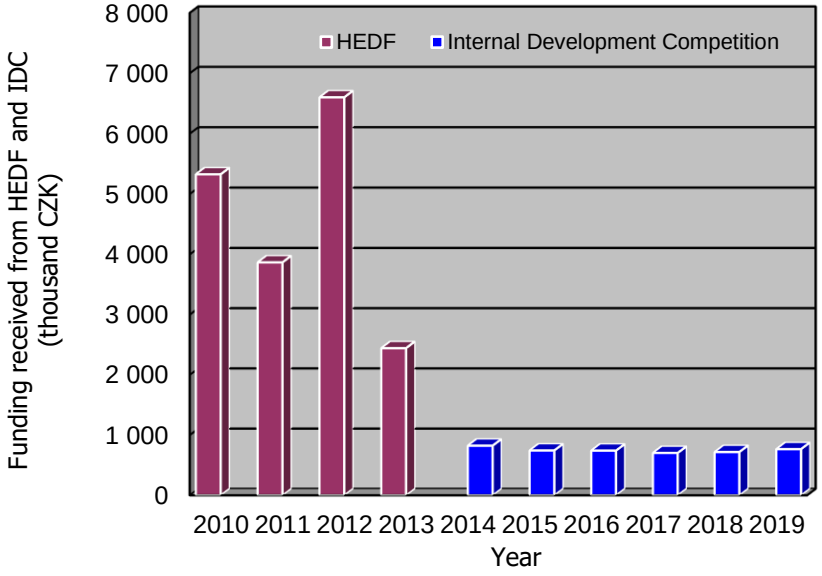


Grant funds received from GA CR and TA CR between 2010 and 2019

Grant funds received in 2019 from the Internal Development Competition

From 2014, Higher Education Development Fund projects shall be replaced by the Internal Development Competition:

Provider	**2019**	
	Number of implemented projects	Funding EUR
MEYS – Internal Development Competition	9	**30,000**



Funds received from HEDF between 2010 and 2013 and funds received in the following years from the Internal Development Competition

Involvement in the preparation and implementation of projects under EU Operational Programmes in the area of research and development

In 2019, FChT continued to implement 4 projects supported by the Operational Programme Research, Development and Education (referred to as OP RDE) launched in previous years. The IT4Neuro project was launched under the Pre-application Research for ITI II Call. In 2019, a total of 4 OP RDE projects were implemented at FChT (NANOBIO, NANOMAT, ORGBAT and IT4Neuro) focused on pre-application research. In two cases FChT is the project coordinator. The NANOBIO project focuses on strengthening interdisciplinary cooperation in nanomaterials research and study of their effect on living organisms. The NANOMAT project focuses on the development of high-sensitivity sensors and low-density materials based on polymeric nanocomposites. Both projects involve partners from the application sphere and their purpose is to find quick applications in practice. FChT continued to implement an ERDF focused on the modernization of instrumentation in practical courses of technical study programmes in chemistry and on the modernization of SW in theoretical and practical courses. The projects implemented at the Faculty contributed to the improvement of the quality and modernization of instrumentation of the respective departments. In 2019, the investments associated with OP RDE projects amounted to 44 million CZK (1,731,602 EUR).

The Faculty is also actively involved in the preparation and implementation of whole-university OP RDE projects. The project International mobility of researchers at the University of Pardubice successfully continued. As a result of the project, selected research groups were joined by 3 foreign post-docs with experience from prestigious international institutions. An ESF project continued in the area of increasing the quality and modernization of education, including a broader offer of courses in English. In 2019, two additional whole-university projects were launched with FChT participation focusing on improving the quality and modernization of education under the OP RDE ESF and ERDF for Higher Education Institutions II Calls.

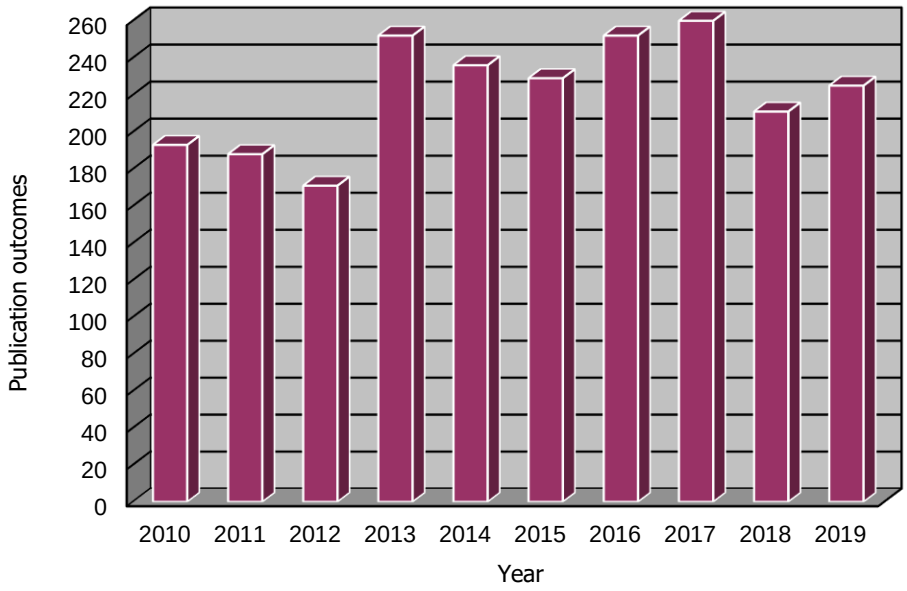
3.3 Publication Activity

The overall data on the publication activity of FChT in impacted journals between 2013 and 2019 and a detailed analysis of all publication activities of the Faculty in 2019 is specified in the following tables.

Overview of the number of FChT publications in impacted journals in recent years

Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Number of $J_{imp.}$ publications	252	236	229	252	260	211	225

The outcomes of scientific and research activity of the Faculty mainly included the publication of original results in scientific and scholarly journals, and presentation of these results at conferences and symposia. The following graph shows a comparison of the most significant publication outcomes in the past ten years.



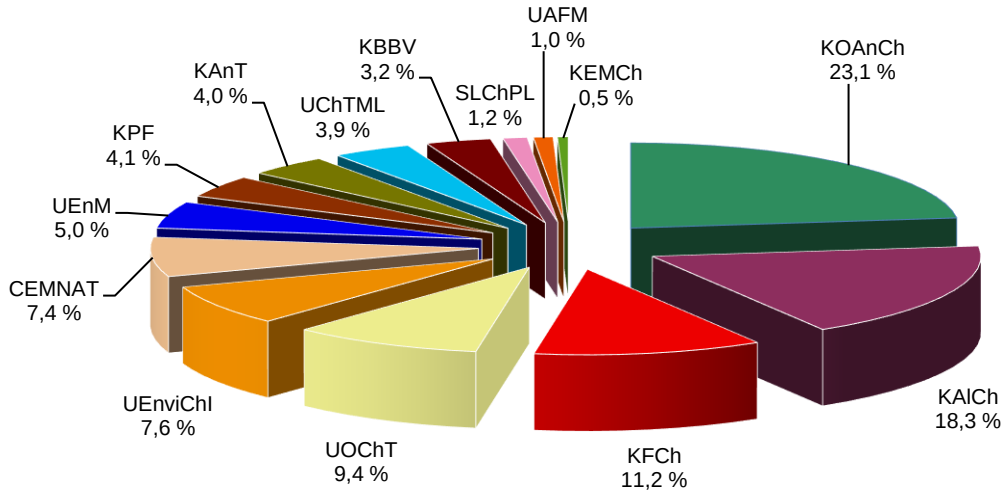
Summary of publication outcomes $J_{imp.}$ between 2010 and 2019

Overview of publication and other activities in 2019 by departments/institutes and outcome categories

Department	A1	A2	A3	A4	B1	B2	C	D	Total number of outcomes
KOAnCh	60	-	-	-	51	17	-	2	130
ÚOChT	25	-	1	-	34	14	-	1	75
KAlCh	35	1	2	-	44	45	2	-	129
KFCh	38	-	-	-	28	11	-	-	77
ÚEnviChI	15	1	5	-	21	27	-	4	73
ÚAFM	11	-	-	-	6	-	1	-	18
SLChPL	16	1	-	-	9	7	-	-	33
KEMCh	9	-	1	-	6	4	2	-	22
KAnT	10	-	3	-	20	16	-	-	49
ÚChTML	18	2	1	3	16	13	1	5	59
KBBV	18	-	2	1	15	20	-	1	57
KPF	10	-	-	-	4	3	1	9	27
ÚEnM	11	-	1	1	10	3	-	-	26
CEMNAT	26	-	-	-	17	8	-	1	52

Legend:

A1 Publication in a scholarly periodical listed in the WoS - J_{imp} database
A2 Publication in a scholarly periodical listed in the SCOPUS - J_{SC} database
A3 Publication in scientific papers proceedings
A4 Other publications J_{ost}
B1 Papers presented at international scientific conferences
B2 Papers presented at national scientific conferences
C Monographs, selected chapters, learning texts, university textbooks
D Granted patents, utility models, open technologies



Share of departments/institutes in the outcomes of science and research according to the evaluation of research organizations in 2016 (evaluation for 2011–2015)

3.4 Scientific Events and Conferences

The current issues in food microbiology

Expert seminar on food safety, new methods of detection and typization of bacteria and the importance of controlling sanitization in food-processing plants and in the market network.

Host: Department of Biological and Biochemical Sciences
Date: 30–31 January 2019

15th RANK Conference

The conference is a forum for the exchange and transfer of practical knowledge and experience, mainly in the field of routine analysis of both human and extrahuman genome. It has become a traditional meeting of Czech and Slovak experts in the field of nucleic acids analysis by molecular biological processes.

Host: Department of Biological and Biochemical Sciences
Date: 6–7 February 2019

22th International Seminar New Trends in Research of Energetic Materials

This seminar on new trends in energy materials research is a global meeting of mainly young professionals and university teachers who work in education, research, development, processing, analysis, and applications for all types of energy materials.

Host: Institute of Energetic Materials
Date: 10–12 April 2019

21st Monitoring of Extraneous Substances in the Environment

The seminar was intended (particularly) to beginning students of doctoral degree programmes, who learned to present the results of their first research activities.

Host: Department of Analytical Chemistry
Date: 10–12 April 2019

7th International Conference on Chemical Technology 2019

The conference builds on the long tradition of chemical-technological conferences and its purpose is to present to the scientific community the key problems in chemistry and power engineering and to develop mutual awareness among experts, support discussion, and encourage cooperation between the chemical industry and academia. The topics of the conference were especially chemical technologies and materials, energy resources and environmental technologies.

Host: Czech Society of Industrial Chemistry, Faculty of Chemical Technology
Date: 15–17 April 2019

Membrane processes for sustainable development "MEMPUR 2019"

The purpose of the conference was to introduce the issue of membrane processes from basic and applied research to real membrane applications in all areas of human activity and industrial sectors.

Host: Institute of Environmental and Chemical Engineering, Czech Membrane Platform
Date: 27–30 May 2019

41st International Czech and Slovak Calorimetric Seminar

The seminar focused on the application of calorimetric methods and thermal analysis methods in various fields, both in terms of research and practice. The contributions combined thermal analysis methods and other methods applicable in material characterization. The programme included two invited presentations, the purpose of which was to give a clear overview of timeless or current topics associated with thermal analysis methods. The seminar was also attended by representatives of world leading calorimetric enterprises.

Host: Joint Laboratory of Solid State Chemistry, Department of General and Inorganic Chemistry
Date: 28–31 May 2019

6th Pharmacokinetic Seminar

Seminar for students and the profess. public focused on dissolution and dissolution testing.

Host: Department of Physical Chemistry
Date: 13–14 June 2019

26th Young Investigators' Seminar on Analytical Chemistry (YISAC 2019)

International students' conference focused on all areas of analytical chemistry. The students themselves took an active part in the conference by organizing sections and evaluating the presentations of their colleagues.

Host: Department of Analytical Chemistry
Date: 24–27 June 2019

13th International Conference on Heteroatom Chemistry (ICHAC 2019)

13th year of the International Conference on Heteroatom Chemistry (ICHAC 2019) held in Prague was a follow-up of previous successful meetings in Vancouver (2017), Caen (2015) and Kyoto (2012). According to tradition, the conference focused on all aspects of the chemistry of main group elements (in the broadest sense), on the synthesis and use of ligand heteroatoms, material chemistry of main group elements, catalytic reactions including these compounds and their biological properties, and on structural and theoretical studies of the above compounds and materials.

Host: Department of General and Inorganic Chemistry
Date: 30 June–5 July 2019

21st CSIP-PM: Conference on Special Inorganic Pigments and Powder Materials

This international conference focused on the preparation and exchange of new knowledge in the area of powder materials and inorganic pigments, their application, physical and chemical properties and methods for their evaluation, environmental aspects of production, and application of inorganic pigments. The results of scientific and research activity in the area of ceramics, ceramic surface treatment and heat-resistant materials were presented.

Host: Department of Inorganic Technology
Date: 18 September 2019

52nd Seminar on Surfactants and Detergents

Seminar on research in the field of production, analysis, and applications of surface-active substances.

Host: Department of Analytical Chemistry
Date: 6–8 November 2019

XII. Conference on Pigments and Binders

The conference focused on pigments and their applications in the construction industry, paints and plastics, and on organic binders for paints and the construction, inorganic binders for ceramics, construction, high temperature paints, etc. Attention was also on recently developed nanomaterials, special materials and technologies in the area of surface treatment.

Host: Institute of Chemistry and Technology of Macromolecular Materials, Department of Paints and Organic Coatings, CHEMAGAZÍN
Date: 11–12 November 2019

15th Sensing in Electroanalysis

Seminar for partners cooperating in European projects aimed at electroanalysis.

Host: Department of Analytical Chemistry
Date: 12–16 November 2019

4. Practical Cooperation

4.1 Practical Cooperation in Education

In the long-term, the Faculty has been involved in practical cooperation with industrial enterprises through several basic activities. The same applied in 2019.

Practical cooperation in the area of education was achieved through:

- Placement of students of all forms of study in industrial enterprises and research institutions,
- Excursions of students in production enterprises, research institutions, and specialized departments,
- Student internships (mandatory internship defined by the study plan),
- Membership of experts from industry and research in the FChT Scientific Board,
- Membership of experts from industry and research in Doctoral Subject Area Boards,
- Appointment of experts from practice in State Final Examination Boards and Dissertation Committees,
- Lectures given by prominent experts from practice; this applies especially to courses in which students learn about real technological procedures and processes,
- Single lectures given by experts from practice for students of all levels of study.

In 2019, student placements in industrial enterprises took place especially in Synthesia, a.s., Pardubice and Výzkumný ústav organických syntéz, a.s., Pardubice. These placements allowed students to experience a broader spectrum of research and production. Students from the Department of Biological and Biochemical Sciences had their practical training in hospitals and healthcare institutions throughout the Czech Republic.

Completion of placements increases students' chances on the labour market after completion of study.

In 2019, the departments and institutes of the Faculty of Chemical Technology organized student excursions in production plants and research and scientific institutions. The following table provides an overview of excursions carried out in 2019.

Excursions carried out in 2019

Department/institute organizing the excursion	Visited production plant, company, institution	Number of students
KOAnCh	Glazura, s. r. o., Roudnice nad Labem	8
	Sklárna Janštejn, s. r. o., Horní Dubenky	6
	Crystalex CZ, s. r. o., Nový Bor	14
	TDK Electronics, s. r. o., Šumperk	16
ÚOChT	Contipro, a. s., Dolní Dobrouč	25
KAlCh	Pardubický pivovar, a. s.	28
	ALBA plus, s. r. o., Pardubice	20
	Bioanalytika CZ, s. r. o., Chrudim	11
	EMPLA AG, s. r. o., Hradec Králové	5
ÚChTML	Temelín Nuclear Power Station	4
	International Engineering Fair Brno	3
	Pleas, a. s., Havlíčkův Brod	6

	Glanzstoff, s. r. o., Lovosice	11
	Synthesia, a. s., Pardubice	2
	Juta, a. s., Dvůr Králové nad Labem	7
	TE Connectivity, branch Tyco Electronics EC Trutnov, s. r. o.	10
ÚEnviChI	SLP testing apparatus – Centrum toxikologie, ekotoxikologie a analytiky, VÚOS a. s., Rybitví	8
	BČOV, Pardubice, Rybitví	13
	Ekotoxikologie, VÚOS a. s., Rybitví	8
	EMPLA AG spol. s r. o., Hradec Králové	6
	Transform, a. s., Lázně Bohdaneč	6
	ČOV Vamberk	9
KEMCh	Česká rafinerská, a. s., branch Kralupy nad Vltavou	24
	Procter & Gamble – Rakona, s. r. o., Rakovník	24
	Jeviněvské vinařství	24
	Glazura, s. r. o., Dobříň	24
	Polabské mlékárny, a. s., Milko, Poděbrady	24
	JUSDA Europe, s. r. o., Pardubice	7
	Synthesia, a. s., Pardubice	7
KPF	OTK GROUP, a. s., Kolín	7
	Amcor Flexibles, s. r. o., Nový Bydžov	11
	Tiskárny Havlíčkův Brod, a. s., Havlíčkův Brod	15
	H+K tisk, s. r. o., Chrudim	15
KAnT	Synthesia, a. s., Pardubice	4
	Glazura, s. r. o., Roudnice nad Labem	7
ÚEnM	Sellier-Bellot, Vlašim	9
	Austin Detonator, a. s.,Vsetín	9
	Kayaku Safety Systems, a. s., Vsetín	9
	Explosia, a. s., Pardubice	2
KFCh	Zentiva Group, a. s., Prague	11

4.2 Practical Cooperation in Science and Research

In 2019, the activities of the following joint institutes successfully continued:

- Joint laboratory of membrane processes, MEGA, a.s., Stráž pod Ralskem and University of Pardubice (SLMP),
- Joint laboratory of polymer analysis and assessment, SYNPO, a.s., Pardubice and University of Pardubice, Faculty of Chemical Technology (SLAP),
- Joint institution of applied medicine, Pardubice Hospital and Faculty of Chemical Technology (SPAM).

Further continuation of active work of these joint institutes remains vital for the development of research and scientific work of the Faculty departments. The institutes are systematically involved in the scientific and research activities of the Faculty and in the process of education. They are equipped with adequate instrumentations, which is gradually renewed and upgraded. The SPAM joint institution successfully continues its activities, which remain focused on increasing the quality of the process of education in master's degree programmes.

The Faculty also cooperates with industrial enterprises, research institutions and hospitals. It would be impossible to list al partners involved in various projects of the Faculty departments, whether in terms of basic or applied research, implemented by means of joint teams of investigators and additional activity. Undoubtedly, this form of collaboration in addressing the current issues in industrial and application practice also contributes to the scientific and research development of the Faculty and its students, and must be paid due attention.

In 2019, the Faculty of Chemical Technology participated in TA CR projects, projects funded by sectoral providers, and contract projects for a number of enterprises and research institutions. The following table presents an overview of joint applied research projects.

Cooperation of the Faculty with enterprises and research institutions on joint projects

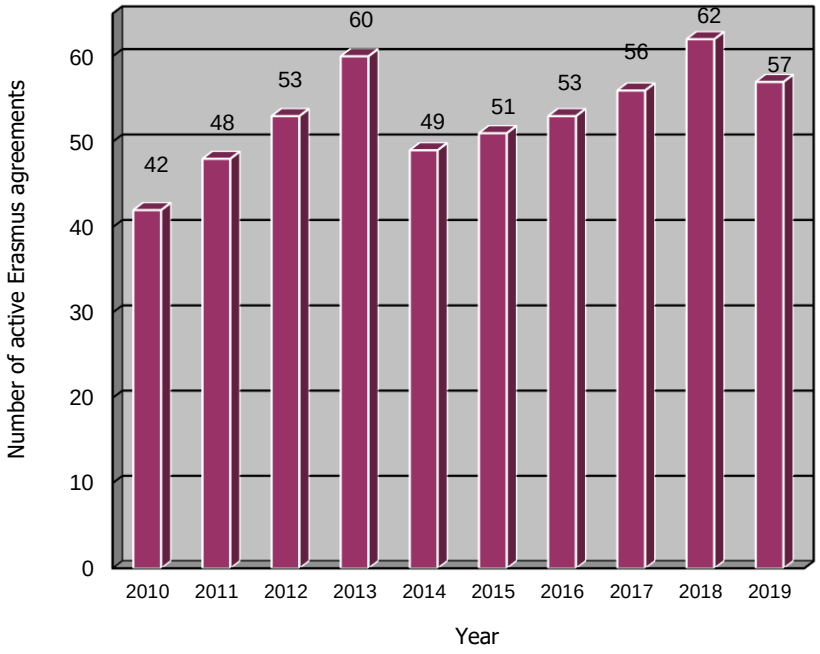
Partner firm/institution — projects funded by TA CR	Partner firm/institution — projects funded by sectoral providers
Aircraft Industries, a. s., Kunovice	Applycon, s. r. o., Dobřany
ASIO, s. r. o., Brno	Austis, a. s., Prague
Cayman Pharma, s. r. o., Neratovice	Barvy a laky TELURIA, s. r. o., Letovice
CEITEC, Brno	Bochemie, a. s., Bohumín
Centrum organické chemie, s. r. o., Pardubice	CICERO Stapro Group, s. r. o., Pardubice
COLORLAK, a. s., Staré Město	Color Spektrum, a. s., Hodonín
Contipro Pharma, a. s., Dolní Dobrouč	Czech Proof House for Arms and Ammunition, Prague
Česká membránová platforma, z. s., Česká Lípa	Explosia, a. s., Pardubice
CTU Prague	Explosia, a. s., Pardubice, VÚPCh
Diamo, s. p., Stráž pod Ralskem	University Hospital Olomouc
Ecocoal s. r. o., Ostrava	University Hospital Hradec Králové
Explosia, a. s., Pardubice	GEMA, s. r. o., Pardubice
FOTON, s. r. o., Nová Paka	Graz University of Technology
GALATEK, a. s., Ledeč nad Sázavou	Holding Contipro, a. s., Dolní Dobrouč
Holzbecher, s. r. o., barevna a bělidlo Zlíč	Innogy Energo, s. r. o., Teplárna Náchod, Náchod
Honeywell Aerospace, s. r. o., Olomouc	Masaryk Institute of Oncology (MOÚ), Brno
INOTEX, s. r. o., Dvůr Králové nad Labem	MEGA, a. s., Stráž pod Ralskem
Invaz, s. r. o., Trutnov	MemBrain, s. r. o., Stráž pod Ralskem
K2pharm, s. r. o., Opava	NOVATISK, a. s., Blansko
Ligum, s. r. o., Jablonec nad Nisou	Pardam, s. r. o., Roudnice nad Labem
KOMFI, spol. s r.o., Lanškroun	Pardubice Regional Hospital
Masaryk University Brno	Poličské strojírny, a. s., Polička
OTK GROUP, a. s., Kolín	Departments of the Ministry of the Interior of the Czech Republic
OPTAGLIO, s. r. o., Husinec-Řež	SPUR, a. s., Zlín
PARDAM, s. r. o., Pardubice	Stavební chemie, a. s., Slaný
SOMA, s. r. o., Lanškroun	Synpo, a. s., Pardubice
SVÚOM, s. r. o., Prague	Synthesia, a. s., Pardubice
Synpo, a. s., Pardubice	ŠKODA AUTO, a. s., Mladá Boleslav
Synthesia, a. s., Pardubice	TOSEDA, s. r. o., Staré Čívice
Teramed, s. r. o., Prague	Charles University, Faculty of Medicine, Hradec Králové
UniCRE, Center for Research and Education, a. s., Ústí nad Labem	Institute of Analytical Chemistry, Czech Academy of Sciences, Brno
Tomas Bata University in Zlín	Institute of Macromolecular Chemistry, Czech Academy of Sciences, Prague
VITON, s. r. o., Veselí nad Lužnicí	UCT Prague, Faculty of Food and Biochemical Technology
UCT Prague, Faculty of Chemical Engineering	BUT Brno
UCT Prague, Faculty of Food and Biochemical Technology	Výzkumný ústav organických syntéz, a. s., Pardubice
BUT Brno	Crop Research Institute, Prague
Výzkumný ústav anorg. chemie, a. s., Ústí nad Labem	Research Institute for Building Materials, a. s., Brno
Výzkumný ústav bramborářský, s. r. o., Havlíčkův Brod	
Forest and Game Management Research Institute, Opočno	
Výzkumný ústav organických syntéz, a. s., Pardubice	
VZLÚ, a. s., Prague-Letňany	
ZVVZ MACHINERY, a. s., Milevsko	

Partner firm/institution — contract research projects
ASIO, spol. s r. o., Brno
AVX Czech Republic, s. r. o., Lanškroun
BG SYS HT, s. r. o., Pardubice
BOCHEMIE, a. s., Bohumín
Contipro, a. s., Dolní Dobrouč
DEZA, a. s., Valašské Meziříčí
ECO-TREND PLUS, s. r. o., Prague
EKOMOR, s. r. o., Lískovec
Ekotech ochrana ovzduší, s. r. o., Všestary
Explosia, a. s., Pardubice
Fatra, a. s., Napajedla
GEOTEST, a. s., Brno
Glanzstoff Bohemia, s. r. o., Lovosice
GrapheneUP SE, Tuřany u Slaného
HE3DA, s. r. o., Prague
Huhtamaki Česká republika, a. s., Přibyslavice
Chemotex Děčín, a. s., Boletice nad Labem, Děčín
IQ Structures, s. r. o., Husineč - Řež
KRUŽÍK, s. r. o., Kroměříž
Lachepra, s. r. o., Pardubice
Lučební závody Draslovka, a. s., Kolín
ManukaMed Ltd. Partnership, Masterton, Nový Zéland
Metrohm, s. r. o., Prague
Mondi Štětí, a. s., Štětí
Papcel, a. s., Litovel
PARDAM, s. r. o., Pardubice
PATVAG, s. r. o., Brankovice
PLEAS, a. s., Havlíčkův Brod
PRECHEZA, a. s., Přerov
SAINT GOBAIN ADFORS CZ, s. r. o., Litomyšl
SINPOL, s. r. o., Starý Kolín
SPM – Security Paper Mill, a. s., Prague
Synpo, a. s., Pardubice
ŠKODA AUTO, a. s., Mladá Boleslav
Tomil, s. r. o., Vysoké Mýto
Toray Textiles Central Europe, s. r. o., Prostějov
VCI Brasil Indústria Ltda., Bauru, São Paulo, Brazílie
VÚOS, a. s., Pardubice
VVUÚ, a. s., Ostrava – Radvanice
Zentiva Group, a. s., Prague

5. International Cooperation

5.1 International Cooperation in Education

An important activity in the field of international cooperation of the Faculty in the area of education and science is involvement of employees and students in the ERASMUS+ and CEEPUS programmes. The total number of inter-institutional agreements in 2019 was 57. In the framework of ERASMUS+, a total of 11 teachers' mobilities took place (allocated amount 3,468 EUR) and 15 students' mobilities lasting for a total of 53.5 months (allocated amount 22,461 EUR). An overview of active agreements is shown in the figure below.



Overview of the number of active bilateral ERASMUS agreements concluded by FChT between 2010 and 2019

Involvement in Erasmus+ programme in 2019

Indicator	Erasmus 2017	Erasmus 2018	Erasmus 2019
Number of outgoing students	27	14	15
Number of incoming students	34	14	26
Number of outgoing academic employees	7	11	11
Number of incoming academic employees	9	7	3

Mobilities of students and academic staff including financial costs in 2019

	Students*			**Academic employees***		
	Number of mobilities	Student/ month	Costs in EUR	Number of mobilities	Academic employee/ week	Costs in EUR
Total	15	53.5	22,461	11	12	3,468

*) EU funding

Inter-institutional agreements with partner institutions (with some partners more than one agreement is concluded)

B	University College Arteveldehogeschool
D	Eberhard Karls Universität Tübingen
D	Friedrich-Schiller-Universität Jena
D	Technische Universität München
D	Technische Universität Chemnitz
DK	University of Southern Denmark
E	Universidad de Burgos
E	Universidad de Huelva
E	Universidad de Jaen
E	Universitat Jaume I
E	Universidad de Málaga
E	Universidad de Sevilla
E	University of the Balearic Islands
F	Université de Lorraine
F	Université des Sciences et Technologies de Lille I
F	Université de Rennes I
F	École Nationale Supérieure de Techniques Avancées Bretagne
G	University of West Attica (2 agreements)
G	National and Kapodistrian University of Athens
G	University of Piraeus
G	Agriculture University of Athens (2 agreements)
HR	University of Dubrovnik
HR	University of Zagreb
HU	University of Debrecen
HU	University of Dunaújváros
I	Universita Degli Studi di L'Aquilla
I	Universita Degli Studi di Modena e Reggio Emilia
I	University of Turin
LT	Kauno Kolegia
LT	Klaipeda University
LV	Riga Technical University
N	NTNU – Norwegian University of Science and Technology
NL	Hanzehogeschool Groningen
P	Universidade de Aveiro
P	University of Coimbra
P	Universidade da Madeira
P	Universidade do Minho
P	University of Viseu
PL	Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie
PL	Uniwersytet Łódzki
PL	Uniwersytet Mikołaja Kopernika w Toruniu
PL	Uniwersytet Marii Curie-Skłodowskiej (2 agreements)
PL	Uniwersytet Rolniczy im. Hugona Kołłątaja w Krakowie
PL	Zachodniopomorski Uniwersytet Technologiczny w Szczecinie
PL	University of Warsaw
PL	Military University of Technology
RO	Universitatea Transilvania din Brasov
RO	Military Technical Academy of Bucharest
RS	University of Novi Sad
S	Umea University
SF	Abo Akademi Turku
SI	Univerza v Ljubljani (2 agreements)

SK	Technical University of Košice (2 agreements)
SK	Slovak University of Technology in Bratislava (2 agreements)
TR	Ankara University
TR	Canakkale Onsekiz Mart University
TR	Marmara University
TR	Mersin University

In 2019 the Faculty was involved in two networks under the CEEPUS programme ("Central European Exchange Program for University Studies"); the mobilities are specified below.

Mobilities of students and academic staff including financial costs in 2019 in the CEEPUS programme

Programme	CEEPUS 2015	CEEPUS 2016	CEEPUS 2017	CEEPUS 2018	CEEPUS 2019
Number of projects	3	3	4	3	2
Number of outgoing students	3	2	1	4	0
Number of incoming students	9	2	13	6	19
Number of outgoing academic employees	6	4	2	16	5
Number of incoming academic employees	9	6	10	21	19
Funding (EUR)	10,971	5,666	13,465[1]	16,327[2]	17,965[3]

[1]) 12,933 EUR incoming – FChT contracts, 532 EUR outgoing – Rector's Office contract
[2]) 13,913 EUR incoming – FChT contracts, 2,414 EUR outgoing – Rector's Office contract
[3]) 16,970 EUR incoming – FChT contracts, 997 EUR outgoing – Rector's Office contract

In 2019 FChT had two CEEPUS networks:

- CIII-CZ-0212 — Ing. Radovan Metelka, Ph.D.
- CIII-RS-0704 — Ing. Ondrej Panák, Ph.D.

5.2 International Cooperation in Research and Development

The Faculty is involved in research and development programmes aimed at the development of international cooperation. The Faculty investigated and applied for projects funded by both domestic providers to promote bilateral cooperation and grants from international providers. Specifically, in 2019 the Faculty investigated two projects funded under Horizon 2020 — EU Framework Programme for Research and Innovation.

European Research Council (ERC) Project

Since 2015 FChT has been the host institution of the prestigious European Research Council grant for excellent young scientists (ERC Starting Grant) who demonstrate significant potential of independence and a convincing original scientific plan. Research activities under the CHROMTISOL grant focus on a new generation of hybrid photovoltaic cells, which will ensure more efficient conversion of solar energy to electrical energy. The total amount of support awarded under Horizon 2020 amounts to 1.7 million EUR.

LoveFood2Market Project

The other project funded by Horizon 2020 is a consortium project LoveFood2Market. In the context of this project, the Faculty cooperates with leading European research centres in France, Germany, and Greece under the leadership of the Institute of Molecular Biology and Biotechnology FORTH in Greece. The project builds on successful cooperation established under the 7th EU Framework Programme and focuses on the development of new methods for capturing potentially pathogenic bacteria in milk products.

The Faculty continues successful cooperation with a number of foreign institutes. The results of this cooperation are many joint publications and presentations at international conferences. The mobility of the employees of the Faculty in the context of international cooperation required, inter alia, costs for international travel, which in 2019 amounted to **252,538 EUR**. A large part of these costs was paid by sources other than budgetary appropriations, which clearly illustrates the Faculty's high activity in the area of presentations at international conferences and in the area of direct scientific cooperation with foreign partners.

Payment of international travel (in EUR)

Year	2013	2014	2015	2016	2017	2018	2019
Costs of international travel	316,061	352,101	243,478	228.090	207,087	254,927	252,538

The structure of the sources for international travel in 2019 is shown in the following table.

Sources of financing of international travel in 2019

Source of financing	Funding in EUR
Basic funding (including participation in ZG and KO), development of research organization	107,123
Specific science	18,890
Developmental projects of MEYS	0
Other main activities	1,810
Other science of MEYS	6,808
R+D GA CR	42,227
R+D Extra-budgetary grants	12,279
R+D Foreign grants	29,595
R+D Other types of scientific cooperation	2,676
OP RDE	31,129
Licence study	0
Contract research	0
Total	**252,537**

Last year, the Faculty implemented programmes to support international collaboration in science and research, which significantly contributed to increasing the quality of scientific and research work. An overview of the projects is shown in the following table.

International science and research collaboration projects

Project Number	Investigator	Funding in EUR	Provider/Programme
N62909-16-1-2088	Pachman Jiří, Ing., Ph.D.	8,962	ONRG/Support for the organization of international seminar
638857	Macák Jan, Dr.-Ing.	272,800	EU/Horizont2020
687681	Bílková Zuzana, Prof. RNDr., Ph.D.	13,120	EU/Horizont2020
EHP-CZ-ICP-1-002	Vávra Jan, Ing., Ph.D.	12,987	DZS/EEA and Norway Grants
8JCH1003	Syrový Tomáš, Doc. Ing., Ph.D.	1,650	MEYS/Czech-Chinese Mobility Programme

A considerable share in international activities of the Faculty and its departments is represented by agreements on cooperation concluded with foreign universities and institutions.

Agreements concluded between the Faculty of Chemical Technology and foreign universities and institutions

Foreign University/Institution	City	Country	Date of conclusion of agreement
Karl-Franzens Universität	Graz	Austria	1993
Cairo University	Giza	Egypt	1993
South Valley University	Qena, Aswan	Egypt	2001
Martin Luther University	Halle	FRG	1996
Eberhard-Karls-Universität Tübingen	Tübingen	FRG	2004
National Institute of Chemistry	Ljubljana	Slovenia	1994
University of Ljubljana	Ljubljana	Slovenia	1998
Technical University of Szczecin (currently West Pomeranian University of Technology)	Szczecin	Poland	1998
Military University of Technology	Warsaw	Poland	2000
Brodarski Institut Zagreb	Zagreb	Croatia	2000
Technical University of Košice	Košice	Slovakia	2000
Institute of Industrial Organic Chemistry	Warsaw	Poland	2001
Institute of Problem of Chemical Physics, Russian Academy of Sciences	Chernogolovka	Russia	2001
Institut of Chemistry	Vilnius	Lithuania	2001
M.V. Lomonosov Moscow State Academy of Fine Chemical Technology	Moscow	Russia	2002
China Academy of Engineering Physics	Mianyang	China	2004
National Institute for Material Science	Tsukuba	Japan	2009
Kumamoto University	Kumamoto	Japan	2015
Xian Modern Chemistry Research Institute	Xi'an	China	2015
The University of Arizona	Tucson	USA	2001
Austin Peay State University	Clarksville	USA	2013
Tennessee Tech University	Cookeville	USA	2016
Matsumoto University	Matsumoto	Japan	2006
National Research Center	Giza	Egypt	2015
Central Electrochemical Research Institute	Karaikudi	India	1998
Alexander Dubček University of Trenčín	Trenčín	Slovakia	2011
Samara State Technical University	Molodogvardeiskaya	Russia	2017
Institute of Optical Materials and Technologies	Sofia	Bulgaria	2017

These agreements resulted in many projects supporting especially teachers' and students' mobility. In addition to agreements concluded by the Faculty, there are also university agreements for example with the University of Rennes I, Rennes, France, Belarusian State Technological, Minsk, Belarus, Toyota Technological Institute, Nagoya, Japan, Friedrich-Schiller-Universität, Jena, Germany, Saint-Petersburg University, Russia, Nanyang Technological University, Singapore, Alexander Dubček University of Trenčín, Slovakia, Kyoto Prefectural University of Medicine, Kyoto, Japan, Yeungnam University, Gyeongsan, Republic of Korea, Gulbarga University, Karnataka, India, VNU — University of Sciences, Hanoi, Vietnam, Institute of Chemistry — Vietnam Academy of Science and Technology, Hanoi, Vietnam, who also cooperate with a number of departments and institutes at FChT.

6. Projects and Grants Implemented at FChT

6.1 GA CR, TA CR, IDC and Other Sectoral Projects

Department of General and Inorganic Chemistry

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
17-08045S	Getting stronger together: exo-substituted heteroboranes and their adducts as suitable motifs for exploration of non-covalent interactions	GA CR	Růžičková Zdeňka, Ing., Ph.D.
17-10377S	Multideprotonable, ambiphilic and hybrid ligands with electron pool suitable for complexation of various low valent metals	GA CR	Růžička Aleš, Prof. Ing., Ph.D.
18-01976S	New prospective phosphate and borophosphate glasses and glass-ceramics	GA CR	Mošner Petr, Prof. Ing., Dr.
18-10222S	From simple precursors to unprecedented heterocyclic systems containing heavier Group 15 elements	GA CR	Dostál Libor, Doc. Ing., Ph.D.
18-12761S	Thermoelectric magnetic sulfides	GA CR	Kucek Vladimír, Ing., Ph.D.
19-11814S	Laser micro-patterning of the high-refractive index glasses	GA CR	Knotek Petr, Ing., Ph.D.
19-17156S	Chemistry of globular shaped hydrocarbons with boron-cage scaffolding inside the methylated sheath	GA CR	Růžičková Zdeňka, Ing., Ph.D.
TA CR projects			
TE01020022	Flexible printed microelectronics based on organic or hybrid materials, FLEXPRINT	TA CR	Wágner Tomáš, Prof. Ing., DrSc.
TH02010197	Modern cyclization reactions	TA CR	Jambor Roman, Prof. Ing., Ph.D.
TH04010080	Functional dyes for security printing	TA CR	Růžička Aleš, Prof. Ing., Ph.D.
TH04010146	Polyglycerine production and its utilisation at the production of alkyds, polyesters and polyurethanes	TA CR	Růžička Aleš, Prof. Ing., Ph.D.
GAMA02/005	Modification of technically significant oligo/polyols by means of sophisticated esterification	TA CR	Růžička Aleš, Prof. Ing., Ph.D.
GAMA02/011	Non-volatile memory based on resistance switching in thin layers of chalcogenides	TA CR	Wágner Tomáš, Prof. Ing., DrSc.
Ministry of Industry and Trade (MIT) Grants			
FV10240	Catalyzed aerobic oxidation in the industry	MIT	Jambor Roman, Doc. Ing. Ph.D.
FV40362	Production technology for vinylchloroformate for advance materials	MIT	Růžička Aleš, Prof. Ing., Ph.D.
Internal Development Competition (IRS) Projects			
IRS_2019_002	Modernization of the educational potential of student laboratory	MEYS	Vinklárek Jaromír, Prof. Ing., Dr.

Institute of Chemistry and Technology of Macromolecular Materials

Project Number	Project Title	Provider	Investigator for FChT UPa
TA CR Projects			
TH02010140	New biocide water-based binders and coatings for exterior and interior hygienic applications	TA CR	Kalendová Andréa, Prof. Ing., Dr.
GAMA02/008	New ecological drying systems based on complex vanadium compounds	TA CR	Kalenda Petr, Prof. Ing., CSc.
FV40136	Innovative increase of the utility properties and resistance of ammunition from combustible mass	MIT	Filipi Michaela, Ing., Ph.D.
TE02000011	Research center of surface treatment	TA CR	Večeřa Miroslav, Ing. CSc.
Internal Development Competition (IRS) Projects			
IRS_2019_010	Implementation of infrared spectroscopy into laboratory courses of the field Organic Coatings and Paints	MEYS	Honzíček Jan, Ing., Ph.D.

Department of Economy and Management of Chemical and Food Industry

Project Number	Project Title	Provider	Investigator for FChT UPa
Internal Development Competition (IRS) Projects			
IRS_2019_003	Creating subjects of "Forecasting in Business Management" and "Business Operations" in the newly accredited Master's Degree Programme "Economy and Management of Chemical Industry Enterprises"	MEYS	Paták Michal, Ing., Ph.D.
IRS_2019_004	Innovation of Enterprise Resource Planning system and Logistics for newly accredited study programmes at the Department of Economy and Management of Chemical and Food Industries	MEYS	Košťálová Jana, Ing., Ph.D.
Other projects			
EHP-CZ-ICP-1-002	Innovation of Education Methods and Skills at the University of Pardubice - INEMSUP	DZS	Vávra Jan, Ing., Ph.D.

Institute of Applied Physics and Mathematics

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
16-07711S	A systematic study of Schottky barrier height effect on energy filtering of electrons in thermoelectric nanocomposites	GA CR	Drašar Čestmír, Prof. Ing., Dr.
19-16315S	Exploration of electronic states of transition metals in tetradymites and their band structure – comparison of 3d, 4d and 5d elements	GA CR	Navrátil Jiří, Ing., CSc.
Internal Development Competition (IRS) Projects			
IRS_2019_012	Software modernization and implementation of new laboratory works and demonstration experiments for subject of the Laboratory Exercise of Physics	MEYS	Sajdlová Světlana, Mgr.

Institute of Organic Chemistry and Technology

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
17-08499S	Recyclable catalysts for sustainable technologies of advanced organic intermediates	GA CR	Sedlák Miloš, Prof. Ing., DrSc.
17-21105S	Multi-photon absorbing Materials FOR 3D fabrication and 3D imaging (M-FOR-3D)	GA CR	Imramovský Aleš, Doc. Ing., Ph.D.
18-03847S	Pseudopeptide proteasome inhibitors	GA CR	Imramovský Aleš, Doc. Ing., Ph.D.
18-03881S	Selenide-based 2D nanomaterials by atomic layer deposition with exciting properties	GA CR	Bureš Filip, Prof. Ing., Ph.D.
19-22783S	Molecular materials: towards breaking Shockley-Queisser limit	GA CR	Imramovský Aleš, Doc. Ing., Ph.D.
TA CR Projects			
GAMA02/002	Optimizing the structure and preparation of pyrazine-2,3-dicarbonitrile photoredox catalysts	TA CR	Bureš Filip, Prof. Ing., Ph.D.
Ministry of Industry and Trade (MIT) Projects			
FV30048	New additives for multifunctional modification of polymer surfaces	MIT	Hrdina Radim, Prof. Ing., CSc.
OP RDE Projects			
CZ.02.1.01/0.0/0.0/16_025/0007445	Organic redox couple-based batteries for energetics of traditional and renewable resources	MEYS	Bureš Filip, Prof. Ing., Ph.D.

Department of Analytical Chemistry

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
18-12204S	Characterization of human lipidome and metabolome for personalized healthcare and biomarker discovery: case study of kidney cancer	GA CR	Holčapek Michal, Prof. Ing., Ph.D.
18-14893S	Focusing effects in multidimensional liquid phase separations	GA CR	Česla Petr, Doc. Ing., Ph.D.
19-03160S	Electrochemical study on new artificial enzymes and their role in sensing of neurotransmitters	GA CR	Mikysek Tomáš, Ing., Ph.D.
Internal Development Competition (IRS) Projects			
IRS_2019_006	The implementation of new task for laboratory practice C513 - Laboratory of Food Analysis	MEYS	Adam Martin, Doc. Ing., Ph.D.
Ministry of Industry and Trade (MIT) Projects			
FV10487	Preservatives for writing inks	MIT	Ventura Karel, Prof. Ing. CSc.
Ministry of the Interior (MI) Grants			
VI20152020004	Identification of residues of improvised explosives using physico-chemical analytical methods under real conditions	MI	Ventura Karel, Prof. Ing. CSc.

Department of Biological and Biochemical Sciences

Project Number	Project Title	Provider	Investigator for FChT UPa
IRS projects			
IRS_2019_013	The determination of mandelic acid in human urine	MEYS	Žáková Pavla, Mgr., Ph.D.
TA CR Projects			
TJ02000134	Removal of polyfluorinated acids from contaminated materials using chemical degradation	TA CR	Šilha David, Ing., Ph.D.
OP RDE Projects			
CZ.02.1.01/0.0/0.0/17_048/0007421	Strengthening of interdisciplinary cooperation in the research of nanomaterials and their effects on living organisms.	MEYS	Bílková Zuzana, Prof. RNDr., Ph.D.
CZ.02.1.01/0.0/0.0/18_069/0010054	IT4Neuro	MEYS	Roušar Tomáš, Doc. RNDr., Ph.D.

Institute of Environmental and Chemical Engineering

Project Number	Project title	Provider	Investigator for FChT UPa
GA CR Grants			
17-03868S	New methods of electrochemical monitoring of biologically active organic compounds in environmental, biological and food matrices	GA CR	Šelešovská Renáta, Doc. Ing., Ph.D.
TA CR Projects			
TH02010762	Supplements for the positive effects on the human microbiome	TA CR	Kořínková Jaroslava, Ing., Dr.
TH02030823	Development of methodological-technical procedures, minimizing the impacts of forest management on the quality of groundwater as a result of the migration of excess reactive nitrogen and phosphorus	TA CR	Slezák Miloslav, Ing., CSc.
TH03030260	Biocomposite component for slow release of active minerals in soil for plant nutrition	TA CR	Slezák Miloslav, Ing., CSc.
TH02030200	Efficient removal of aromatic halogenderivatives (AOX) from the local industrial sources	TA CR	Weidlich Tomáš, Doc. Ing., Ph.D.
Ministry of Industry and Trade (MIT) Projects			
FV40062	Zero liquid discharge of industrial waste water using electrodialysis	MIT	Doleček Petr, Doc. Ing., CSc.

Department of Physical Chemistry

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
17-07642S	Unfeasible molecular frameworks: properties and applications	GA CR	Bulánek Roman, Prof. Ing., Ph.D.
17-20737S	Advanced analysis of the relationship between optical/electron/textural/ structural properties of TiO_2 doped materials and its photocatalytic activity	GA CR	Čapek Libor, Prof. Ing., Ph.D.
17-11753S	Kinetic analysis of complex physico-chemical processes	GA CR	Svoboda Roman, Ing., Ph.D.

19-00669S	The relations between activity and structure of Mg-Al/Fe mixed oxides including post-treatment for transesterification and Guerbet reaction	GA CR	Hájek Martin, Doc. Ing., Ph.D.
19-19542S	A structure-based predictive model for Brønsted acid catalyzed reactions	GA CR	Bulánek Roman, Prof. Ing., Ph.D.
19-22978S	Quantifying the basicity of reconstructed layered double hydroxides and correlating this with their performance in base-catalysed reactions	GA CR	Čapek Libor, Prof. Ing., Ph.D.
Internal Development Competition (IRS) Projects			
IRS_2019_014	Tablets preparation using 3D printing	MEYS	Komersová Alena, Doc. Ing., Ph.D.

Joint Laboratory of Solid State Chemistry

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
17-10639S	Nanoparticles of selected layered compounds as precursors for nanocomposites and inorganic-organic hybrid materials	GA CR	Beneš Ludvík, Doc. Ing., CSc.
TA CR Projects			
TH02020201	New generation of functionally modified layered nanoparticles with improved manipulation and processing in polymeric matrix	TA CR	Beneš Ludvík, Doc. Ing., CSc.

Institute of Energetic Materials

Project Number	Project Title	Provider	Investigator for FChT UPa
Ministry of Industry and Trade (MIT) Projects			
FV10332	Advanced chemical gas generators, not only for the automotive industry	MIT	Jalový Zdeněk, Doc. Ing., Ph.D.
FV40140	Perspective methods of production and testing of emulsion explosives	MIT	Pachman Jiří, Doc. Ing., Ph.D.
TA CR Projects			
TH03020263	Propellants with increased specific impulse	TA CR	Matyáš Robert, Doc. Ing., Ph.D.
Foreign grants			
N62909-19-1-2046	Organizing of 22th annual international seminar - New Trends in Research of Energetic Materials	ONRG	Pachman Jiří, Doc. Ing., Ph.D.

Department of Graphic Arts and Photophysics

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
18-03823S	Advanced methods of fabrication of chalcogenide thin films and their modifications	GA CR	Němec Petr, Prof. Ing., Ph.D.
19-24516S	Chalcogenide films doped with rare-earth ions for gas sensing in the mid-infrared spectral region	GA CR	Nazabal Virginie, Doc., Dr.
TA CR Projects			

TH02010414	Autonomous identification system for detection and security of the products for the system Industry 4.0	TA CR	Syrový Tomáš, Doc. Ing., Ph.D.
GAMA02/004	Development of UV-cured varnish for digital varnishing machines	TA CR	Vališ Jan, Ing., Ph.D.
Internal Development Competition (IRS) Projects			
IRS_2019_009	Innovation of laboratory equipment for the branch of Graphic Arts (Department of Graphic Arts and Photophysics)	MEYS	Bouška Marek, Ing., Ph.D.
Ministry of Industry and Trade (MIT) Projects			
FV20137	Research and development of a system to support Lean Manufacturing for production processing technology in the printing industry	MIT	Němec Petr, Prof. Ing., Ph.D.
FV30065	Research and development of the integration of telemetric and analytical processes into the management of polygraphic production and the implementation of elements of industry 4.0	MIT	Němec Petr, Prof. Ing., Ph.D.
Ministry of Agriculture (MA) Grants			
QK1810010	SMARTFIELD - Autonomous acquisition of temperature and moisture data of microclima and earth for smart farming based on platform IoT	MA	Syrový Tomáš, Doc. Ing., Ph.D.
MEYS projects			
8JCH1003	Gravure-printed ammonia sensor based on 3D RGO	MEYS	Syrový Tomáš, Doc. Ing., Ph.D.

Centre of Materials and Nanotechnologies

Project Number	Project Title	Provider	Investigator for FChT UPa
GA CR Grants			
19-17997S	Amorphous to crystal (3D2D) transition in van der Waals bonded chalcogenide materials	GA CR	Krbal Miloš, Ing., Ph.D.
MEYS projects			
LM2015082	CEMNAT Research Infrastructure	MEYS	Vlček Miroslav, Prof. Ing., CSc.
OP RDE Projects			
CZ.02.1.01/0.0/0.0/ 16_013/0001829	Modernization and upgrade of the CEMNAT infrastructure	MEYS	Vlček Miroslav, Prof. Ing., CSc.
CZ.02.1.01/0.0/0.0/ 17_048/0007376	High-sensitivity sensors and low-density materials based on polymeric nanocomposites.	MEYS	Vlček Miroslav, Prof. Ing., CSc.

Faculty Projects

Project Number	Project Title	Provider	Investigator for FChT UPa
OP RDE Projects			
OP RDE - PRAKTIK: CZ.02.2.67/0.0/0.0/ 16_016/0002458	Modernization of practical teaching and innovation of practical skills in technically focused study programs	MEYS	Čapek Libor, Prof. Ing., Ph.D.

Student Grant Competition (SGS) projects at FChT in 2019

Project Number	Project title	Provider	Investigator for FChT UPa
SGS FCHT 2019			
SGS_2019_001	Advanced practices of environmental engineering and value management	UPa	Mikulášek Petr, Prof. Ing., CSc.
SGS_2019_002	Chemistry and advanced technology of new organic compounds - synthesis, characterization, reactivity, functional characteristics and their safety	UPa	Sedlák Miloš, Prof. Ing., DrSc.
SGS_2019_003	Modern instrumental methods in analysis of materials, food and biological samples	UPa	Ventura Karel, Prof. Ing., CSc.
SGS_2019_004	Special materials for chemical and pharmaceutical technology and other applications	UPa	Komersová Alena, Doc. Ing., Ph.D.
SGS_2019_005	Synthesis and study of macromolecular and supramolecular structures of materials	UPa	Bouška Marek, Ing., Ph.D.
SGS_2019_006	New inorganic materials	UPa	Koudelka Ladislav, Prof. Ing., DrSc.
SGS_2019_007	The use of modern analytical, molecular biological, microbiological and cytological methods for analysis of biological samples	UPa	Kanďár Roman, Prof. Mgr., Ph.D.

6.2 European Research Council (ERC) Project

Centre of Materials and Nanotechnologies

Project Number	Project Title	Provider	Investigator for FChT UPa
ERC			
638857	Towards New Generation of Solid-State Photovoltaic Cell: Harvesting Nanotubular Titania and Hybrid Chromophores - CHROMTISOL	EU	Macák Jan, Dr.-Ing.

6.3 Involvement in Other Projects under Framework EU Programme

Department of Biological and Biochemical Sciences

Project Number	Project Title	Provider	Investigator for FChT UPa
687681	A portable MicroNanoBioSystem and Instrument for ultra-fast analysis of pathogens in food: Innovation from LOVE-FOOD lab prototype to a pre-commercial instrument (LoveFood2Market)	EU	Bílková Zuzana, Prof. RNDr. Ph.D.

7. Academic Staff

This chapter specifies the number of academic staff of the Faculty in recent years and at the end of 2019. For comparison, the numbers of other employees are shown as well. The tables also suggest the qualification and age structure of the Faculty teachers and the trends of relevant indicators.

Recalculated number of FChT employees from 2015 until the end of 2019 (each year as of 31 December)

Year	Educational staff	Scientific staff	Other staff				Total
			Technical experts, laboratory technicians	Administration TES	Workers	Total	
2019	168.4	64.3	44.5	34.9	6.0	85.4	318.1
2018	168.8	54.2	43.6	34.4	6.0	84.0	307.0
2017	169.9	51.4	46.6	31.3	6.2	81.1	302.4
2016	171.7	48.3	43.4	28.5	6.2	78.1	298.1
2015	170.8	46.7	44.1	30.3	6.2	80.6	298.1

Qualification structure of educational staff as of 31 December of the relevant year

Working position	2015		2016		2017		2018		2019	
	F	P	F	P	F	P	F	P	F	P
Professors	37	32.1	40	33.8	40	34.1	42	36.8	40	36.1
Associate professors	43	41.1	44	42.5	45	42.3	45	41.9	47	42.4
Assistant professors	91	87.9	91	89.0	90	87.5	87	84.5	86	84.4
Assistants	12	9.8	9	6.5	9	6.0	8	5.6	9	5.5
Total	**183**	**170.9**	**184**	**171.8**	**184**	**169.9**	**182**	**168.8**	**182**	**168.8**

Note: F – physical number, P – recalculated number

Age structure of educational staff as of 31 December 2019 (number of persons)

Age	Educational staff				
	Professors	Associate professors	Assistant professors	Assistants	Researchers
Less than 29 years	0	0	0	2	18
30–39 years	0	2	27	6	31
40–49 years	10	24	43	0	13
50–59 years	9	8	10	0	4
60–69 years	11	9	6	1	2
More than 70 years	10	4	0	0	2

Average age in the groups of academic staff in recent years

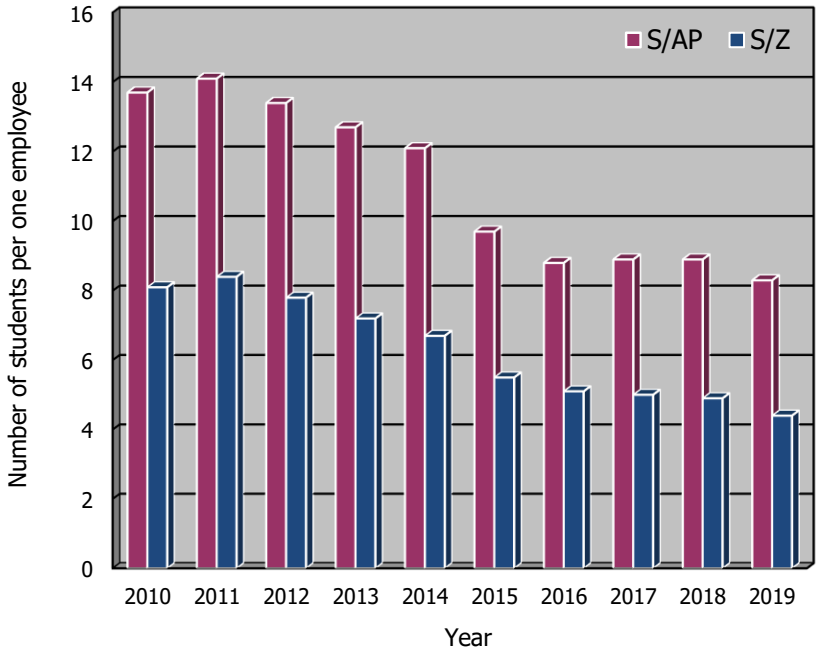
Age	Educational staff				Researchers
	Professors	Associate professors	Assistant professors	Assistants	
Average age 2015	62.4	49.9	41.9	38.8	36.4
Average age 2016	62.2	50.2	42.0	36.2	36.3
Average age 2017	62.2	50.8	42.5	35.6	37.3
Average age 2018	60.8	51.8	43.1	35.7	38.3
Average age 2019	61.3	52.3	43.8	36.7	38.2

Average age of academic staff from 2013 until the end of 2019

Year		2013	2014	2015	2016	2017	2018	2019
Average age	Educational staff	46.9	47.0	47.7	48.0	48.7	49.2	49.5
	Researchers	35.4	35.5	36.4	36.3	37.3	38.3	38.2

Number of students (S) for 1 average recalculated teacher (AP) and for 1 average recalculated employee (Z) of the Faculty

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
S/AS	13.7	14.1	13.4	12.7	12.1	9.7	8.8	8.9	8.9	8.3
S/E	8.1	8.4	7.8	7.2	6.7	5.5	5.1	5.0	4.9	4.4



Number of students (S) per one teacher (AP) and number of students per one employee of the Faculty (Z) in recent years

Habilitation procedure and professor appointment procedure

List of areas for habilitation procedure and professor appointment procedure

Names of areas for habilitation procedure and professor appointment procedure	Validity of accreditation
Analytical chemistry	until 1 November 2023
Inorganic chemistry	until 1 November 2023
Organic chemistry	until 1 November 2023
Physical chemistry	until 1 November 2023
Chemical engineering	until 1 November 2023
Chemistry and technology of inorganic materials	until 1 November 2023
Technology of organic substances	until 1 November 2023
Surface engineering	until 31 5. 2024

Ongoing habilitation proceedings in 2019

Surname, first name, title	Faculty	Field of expertise	Result of the procedure
Krupka Miloslav, Ing., Dr.	FChT	Technology of organic substances	in progress
Večeřa Miroslav, Ing., CSc.	FChT	Technology of macromolecular substances	in progress
Dohnalová Žaneta, Ing. Ph.D.	FChT	Chemistry and technology of inorganic materials	completed
Husáková Lenka, Ing. Ph.D.	FChT	Analytical chemistry	completed
Janíček Petr, RNDr. Ph.D.	FChT	Surface engineering	in progress
Bouška Marek, Ing. Ph.D.	FChT	Surface engineering	in progress

Associate professors appointed in 2019

Surname, first name, title	Faculty	Field of expertise	Effect of appointment
Dohnalová Žaneta, Ing. Ph.D.	FChT	Chemistry and technology of inorganic materials	1 January 2019
Husáková Lenka, Ing. Ph.D.	FChT	Analytical chemistry	15 October 2019

Ongoing professor appointment procedures in 2019

Surname, first name, title	Faculty	Field of expertise	Result of the procedure
Čermák Roman, Doc. Ing. Ph.D.	Faculty of Technology, TBU Zlín	Surface engineering	completed
Čermák Jan, Doc. Ing. CSc.	Faculty of Science, JEPU Ústí nad Labem	Surface engineering	in progress
Pouzar Miloslav, Doc. Ing. Ph.D.	FChT	Environmental and Chemical Engineering	in progress

Professors appointed in 2019

Surname, first name, title	Faculty	Field of expertise	Effect of appointment
Roman Čermák, Doc. Ing. Ph.D.	Faculty of Technology, TBU Zlín	Surface engineering	28 November 2019

8 Quality and Culture of Academic Life

In 2019 the Dean of the Faculty of Chemical Technology awarded the Silver Medal of Merit and the Memorial Medal of the Faculty of Chemical Technology to significant personalities, who had contributed to the development of the Faculty, its scientific and research activity, and cooperation.

The Silver Medal of Merit was awarded to the following personalities:

Prof. Ing. Marek Liška, DrSc.
For long-term cooperation in science and research

Prof. Ing. Karel Ventura, CSc.
Prof. Ing. Petr Mošner, Dr.
Prof. Ing. Petr Němec, Ph.D.
Prof. Ing. Alexandr Čegan, CSc.
Prof. Ing. Zdeněk Černošek, CSc.
Prof. Ing. Čestmír Drašar, Dr.
Prof. Ing. Radim Hrdina, CSc.
Prof. Ing. Pavel Jandera, DrSc.
Prof. Ing. Jiří Kulhánek, Ph.D.
Prof. Ing. Petr Lošťák, DrSc.
Prof. Ing. Hana Lošťáková, CSc.
Prof. Ing. Jiří Málek, DrSc.
Prof. Ing. Petr Mikulášek, CSc.
Prof. Ing. Aleš Růžička, Ph.D.
Prof. Ing. Miloš Sedlák, DrSc.
Doc. Ing. Ladislav Svoboda, CSc.
Prof. Ing. Svatopluk Zeman, DrSc.
Ing. Dr. Petr Antoš, Ph.D.
Ing. Jana Bludská, CSc.
Doc. RNDr. Jiří Dostál, CSc.
Prof. Ing. Jiří Hanika, DrSc.
Prof. Ing. Jaromír Havlica, DrSc.
Prof. Ing. Aleš Helebrant, CSc.
Ing. Josef Liška
Prof. Ing. Václav Švorčík, DrSc.
Prof. Ing. Ladislav Tichý, DrSc.
Prof. Ing. Zuzana Bílková, Ph.D.
Prof. Ing. Ján Šajbidor, DrSc.
Ing. Josef Tichý, CSc.
For membership in the Scientific Board between 2015 and 2019

Ing. Bohumil Bernášek
For significant contribution in the field of promotion and popularization of chemistry

Ing. Olga Marečková
For significant contribution in the field of promotion and popularization of chemistry

Ing. Jan Ptáček
For significant contribution in the field of promotion and popularization of chemistry

Prof. MUDr. Josef Fusek, DrSc.
For outstanding cooperation between faculties

The Memorial Medal of the Faculty of Chemical Technology was awarded to the following personalities:

RNDr. Hana Nečasová
For increasing students' interest in the study of chemistry

RNDr. Eva Spilková
For increasing students' interest in the study of chemistry

Mgr. Lucie Lyková
For increasing students' interest in the study of chemistry

Doc. Ing. Lenka Česlová, Ph.D.
For publication in a journal in the first decile according to the Web of Science database

Doc. Ing. Petr Česla, Ph.D.
For publication in a journal in the first decile according to the Web of Science database

Ing. Petra Kalendová, Ph.D.
For publication in a journal in the first decile according to the Web of Science database

Academic ceremonies at FChT in 2019

On 14 June 2019, the graduation ceremony of students who completed the follow-up master's degree took place. Between 3 and 7 June the graduates took their final exams and defended their master's diploma theses. The Dean of the Faculty of Chemical Technology presented the graduates from the follow-up master's degree with a graduation badge. The Dean presented the badge to a total of 121 graduates.

On 6 September 2019, the ceremonial pledge of graduates from bachelor's degree programmes was held. The Dean of the Faculty of Chemical Technology presented the bachelor's diploma to a total of 157 graduates who had taken their final exams and defended their bachelor's diploma theses between 19 and 23 August.

On 28 November 2019, the official matriculation of students enrolled in the first year of bachelor's degree at the Faculty of Chemical Technology took place.

Appreciation of FChT employees for their work in 2019

Prof. Ing. Petr Kalenda, CSc.
Commemorative Medal of the Faculty of Technology, Tomas Bata University in Zlín for long-term cooperation. The commemorative medal was awarded at the occasion of the 50th anniversary of the Faculty of Technology, Zlín, 15 April 2019.

Ing. Milan Sýs, Ph.D.
The Metrohm 2019 Award for the best young chemist's publication (chemists younger than 35 years) awarded during the 9th year of the Metrohm Award 2019 Competition was presented by METROHM Česká republika s.r.o. in cooperation with the Expert Analytical Chemistry Group and Expert Electrochemistry Group of the Czech Chemical Society at the 2019 Modern Electroanalytical Methods Seminar, Chemistry Institute, Faculty of Science, Charles University, Prague, 13 February 2020.

Doc. Ing. Tomáš Syrový, Ph.D.
"2019 Visionary" award presented by CzechInno for "Bandage sensor for the detection of the optimum moment for changing bandage materials using colours", 3 December 2019.

Prof. Ing. Svatopluk Zeman, DrSc.
Web of Science Group Award for placement in the top 1% of reviewers in terms of the number of reviews between 2018 and 2019 in the global Publons database across all disciplines, September 2019.

Award for cooperation presented at the Military University of Technology (Wojskowa Akademia Techniczna), Warszawa by the Dean of the Faculty of Advanced Technologies and Chemistry at the occasion of the 60th anniversary of the Faculty, October 2019.

Merit Badge awarded at the 100th anniversary of Czech and Slovak pyrotechnics by the Chairman of the Board of Directors of ZVS holding a.s., Dubnica nad Váhom, November 2019.

9. Activities of the Faculty and Other Affiliates

The main activities of the Faculty focus on education, science, and research. These activities are described in detail in Chapters 2 and 3 of this Annual Report. This section describes only those activities that support or develop the main activities of the Faculty or those that provide the conditions necessary for further development of the Faculty.

9.1 Publishing

An overview of university textbooks and monographs issued at FChT in 2019 is provided in Chapter 2.7 of this Annual Report. In 2019, the following proceedings were issued:

1. Scientific Papers of the University of Pardubice, Series A, Faculty of Chemical Technology, Volume 25 (2019), 82 copies.
2. Proceedings of the 22nd Seminar on New Trends in Research of Energetic Materials, 50 copies + 300 pcs CD-ROM.
3. 41st International Czech and Slovak Calorimetric Seminar — KALSEM 2019, 88 copies.
4. 21st Conference on Special Inorganic Pigments and Powder Materials, 68 copies
5. Students' scientific activity 2018/19, Proceedings, 120 copies
6. 52nd Seminar on Surfactants and Detergents, 55 copies
7. Industrial toxicology and ecotoxicology 2019, 104 copies
8. Monitoring of Extraneous Substances and Risk Assessment in the Environment, 73 copies
9. 26th Young Investigators' Seminar on Analytical Chemistry — YISAC 2019, 64 copies
10. VITATOX 2019, 70 copies
11. 19th International Nutrition & Diagnostics Conference — INDC 2019, 180 copies

In total, the FChT published 11 titles, 954 copies + 300 pcs CD-ROM.

9.2 Service Departments at FChT

In 2019 the Faculty of Chemical Technology operated a number of service departments that provided their services both to the Faculty and entities outside the Faculty. The service departments are specified below (the abbreviations in brackets identify the institutes of the Faculty where the service department is established):

- Centre of statistical analyses using SW IBM SPSS Statistics (KEMCh)
- Physical-mechanical testing laboratory for plastics, composite and textile materials (ÚChTML)
- Assessment of the properties of paper, cardboard, paperboard and cellulose (ÚChTML)
- Thermoanalytical laboratory (KAnT)
- AFM microscopy laboratory (SLChPL)
- Water analysis laboratory (ÚEnviChI)
- Centrifugal spinning laboratory (CEMNAT)
- Electron microscopy and x-ray analysis laboratory (SLChPL and KOAnCh)
- Electron microscopy, x-ray analysis, FIB and electron lithography laboratory (CEMNAT)
- Electron paramagnetic resonance laboratory (KOAnCh)

- FTIR and Raman spectroscopy laboratory (SLChPL)
- Dispersion system analysis laboratory (ÚEnviChI)
- Pigments and powder material analysis laboratory (KAnT)
- Thermoelectric material analysis laboratory (SLChPL)
- Infrared spectroscopy laboratory (CEMNAT)
- Nuclear magnetic resonance laboratory (ÚOChT)
- Organic elemental analysis laboratory (ÚOChT)
- Powder x-ray diffractometry laboratory (KOAnCh)
- Raman and infrared spectroscopy laboratory (KOAnCh)
- X-ray diffractometry laboratory (CEMNAT)
- X-ray diffractometry of mono-crystalline materials laboratory (KOAnCh)
- X-ray photoelectron spectroscopy laboratory XPS (CEMNAT)
- Rheometry laboratory (ÚEnviChI)
- Thermal analysis and optical microscopy laboratory (SLChPL)
- Measurement of temperature and thermal conductivity (ÚAFM)
- Surface and thin layer optical laboratory (ÚAFM)
- Polygraphic testing laboratory (KP)
- Thermal stability tests DTA, DSC, TGA (ÚEnM)
- Simultaneous analysis of samples using TG-GC-MS (CEMNAT)
- Micronization of samples by flow grinding (CEMNAT)
- Element analysis service (ÚEnviChI)
- Determination of electrostatic spark sensitivity (ÚEnM)
- Press services (KPF)
- Development workshops of FChT (ÚEnviChI)

10. Other Activities of FChT Staff and Students

- Involvement of the members of the academic community in the activities of various university bodies; Council of Higher Education Institutions; Governmental Office for Research, Development and Innovation; National Accreditation Bureau for Higher Education,
- Active cooperation of the Faculty representatives with scientific and research departments and participation in various professional boards, including grant commissions and work groups of relevant advisory bodies,
- Involvement of students and employees in various professional and interest organizations:

American Chemical Society,
American Society for Mass Spectrometry,
Association for Youth, Science and Technology, AMAVET, z. s., (Asociace pro mládež, vědu a techniku AMAVET, z. s.),
Association of Chemical Industry of the Czech Republic (Svaz chemického průmyslu ČR),
Association of Paint Manufacturers of the Czech Republic (Asociace výrobců nátěrových hmot),
Association of University Educators of Non-Medical Health Professions in the Czech Republic (Asociace vysokoškolských vzdělavatelů nelékařských zdravotnických profesí v ČR),
Association of the Czech Pulp and Paper Industry (ACPP), Czech Republic (Asociace českého papírenského průmyslu (ACPP)),
Association of the Pulp and Paper Industry (Společnost průmyslu papíru a celulózy (SPPC), Czech Republic, Slovak Republic,
Central European Group for Separation Sciences (CEGSS),
Czech Immunological Society (Česká imunologická společnost),
Czech and Slovak Crystallographic Association (Česká a slovenská krystalografická společnost),
Czech Association of Textile Chemists and Colourists (Spolek textilních chemiků a koloristů),
Czech Astronomical Society (Česká astronomická společnost),
Czech Chemical Society (Česká společnost chemická, z. s.),
Czech Glass Society (Česká sklářská společnost, z. s.),
Czech Marketing Association (Česká marketingová společnost),
Czech Membrane Platform (Česká membránová platforma, z. s., CZEMP),
Czech Packaging Institute (Česká obalová asociace SYBA, z. s.),
Czech Physiological Society (Česká fyziologická společnost),
Czech Society for Biochemistry and Molecular Biology (Česká společnost pro biochemii a molekulární biologii),
Czechoslovak Society for Forensic Genetics (Československá společnost pro forenzní genetiku),
Czech Society for New Materials and Technology (Česká společnost pro nové materiály a technologie),
Czech Society for Nutrition (Společnost pro výživu, z. s.),
Czech Society of Chemical Engineering (Česká společnost chemického inženýrství),
Czech Society of Clinical Biochemistry (Česká společnost klinické biochemie),
Czech Society of Cosmetology (Kosmetologická společnost České republiky),
Czech Society of Industrial Chemistry (Česká společnost průmyslové chemie),
Czech Statistical Society (Česká statistická společnost),
Czech Technology Platform for Sustainable Chemistry (Česká technologická platforma pro udržitelnou chemii),
Czechoslovak Association for Crystal Growth (Československá společnost pro růst krystalů),
Czechoslovak Microscopy Society (Československá mikroskopická společnost),
Czechoslovak Society for Microbiology (Československá společnost mikrobiologická),

Department of Human Nutrition and Food Quality CAAS (Odbor výživy obyvatelstva a jakosti potravin ČAZV),
Engineering Academy of the Czech Republic (Inženýrská akademie České republiky, z. s.),
European Chemical Society (EUCheMS),
European Defence Agency,
European Federation of Chemical Engineering, Section on Membrane Separation,
European Safety, Reliability, and Data Association (ESReDA),
European Union of Cellulose and Paper Industry (EUCEPA), EU,
Federation d'Associations de Techniciens des Industries de Peintures, Vernis, Emaux et Encres d'Imprimerie de l'Europe (FATIPEC),
Filtration Society UK,
Finalists Club of the FameLab Competition (Klub finalistů soutěže FameLab), British Council Czech Republic,
Flexographic Expert Group of the Czech Republic and Slovak Republic (Společnost tisku, z. s.),
International Adsorption Society,
International Association of Research Organizations for the Information, Media and Graphic Arts Industries (IARIGAI),
International Biographical Centre Advisory Council,
International Circle of Educational Institutes for Graphic Arts Technology and Management (IC),
International Confederation for Thermal Analysis and Calorimetry (ICTAC),
International Federation of Associations of Textile Chemists and Colourists (IFATCC),
International Humic Substances Society,
International Lipidomics Society (ILS),
International Polymer Colloids Group (IPCG),
International Pyrotechnic Society,
International Society of Electrochemistry (ISE),
International Society of Explosives Engineers,
International Zeolite Association,
IPMA Czech Rebuplic – Member of International Project Management Association,
Materials Research Society (MRS), USA,
NANOPROGRESS, z. s.,
Optical Society of America (OSA), USA,
Organic Electronics Association (OE-A),
Printing of Functional Applications Summer School - Swansea University,
Slovak Information and Marketing Company, SIMS, a. s. (Slovenská informačná a marketingová spoločnosť, a. s.),
Society for Blasting Techniques and Pyrotechnics Member (Společnost pro trhací techniku a pyrotechniku (STTP),
Society for Imaging Science and Technology,
Society of Applied Spectroscopy,
Spectroscopic Society of J. M. Marci (Spektroskopická společnost Jana Marka Marci),
Slovak company for blasting and drilling work (Slovenská spoločnosť pre vŕtacie a trhacie práce SSTVP),
Student Board of University of Pardubice (Studentská rada Univerzity Pardubice),
Students' Professional Activities SPA (Středoškolská odborná činnost SOČ),
Sustainable Development of Energy, Water and Environment Systems (SDEWES),
Technical Association of Pulp and Paper Industry (TAPPI), USA,
Technical Committee of Standardization TC142 (ÚNMZ) (Technická normalizační komise 142),
Technical Working Group of Ministry of the Environment of Czech republic, Waste Water and Waste Gas Management (Technická pracovní skupina MŽP, Nakládání s odpadními vodami a odpadními plyny),
The Comenius Academic Club,
The Electrochemical Society, Inc.,
The European Membrane Society,

The European Society of Rheology,
TJ Tesla Pardubice,
Union of Czech Mathematicians and Physicists (Jednota českých matematiků a fyziků), Pardubice,
Union of Polygraphic Businessmen (Svaz polygrafických podnikatelů),
University of Pardubice, Art Ensemble (Vysokoškolský umělecký soubor Pardubice),
University of Pardubice, Sports Club (Univerzitní sportovní klub, z. s., Pardubice),
University of Pardubice, Trade Union (Vysokoškolský odborový svaz Univerzity Pardubice).

- 14 major events of a scientific and educational nature, seminars and conferences organized and co-organized by the Faculty departments (overview provided in Chapter 3.4),
- Participation of the Faculty employees in similar events focused on education, science, and research both in the Czech Republic and abroad,
- Open days for potential applicants from secondary schools, provision of information and materials concerning the admission exam (see Chapter 2.3),
- Continuation of the series of specialized seminars for secondary school chemistry teachers, where advances in various areas of chemistry were presented. The programme of the course was organised in cooperation with the participants and continuation is expected in the following years,
- To allow active involvement of the University and FChT in international education, in 2019 FChT organized language courses for the administrative staff of the Dean's office, departments and institutes,
- Active participation in a meeting of the management of chemical faculties from the Czech Republic and Slovakia held from 30 September to 4 October 2019 in Velké Karlovice.

Publicity

The Faculty continued to increase the awareness of potential applicants and the general public. In this respect, the most significant activities included participation in traditional higher education exhibitions in the Czech Republic — Gaudeamus in Prague and in Brno. The stalls of the Faculty were attended by hundreds of secondary school students, their teachers, educational counsellors, and representatives of other universities, hundreds of information and promotion materials were given away, and oral presentations were held.

A significant part of publicity is presentation of the Faculty in selected secondary schools. In 2019, representatives of the Faculty visited numerous grammar schools and secondary vocational schools:

1. soukromé jazykové gymnázium, Hradec Králové
Gymnázium Broumov
Gymnázium Česká Třebová
Gymnázium Hlinsko
Gymnázium Holice
Gymnázium Jevíčko
Gymnázium Lanškroun
Gymnázium Letohrad
Gymnázium Litomyšl
Gymnázium Dašická, Pardubice
Gymnázium Mozartova, Pardubice
Gymnázium Polička
Gymnázium Přelouč
Gymnázium Skuteč
Gymnázium P. de Coubertina, Tábor
Gymnázium Vysoké Mýto
Gymnázium Žamberk
SOŠ ekologická a potravinářská, Veselí nad Lužnicí
SŠIS Dvůr Králové nad Labem

SPŠCh Brno
SPŠCh akademika Heyrovského, Ostrava
SPŠS Železný Brod
ÚJOP Mariánské Lázně

Some secondary schools also visited the Faculty. Secondary school students were provided with all information about the study, they had the opportunity to see the buildings and equipment, laboratories and specialized lecture rooms. In 2019 the Faculty was visited by students from Gymnázium J. K. Tyla, Hradec Králové, Gymnázium Polička, Gymnázium Pierra de Coubertina, Tábor, Gymnázium Žamberk, SPŠCh Hranice, SPŠCh akademika Heyrovského Ostrava, SPŠCh Pardubice, and students from the prestigious Kolmogorov School in Moscow.

Existing cooperation with secondary vocational schools specialized in chemistry was deepened by signing a memorandum. The purpose of the memorandum is to develop the knowledge and abilities of students from both institutions and to establish links between secondary and university education in order to train top industry experts. Last year, memoranda of cooperation were signed with SPŠCh Hranice and SPŠCh akademika Heyrovského Ostrava. These secondary schools became **Faculty Schools of the Faculty of Chemical Technology, University of Pardubice**.

The publicity of the Faculty was also increased by participation in the KONTAKT 2019 labour fair and the following promotion events: Science and technology in school yards, Young researchers' night, Science exhibition and scientific-technical fair in the city centre. The Faculty took part in the European project Researchers' Night, the purpose of which was to support young people's interest in studying technical and natural scientific disciplines.

The publicity of the Faculty was also increased through the following events: "Search for the best young chemist" competition (for elementary schools), AMAVET (for elementary and secondary schools), "Chemiklání" (for secondary schools), Chemical Olympiad (for secondary schools), visits of elementary and secondary school students to the Faculty.

On a regular basis, the Faculty updates the offer of various educational courses (especially the licence study) and continues to organize seminars for secondary school teachers. To increase publicity and awareness, the Faculty uses the internet (website, direct mail) and social networks (Facebook Instagram, YouTube). In 2019 the Faculty continued to improve the faculty website, including the websites of the departments and institutes, and its Facebook and Instagram profiles. These activities still continue. The Faculty presents the offer of study programmes on relevant websites.

The information about FChT events were published in dozens of press releases and media reports in Czech and Slovak newspapers and in national and regional radio broadcasting. Many current reports and articles were published in the University of Pardubice Newsletter including its electronic version.

11. Care for Students

11.1 Information and Counselling Services

In 2019, the management of the Faculty continued to improve the system of providing information and counselling in order to facilitate the students' decisions concerning the selection of their future employers. The Faculty published the demand of enterprises for graduates, regularly informed about study abroad, and organized meetings of FChT students with the representatives of chemical enterprises called KONTAKT 2019. Similarly to previous years, the event was jointly organized by FChT and the Faculty of Economics and Administration. The purpose of this meeting was to establish contact between future graduates and their potential employers and facilitate the students' orientation on the labour market. Presentations and personal meetings were held in the University auditorium and the Faculty premises. Both the students and employers had enough opportunities to clarify the matters they were interested in. The presence of the media was used not only to inform the public about the purpose and mission of this event, but to inform about the Faculty in general, about job opportunities of the graduates, and about the relationships between the Faculty and industrial and scientific-research institutions.

11.2 Physical education, Sports and Other Activities

Sport is an inseparable part of the students' free time. In the academic year 2018/2019, the traditional competition for the Flag of the Rector of the University of Pardubice was held. Throughout the whole year, assistants from the Department of Physical Education and Sports organized competitions in ten sports (athletics, aerobics, badminton, floorball, futsal, swimming, squash, rowing, multi-event, volleyball) and in 17 sports disciplines involving a total of 834 athletes. The 61st year of the competition for the Flag of the Rector was won by the Faculty of Transport Engineering (71 points), followed by the Faculty of Economics and Administration (64 points), and the Faculty of Chemical Technology (62.5 points).

The following FChT students were among the best university athletes for 2018/2019:

2nd place European Championship in the RELAY category, 2nd place in the TANDEM WOMEN category, 3rd place in the INDIVIDUAL category, 3rd place European Championship in the TANDEM MIX category, 3rd place in the RELAY category — fire-fighting sport
Hana Havlíčková

1st place Academic Championship in Ostrava 2019, Fire-fighting sport, Tower climbing
1st place Academic Championship in Ostrava 2019, Fire-fighting sport, 100-metre obstacle course
Markéta Marková

2nd place Academic Championship in Ostrava 2019, Fire-fighting sport, Fire attack women
Monika Hrazdilová, Dominika Jiráková, Markéta Marková, Barbora Punarová

2nd place Czech Academic Games in Brno 201, Rowing, Coxed 4, Men
Tomáš Halík, Ondřej Jung

2nd place Czech Academic Games in Brno 2019, Rowing, Coxed 4, Mix
Tomáš Halík, Lucie Smetanová

3rd place Czech Academic Games in Brno 2019, Rowing, Single scull, Men
Ondřej Jung

3rd place Czech Academic Games in Brno 2019, Swimming, Breaststroke, 50 m
Kateřina Hromadníková

In 2019 the employees of the Faculty were actively involved in the preparation and organization of the 22nd year of Run for Hope (formerly Terry Fox Run).

12. Evaluation

12.1 Internal Evaluation

Internal evaluation is performed on a regular basis and involves the whole Faculty and its departments and institutes. The same was performed in 2019.

Evaluation of academic staff

All educational staff of the Faculty undergo yearly evaluation according to the following structure:

Educational activity:
- Teaching: lectures, seminars, laboratories,
- Supervision of master's and bachelor's diploma theses, supervision of doctoral students,
- Development of teaching aids, teaching plans, laboratory tasks, building of laboratories,
- Educational activity in different institutions (faculties).

Scientific activity:
- Papers published in the previous year,
- Participation in conferences,
- Grants, technological projects, additional activity,
- International visits and travel,
- Membership in scientific and professional boards and committees.

Other activities:
- Organization activities,
- Increasing qualification,
- Other worthwhile activities.

Evaluation of Excellence

In 2019, the evaluation of excellent scientific teams in basic and applied research was performed with a special focus on the following:
- Implementation of scientific projects,
- Publication activity,
- Recognition by the international community,
- Leadership of the scientific team,
- Solving scientific problems,
- Commercialization of applied research.

In all cases, emphasis was on the quality of activities taking into account the evaluation of research organizations.

Evaluation of the quality of education by students

Between May and September 2019, university students evaluated the quality of education using a special module in the IS STAG system. This evaluation was organized in the context of the whole university.

In the national competition "**Faculty of the Year 2018/2019**" FChT was ranked first of all chemical faculties. This competition is announced by the Czech Student Union (ČeSU) in order to provide future students with relevant information in selecting their university. The competition is based on assessing the quality by our students, which is a criterion that should be taken into account by future university students. The order of the faculties is based on students' vote (positive and negative votes) respecting the number of students at each faculty.
The evaluation is based on the following:
- Overall satisfaction with the university/faculty,
- Course attractiveness,
- Teachers' qualification,

- Quality of preparation for practice/work,
- Possibility to implement and participate in students' ideas and projects.

Dean's Annual Reports

The Dean's Annual Reports are submitted to the Academic Senate of FChT and the academia at the beginning of each calendar year.

12.2 External Evaluation

The most significant external evaluation of the University of Pardubice and the Faculty of Chemical Technology conducted already in 2018 is undoubtedly that by the National Accreditation Bureau for Higher Education as part of our application for awarding institutional accreditation to the University of Pardubice. The Faculty of Chemical Technology was actively involved in the preparation of institutional accreditation for the following areas of education: Chemistry, Economy courses, Healthcare courses. On 7 September 2018 the decision came into force by which the University of Pardubice was awarded institutional accreditation for a period of 10 years for the following areas:
a) Educational area of Transport; bachelor's, master's and doctoral degree programme,
a) Educational area of Economy courses; bachelor's, master's and doctoral degree programme,
a) Educational area of Historical science; bachelor's, master's and doctoral degree programme,
a) Educational area of Chemistry; bachelor's, master's and doctoral degree programme,
a) Educational area of Information science; bachelor's, master's and doctoral degree programme,
a) Educational area of Healthcare courses; bachelor's, master's and master's degree programme.

Institutional accreditation in the above specified educational areas at the University of Pardubice allows, through the Internal Evaluation Board (IEB), the implementation of internal processes the purpose of which is to acquire, extend or prolong the period of validity of the accreditation. The Faculty of Chemical Technology is represented in IEB by Prof. Ing. Petr Kalenda, CSc. IEB has three scientific committees: Technical and Natural Science; Economic; and Healthcare, Humanities and Arts. In 2019, FChT was represented in the Technical and Natural Science Committee by its chairperson (Prof. Ing. Petr Kalenda, CSc.) and two of its members (Prof. Ing. Petr Mikulášek, CSc.; Prof. Ing. Petr Němec, Ph.D.). A member of the Economic Committee of IEB in 2019 was Prof. Ing. Hana Lošťáková, CSc.

Evaluation of educational activity

Following Rector's Decree No. 1/2019 concerning the Faculty Study Programme Boards, in 2019 the FChT Study Programme Board was appointed by the Dean of FChT as the authority to oversee the delivery of bachelor's and follow-up master's degree programmes accredited at FChT. The course and the quality of study in doctoral degree programmes was supervised and evaluated by Subject Area Boards appointed separately for each doctoral degree programme.

In 2019, internal accreditation of FChT study programmes was performed and accreditation was granted to the following study programmes (Unless stated otherwise, the courses are taught in Czech):

Academically-focused bachelor's study programme **Graphic Arts and Printing Technology**, standard length 3 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 18 March 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 May 2019 for the period of accreditation is Prof. Ing. Petr Němec, Ph.D.

Academically-focused bachelor's study programme **Inorganic and Bioinorganic Materials**, standard length 3 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998

Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 13 May 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 10 July 2019 for the period of accreditation is Doc. RNDr. Jana Holubová, Ph.D.

Academically-focused bachelor's study programme **Polymeric Materials and Composites**, standard length 3 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 13 May 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 10 July 2019 for the period of accreditation is Ing. David Veselý, Ph.D.

Academically-focused bachelor's study programme **Evaluation and Analysis of Foodstuffs**, standard length 3 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 11 November 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 January 2020 for the period of accreditation is Doc. Ing. Libor Červenka, Ph.D.

Academically-focused bachelor's study programme **Chemistry**, standard length 3 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 11 November 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 January 2020 for the period of accreditation is Prof. Ing. Libor Čapek, Ph.D.

Academically-focused follow-up master's study programme **Graphic Arts and Printing Technology**, standard length 2 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 18 March 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 May 2019 for the period of accreditation is Prof. Ing. Petr Němec, Ph.D.

Academically-focused follow-up master's study programme **Chemical and Process Engineering**, standard length 2 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 8 April 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 3 June 2019 for the period of accreditation is Prof. Ing. Petr Mikulášek, CSc.

Academically-focused follow-up master's study programme **Sustainable Development in Chemistry and Technology**, standard length 2 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 8 April 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 3 June 2019 for the period of accreditation is Doc. Ing. Anna Krejčová, Ph.D.

Academically-focused follow-up master's study programme **Inorganic Technology**, standard length 2 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended,

the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 9 September 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 November 2019 for the period of accreditation is Prof. Ing. Petra Šulcová, Ph.D.

Academically-focused follow-up master's study programme **Engineering of Energetic Materials**, standard length 2 years, full-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 14 October 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 November 2019 for the period of accreditation is Doc. Ing. Zdeněk Jalový, Ph.D.

Doctoral degree programme **Analytical Chemistry** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 9 September 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 November 2019 for the period of accreditation is Doc. Ing. Jan Fischer, CSc.

Doctoral degree programme **Inorganic Chemistry** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 9 September 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 November 2019 for the period of accreditation is Prof. Ing. Aleš Růžička, Ph.D.

Doctoral degree programme **Chemistry and Technology of Inorganic Materials** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 9 September 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 November 2019 for the period of accreditation is Prof. Ing. Petr Mošner, Dr.

Doctoral degree programme **Organic Chemistry** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 9 September 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 November 2019 for the period of accreditation is Prof. Ing. Miloš Sedlák, DrSc.

Doctoral degree programme **Physical Chemistry** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 14 October 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2019 for the period of accreditation is Prof. Ing. Roman Bulánek, Ph.D.

Doctoral degree programme **Chemical and Process Engineering** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the

Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 14 October 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2019 for the period of accreditation is Prof. Ing. Petr Mikulášek, CSc.

Doctoral degree programme **Biochemistry** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 14 October 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2019 for the period of accreditation is Prof. Mgr. Roman Kanďár, Ph.D.

Doctoral degree programme **Engineering of Energetic Materials** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 14 October 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2019 for the period of accreditation is Doc. Ing. Robert Matyáš, Ph.D.

Doctoral degree programme **Inorganic Technology** (The course is also taught in English.), standard length 4 years, full-time and part-time form of study, in compliance with Section 44a of Act No. 111/1998 Coll., on Higher Education Institutions and on amendment to some acts (the Higher Education Act), as last amended, the study programme shall be included in the area of education Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 14 October 2029. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2019 for the period of accreditation is Prof. Ing. Petra Šulcová, Ph.D.

Following the accreditation granted to the doctoral degree programmes of Biochemistry and Biochemistry, in 2019 a change took place in the position of the guarantor of the study programme **Analysis of Biological Materials**. The guarantor of the study programme appointed by the Dean of FChT effective from 1 January 2020 for the period of accreditation is Doc. Ing. Marcela Pejchalová, Ph.D.

Pursuant to Section 82, Sub-section 7 and Section 83c, Sub-section 2, Clause b), Item 1 of Act No. 111/1998 Coll. on Higher Education Institutions and on amendment to some acts (the Higher Education Act), the Council of the National Accreditation Bureau for Higher Education granted accreditation for the habilitation procedure and professor appointment procedure in **Environmental Chemistry and Engineering** delivered by the Faculty of Chemical Technology, University of Pardubice for a period of 10 years after coming into force, i.e. from 12 November 2019.

Evaluation of the results of science and research

From 2004 to 2017, the Research, Development and Innovation Board (RDIB) performed yearly evaluation of R&D results. The methodology that RDIB used for the evaluation is specified at http://www.vyzkum.cz/.

The evaluation applies only to those result that are directly linked with the activities of the respective research organization, meet the definition of the results and other requirements for inclusion in the R&D Information System (referred to as "R&D IS"), and are properly registered in the system. The basic information sources are:

CRRP – Central register of research plans,
CRP – Central register of projects,
RII – Result information index.

The evaluation of the results of research organizations means that the results of an organization are translated to a single numerical scale (quantification of results). The evaluation of the results was performed solely on the basis of valid data contained in R&D IS.

In the event that an R&D activity included multiple entities, the corresponding funding was adequately distributed, provided that this distribution was defined in the agreements on information resources. In the event that an R&D result included multiple entities, the points were divided evenly. The documents obtained from the RII database were standardized according to a procedure precisely defined in the methodology. This for example eliminates duplications, etc.

The following table indicates 25 top research organizations (their organizational units) according to the points awarded for R&D results. The order is clearly influenced by the size of the institution. The share of FChT in overall performance of research organizations evaluated in the Czech Republic is 1.3% and FChT occupies tenth place among all research organizations.

Order of organizational unit of research organizations by points awarded for R&D results (evaluation for 2016)

Order	Research organization	Number of points
1.	Charles University in Prague / Faculty of Mathematics and Physics.	155,253.6
2.	Charles University in Prague / Faculty of Science	123,957.3
3.	Palacký University Olomouc / Faculty of Science	117,706.4
4.	Institute of Physics of the Czech Academy of Sciences	110,690.8
5.	Masaryk University / Faculty of Science	91,888.7
6.	Czech Technical University in Prague / Faculty of Electrical Engineering	74,706.7
7.	Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences	72,411.9
8.	Czech Technical University in Prague / Faculty of Civil Engineering	54,230.8
9.	Charles University in Prague / Faculty of Education	52,711.9
10.	**University of Pardubice / Faculty of Chemical Technology**	**47,986.1**
11.	Charles University in Prague / Faculty of Arts	47,966.9
12.	J. Heyrovský Institute of Physical Chemistry of the Czech Academy of Sciences	47,211.6
13.	Biology Centre of the Czech Academy of Sciences	45,984.2
14.	Brno University of Technology/ Faculty of Mechanical Engineering	43,862.0
15.	University of Chemistry and Technology in Prague/ Faculty of Chemical Technology	43,183.1
16.	Masaryk University / Central European Institute of Technology	42,748.4
17.	Czech Technical University in Prague / Faculty of Mechanical Engineering	42,203.4
18.	Institute of Macromolecular Chemistry of the Czech Academy of Sciences	40,353.1
19.	Institute of Microbiology of the Czech Academy of Sciences	39,007.1
20.	Czech Technical University in Prague / Faculty of Nuclear Sciences and Physical Engineering	38,819.1
21.	Brno University of Technology/ Faculty of Electrical Engineering and Communication	37,832.6
22.	Palacký University Olomouc, Faculty of Medicine and Dentistry	32,872.9
23.	University of South Bohemia in České Budějovice / Faculty of Science	31,619.2
24.	University of West Bohemia in Pilsen / Faculty of Applied Sciences	30,980.3
25.	University of Chemistry and Technology in Prague/ Faculty of Chemical Engineering	29,461.7

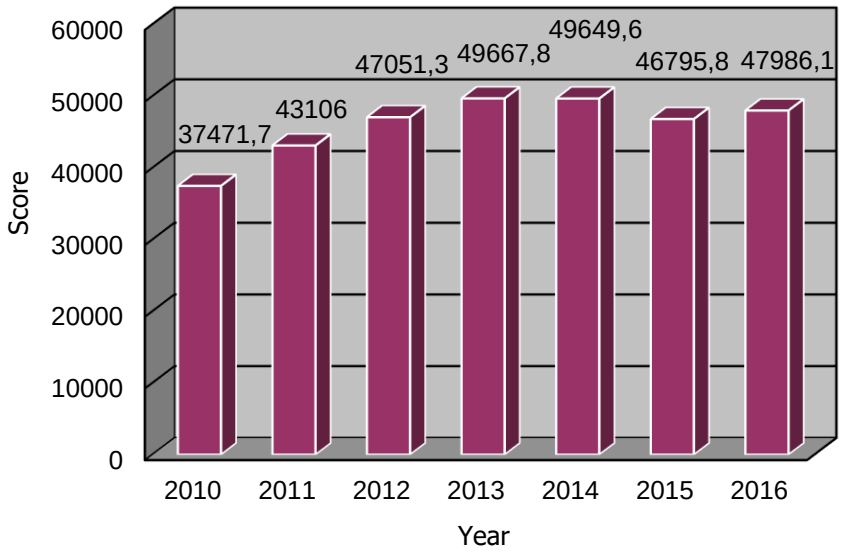
The following table compares the absolute results of all faculties specialized in chemistry. In this comparison the best results were achieved by the Faculty of Chemical Technology, University of Pardubice.

Order of public university faculties with chemical-technological focus by points awarded for R&D results (evaluation for 2016)

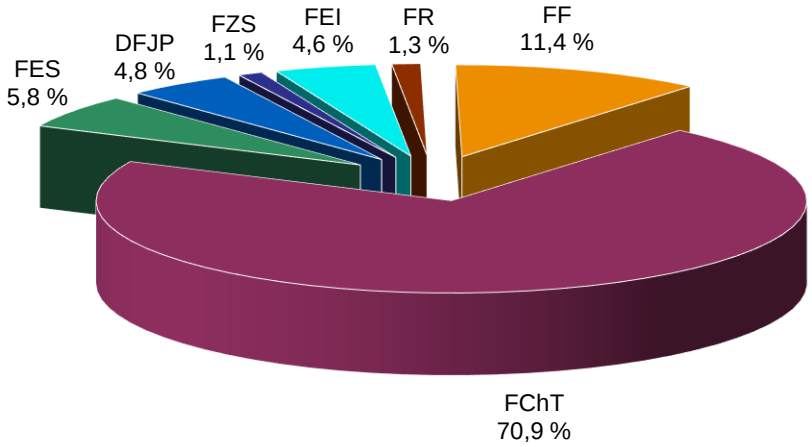
Order	Faculty	Number of points
1.	**University of Pardubice / Faculty of Chemical Technology**	**47,986.1**
2.	University of Chemistry and Technology in Prague/ Faculty of Chemical Technology	43,183.1

3.	University of Chemistry and Technology in Prague/ Faculty of Chemical Engineering	29,461.7
4.	University of Chemistry and Technology in Prague/ Faculty of Food and Biochemical Technology	24,378.3
5.	Brno University of Technology / Faculty of Chemistry	12,431.4
6.	Tomas Bata University in Zlín / Faculty of Technology	10,951.7
7.	University of Chemistry and Technology in Prague/ Faculty of Environmental Technology	8,364.2

The development of the results of FChT for 2010–2016 is shown in the following graph.



Results of FChT UPa for 2010-2016



Share of the Faculty of Chemical Technology in the overall results of the University of Pardubice in the area of science and research for 2016

Since 2017, the concept of Evaluating research organisations and RD&I purpose-tied aid programmes according to M17+ Methodology has gradually been introduced. The methodology that RDIB uses for evaluation is specified at: http://www.vyzkum.cz/.

For the time being, the results are evaluated in the following categories:

- Module 1: Evaluation of the quality of selected results by RDIB through Expert Panels,
- Module 2: Evaluation of bibliometric results based on subject-specific analyses. In the event that the bibliometric result includes multiple research organizations, the result shall be awarded to each research organization in full extent.

In 2019, the results of the second year of M17+ implementation were published. M17 included evaluation H18 (2017 results) and H17 (2016 results). The following tables provide a comparison of chemical faculties in Module 1 and Module 2. The tables are based on the results of H18 and H17.

The number of the results in Module 1 is influenced, inter alia, by the size of the research organization. The evaluation of the results in the H1 to H5 interval is carried out by RDIB through Expert Panels. H1 represents the best evaluation result.

	Number of evaluated results*						**Proportion H1 to H3, %**
	Total	**H1**	**H2**	**H3**	**H4**	**H5**	
Charles University, Faculty of Science	39	5	14	13	5	2	82
UCT Prague, Faculty of Chemical Engineering	9	1	3	3	1	1	78
University of Ostrava, Faculty of Science	8	0	5	1	1	1	75
UCT Prague, Faculty of Chemical Technology	21	0	7	8	4	2	71
University of Pardubice, Faculty of Chemical Technology	23	1	7	8	4	3	70
Masaryk University in Brno, Faculty of Science	72	1	16	28	17	10	63
Palacký University Olomouc, Faculty of Science	35	1	8	12	10	4	60
Brno University of Technology, Faculty of Chemistry	24	1	1	7	10	5	38
Tomas Bata University in Zlín, Faculty of Technology	6	0	0	1	2	3	17

The number of the results in Module 2 is affected by the size of the research organization and the degree of cooperation with other research organizations. The quality of the bibliometric results reflects the subject-specific classification of journals in the Q1 to Q4 quartiles. In 2019, FChT set a strategic goal to improve the percentage of the bibliometric results presented in the first and second quartile journals.

University, Faculty	**Bibliometric results***					**Proportion Q1 and Q2, %**
	Total	**Q1**	**Q2**	**Q3**	**Q4**	
Palacký University Olomouc, Faculty of Science	1410	791	322	158	139	79
UCT Prague, Faculty of Chemical Engineering	305	106	125	44	30	76
Masaryk University in Brno, Faculty of Science	1193	542	344	185	122	74
Charles University, Faculty of Science	1858	845	491	298	224	72
UCT Prague, Faculty of Chemical Technology	406	152	137	70	47	71
Tomas Bata University in Zlín, Faculty of Technology	95	30	32	22	11	65
Brno University of Technology, Faculty of Chemistry	98	21	35	28	14	57
University of Pardubice, Faculty of Chemical Technology	504	114	173	143	74	57
University of Ostrava, Faculty of Science	219	80	42	48	49	56

The share of the Faculty of Chemical Technology in the overall bibliometric results of the University of Pardubice in Module 2 (H18 + H17) is shown in the table below. In the event that more faculties of the University of Pardubice were involved in the bibliometric result, the result was awarded to all of these faculties in full extent.

University of Pardubice - Faculty	Bibliometric results*					Proportion Q1 and Q2, %
	Total	Q1	Q2	Q3	Q4	
University of Pardubice	562	121	179	151	111	54
Faculty of Chemical Technology	504	114	173	143	74	57
Faculty of Economics and Administration	25	4	3	1	17	28
Faculty of Transport Engineering	14	1	2	5	6	21
Faculty of Health Studies	17	2	1	1	13	18
Faculty of Electrical Engineering and Informatics	10	0	0	5	5	0
Faculty of Arts and Philosophy	1	0	0	0	1	0
Faculty of Restoration	0	0	0	0	0	0

13. Further Development of the Faculty of Chemical Technology

13.1 Investment Development of FChT

In accordance with the long-term plan, in 2019 the Faculty continued to purchase new and upgrade existing instrumentation in order to strengthen the scientific and research activity in relation to educational activity.

The details on economic management and investment development are included in the Annual Report on Economic Management of FChT for 2019. This document includes only significant investments.

Investments relating to machines, devices, equipment, and software (exceeding 200 thousand CZK, approx. 7,871 EUR) in 2019

Identification of machine, device, equipment, or software	Department	Price (thousand CZK/EUR)
UV/VIS spectrophotometer	KAlCh	357 / 14
Mass spectrometer with ionization in inductively coupled plasma	KAlCh	2,288 / 90
Robotic device for sample preparation	KAlCh	2,995 / 118
Granular strength measuring instrument	KAnT	260 / 10
Additional SW for XRD Rigaku Miniflex 600	KAnT	228 / 9
Mass detector for the HPLC system (2nd instalment)	KBBV	2,293 / 90
High-performance respirometer	KBBV	744 / 29
Specific surface and pore size distribution analyser	KFCh	1,246 / 49
Gas chromatograph with FID + TCD detector	KFCh	1,602 / 63
Modular fluorescence spectrophotometer (extension)	KFCh	668 / 26
DRIFT spectrophotometer (extension)	KFCh	1,140 / 45
Photoluminescent spectrometer	KOAnCh	3,706 / 146
Combined FTIR-Raman spectrometer	KOAnCh	4,130 / 163
Fibre UV/VIS spectrometer for inert gas measurement	KOAnCh	497 / 20
Flash and HPLC chromatography system	KOAnCh	1,499 / 59
Light source for EPR spectrometer	KOAnCh	250 / 10
Hyperion Infrared Microscope	KPF	3,279 / 129
Vacuum/inert tempering table	KPF	333 / 13
Flexo printer with deep-print and rollers	KPF	1,195 / 47
Offset printer	KPF	2,240 / 88
Laboratory IJ equipment	KPF	3,400 / 86
MAC computers for graphics	KPF	976 / 38
Elemental analysis device	ÚEnM	1,633 / 64
Particle size distribution measuring instrument	ÚEnM	1,141 / 45
Containers for safe storage of explosive samples	ÚEnM	1,234 / 49
Constructions in laboratories	ÚEnM	953 / 38
Optical emission spectrometer with excitation in inductively coupled plasma	ÚEnviChI	2,118 / 83
Flow-through analyser for determining phosphorus forms	ÚEnviChI	1,138 / 45
Lifecycle assessment software	ÚEnviChI	437 / 17
UV and photocatalysis contaminant removal instrument	ÚEnviChI	240 / 9
Instrument for determining particle morphology and size by image analysis	ÚEnviChI	2,699 / 106
Ozonization contaminant removal instrument	ÚEnviChI	239 / 9
Instrument for determining particle size distribution	ÚEnviChI	2,348 / 92
Instrument for determining substance specific surface	ÚEnviChI	1,207 / 48
Portable NMR with permanent magnet	ÚOChT	1,498 / 59

Combined absorption and fluorescence spectrometer	ÚOChT	778 / 31
Vacuum rotary evaporator	ÚOChT	238 / 9
Analytical scales	ÚOChT	242 / 10
Dosing instrument for flow-through arrangement reactions	ÚOChT	524 / 21
High-pressure reactor	ÚOChT	778 / 31
Determination of particle size distribution by dynamic light scattering and zetapotential using electrophoretic light scattering	ÚChTML	763 / 30
SW Comsol Multiphysics	ÚAFM	220 / 9
P9 AFM microscope controller	SLChPL	1,227 / 48
Potentiostat/galvanostat for electrochemical anodization	CEMNAT	767 / 30
Upgrade of atomic force microscope	CEMNAT	683 / 27
Upgrade of infrared spectrometer with microscopic attachment	CEMNAT	901 / 35
Precursor containers for atomic layer deposition (ALD) instruments	CEMNAT	392 / 15
ALD pressure check instrument	CEMNAT	576 / 23
Backup power supply for XPS	CEMNAT	302 / 12
Rapid heating instrument	CEMNAT	1,705 / 67
Modular atomic force microscope	CEMNAT	4,615 / 182
Raman spectrometer	CEMNAT	6,292 / 248
Fluorometer upgrade	CEMNAT	1,820 / 72
Laboratory autoclave with accessories for working with supercritical CO_2	CEMNAT	3,343 / 132
Freeze dryer	CEMNAT	421 / 17
Three-zone burning furnace for different atmospheres	CEMNAT	1,313 / 52
Vacuum furnace up to 1500 °C with controlled atmosphere	CEMNAT	1,863 / 73

In collaboration with TO UPA, the FCHT radio control panel was modernized, backup power supply for CEMNAT installed, blinds repaired (buildings HA, HB, HC and TP Doubravice), waterproofing repaired on the pressing shop (TP Doubravice), and broken window glass replaced on the Faculty buildings.

13.2 Long-Term Priorities

Further development of the Faculty of Chemical Technology, University of Pardubice is defined in the updated version of the Long-term plan of educational, scientific, research, developmental, artistic and other activities of the Faculty for 2020. In 2020, attention will be paid to the key areas of development and related priorities, which complement and condition each other.

Ensuring the quality of education

Objective: To gradually increase the quality of the content of university education in the context of bachelor's, master's, and doctoral degrees, to increase the number of talented students at the Faculty of Chemical Technology, University of Pardubice, and to promote their active involvement in scientific activity. To systematically match education with research, development, innovations and applications.

Strategies

- Continuous selection of top quality applicants for all levels of study.
- Improving educational activity at all departments/institutes of the Faculty of Chemical Technology, University of Pardubice.
- Care of talented students in bachelor's and master's degree programmes.
- Emphasis on the doctoral degree programmes as an educational priority of the Faculty.
- Sustained development of systematic work with the students in the doctoral degree programmes in order to increase their involvement in research projects.
- Innovation of the educational content in relation to new theoretical knowledge and current needs of the labour market. Supporting cooperation with the application sphere.
- Ensuring compliance of the educational content structure with the required graduate profile in the context of relevant areas of education.

- Monitoring the students' feedback concerning the study and academic staff.
- Preventing plagiarism as a gross breach of ethics.
- Supporting cooperation between the Faculty departments and institutes.

Activities to achieve the objective

- Promotion of study at the Faculty of Chemical Technology, University of Pardubice among secondary and elementary schools. Development of systematic cooperation with secondary schools in the area of education.
- Continued promotion of activities to support talented students. Scientific competitions for potential applicants. Granting merit scholarships to students who succeed in competitions.
- Systematic strengthening of cooperation with partner secondary schools and development of cooperation with other secondary schools. Educational activities for innovative secondary school teachers.
- Monitoring and evaluation of the attractiveness of individual study programmes.
- Supporting participation of talented students from bachelor's and master's degree programmes in scientific competitions and other events in order to develop their professional focus and skills.
- Strengthening systematic cooperation with practice.
- Description of the study programmes in cooperation with the application sphere, providing high-quality information about the study programmes through various media.
- Continuing analysis of job opportunities for students in all levels of study.
- Evaluation of the process of education by the students, graduates, and management of the Faculty. Evaluation of the study programmes in cooperation with professionals from practice, graduates, and the application sphere.
- Analysis of jobs acquired by the graduates from all levels of study on the labour market or in further study in order to obtain long-term and systematic feedback for further evaluation of the educational processes.
- Implementation of measures based on an analysis of doctoral degree programmes with an emphasis on its quality and relevance for scientific and creative activity.
- Regular evaluation of the study by the graduates and application of its results.
- Monitoring and evaluation of the reasons for early termination of study in the bachelor's degree programmes.
- Systematic actions involving the students and employees in order to fight plagiarism.
- Recruitment of the graduates from the Faculty of Chemical Technology, University of Pardubice, but also talented graduates from other universities in the Czech Republic and abroad for follow-up master's and doctoral degree programmes.
- Targeted support of the doctoral students of all fields of study in their involvement in grants and projects implemented by their departments.
- Development of international student exchange with an emphasis on high-quality scientific cooperation. Promotion of involvement of the doctoral students in projects carried out in cooperation with foreign partners.
- Providing adequate conditions and preparation of projects for the placement of the students from the bachelor's and follow-up master's programmes in industrial enterprises and research institutions.
- Systematic promotion of interdisciplinarity and internationalization of the doctoral degree programmes.
- Development of a communication and information platform for the Faculty's partners, graduates, employers, and other institutions.
- Support of professional development of the academic staff in area of education.
- Support and development of mobilities of the academic staff and students of the Faculty in the context of educational programmes.
- Maintaining the established post-doc employment positions for excellent doctoral graduates (own graduates, graduates from other universities, graduates from abroad).

Diversity and availability of education

Objective: To play the role of an open educational centre. To positively influence the public attitude to education, research, and exploration, and to involve young people in these activities as a prerequisite for economic development of the country.

Strategies

- Promotion of educational, scientific, and research activities of the Faculty.
- Development of new study programmes based on the broad range of existing fields of study and the strengths of individual departments and institutes.
- Development of cooperation with elementary and secondary schools and their authorities.
- Development of adequate conditions for study and motivation of talented students.
- Provision of information and counselling services concerning the study and professional career.
- Improving the specializations of the existing study programmes and maintaining the unique fields of study.
- Maintaining the offer of lifelong learning programmes.
- Implementation of measures to decrease study failure and measures supporting completion of regular study periods in all types of study.

Activities to achieve the objective

- Popularization of educational, scientific, and research activities of the Faculty, communication of the latest findings in relevant scientific disciplines. Implementation of activities that systematically support the interest and motivation of talented applicants, especially in technical and natural science disciplines.
- Use of active media relations, promotional and marketing tools to inform about the educational opportunities and diversified range of study programmes provided by the Faculty, by which access is granted to various population groups.
- Targeted search for talented students and development of their talent through various forms of educational programmes, individual approaches, competitions, and scholarship funds.
- Exchange of information with lower educational levels and their authorities, organizing events for them or together with them.
- Extended cooperation with scientific institutions and industrial enterprises in providing selected bachelor's and master's degree programmes.
- Increasing professional competences of beginning academic staff by means of foreign internships or internships in industrial enterprises in the Czech Republic.
- Faculty system of awarding outstanding university teachers.
- Broadening the offer of lifelong learning courses, counselling services, and information and promotion activities of the Faculty for the general and professional community and for all those who are interested.

Internationalization

Objective: To deepen the process of internationalization of the Faculty. To increase the number of international students in accredited study programmes and the number of study placements of students of the Faculty of Chemical Technology, University of Pardubice abroad. To improve the quality of study by increasing its usefulness and effectiveness in the context of the desired graduate profile. To develop targeted scientific and research cooperation with foreign entities in order to increase and deepen the research performed by the academic staff, young researchers and students.

Strategies

- Strengthening of cooperation with strategic foreign universities and other research institutions in the area of education, science, and research.
- Emphasis on maintaining the number of foreign students in accredited study programmes and students arriving at the Faculty.
- Selection of foreign partner institutions and study programmes performed in a way to allow recognition of credits and completed courses, both in terms of quality and factual similarity.

- Preparation of joint study programmes — joint/double degrees with foreign universities.
- Employment of foreign researchers at the Faculty.
- Increasing the language competences of the academic and non-academic staff and students of the Faculty.
- Improving the quality of the courses taught in English and providing an offer of courses taught in English for Czech students, increasing the number and improving the quality of the study materials used in the courses taught in English.
- Expanding the opportunities for foreign research internships for the academic staff, young researchers, and students in the doctoral degree programmes.
- Systematic involvement of the academic staff and students in doctoral and master's degree programmes in international research projects.
- Promotion of "mobility windows" in selected terms and specific study programmes so that the course of mobility becomes organic part of the standard study plan.
- Introduction of new study programmes taught in English.
- Systematic development of cooperation with international partners in line with the established strategic cooperation in the field of education, science, and research.
- Using the potential of foreign academic staff and students during their long-term and short-term visits to the Faculty.

Activities to achieve the objective

- International promotion of study and scientific-research activity of the Faculty, innovating and extending the forms and tools of this promotion.
- Concluding new framework agreements on cooperation with international departments with an emphasis on their contribution and implementation.
- Deepening international contacts, integration of incoming students into scientific and academic activity.
- Preparation of "joint" and "double degree" study programmes.
- Continued analysis of international territories for further partnership.
- Deepening of strategic educational partnerships with prestigious foreign departments.
- Increasing the offer of study programmes in foreign languages. Extending the offer of study for foreign students.
- Supporting mobilities in the framework of the Erasmus+ programme, research projects and other forms with an emphasis on quality.
- Continued internationalization of the Faculty through accreditation of study programmes and mobilities of academic/scientific staff and students. Multilingual version of the Faculty websites.
- Provision of intensive care to foreign students and the academic and non-academic staff in order to overcome language and cultural barriers.

Relevance

Objective: To reflect on the current social development, latest scientific knowledge, and the needs of society. To cooperate with partners on the regional, national, and international level, with graduates, employers, scientific and academic institutions, public administration non-profit sector, and the public. To expand applied research and link it with innovation activities that support economic competitiveness and socio-economic development. To increase the degree of active cooperation with the application sphere. To provide job opportunities for graduates and encourage employers from the application sphere to recruit graduates from the Faculty of Chemical Technology, University of Pardubice.

Strategies

- Deepening of cooperation between the public, academic, and application sphere, maintaining long-term knowledge-based competitive advantage.
- Emphasis on the relevance of educational activity in accordance with the needs of the labour market.
- Systematic focus on the graduates' language skills and other transferable competences.
- Providing infrastructure, spatial and material conditions, particularly for specialized courses.

- Development of conceptual work with external entities, employers, graduates, and adoption of measures to decrease the proportion of unemployed graduates.
- Improving the conditions for the development of lifelong learning at the Faculty.

Activities to achieve the objective

- Building of a positive image of the Faculty in the eyes of the public.
- Systematic strengthening of the relevance of all study programmes to increase the graduates' job opportunities on the labour market.
- Providing information and counselling services to students, and organization of activities to prepare the graduates for the labour market (internships, scientific competitions, involvement of students in solving application tasks, and other educational activities).
- Designing and implementation of specialized educational activities, teaching techniques, courses or modules to increase the graduates' chances on the labour market.
- Consultations with employers, local stakeholders and other external partners in the process of preparation of the study programmes to reflect their requirements and needs concerning the graduates' qualification.
- Systematic and contract cooperation with employers and external partners, providing information and counselling services to the students, and organization of activities to prepare the graduates for the labour market.
- Ensuring the conditions for improving the students' language skills.
- Conceptual work with the graduates. Use of the system of communication with the graduates, monitoring of their career. Use of information technology, new media, graduates' club, and social networks for communication.
- Application of general career growth principles.
- Improving communication both within the Faculty and externally.
- Submission of applications for accreditation and extending the accreditation of study programmes reflecting the quality and relevance of university study on the labour market with an emphasis on the current and perspective directions of economic development. Specialization of fields of study to reflect the knowledge, skills and competences expected from the graduates.
- Provision and exchange of information on good practice examples, educational innovations, and creative and other activities between the Faculty and other entities in the application sphere.
- Evaluation of the needs and groups of the employees and students of the Faculty.

High-quality and relevant research, development, and innovations

Objective: To extend and deepen scientific and research activity of the Faculty of Chemical Technology, University of Pardubice in the area of basic research. In the long run, to bring internationally relevant results of research and development and their effective transfer to the application sphere.

Strategies

- Ensuring motivation to increase the productivity of academic and scientific staff and to increase the quality of research results.
- Supporting cooperation with strategic partners in the Czech Republic, Europe, and other parts of the world.
- Cooperation with entities in the application sphere, particularly in the implementation of projects aimed at application research and contract research. Increasing the allocation for research, development, and innovation from private sources.
- Successful implementation of projects supported by sectoral, national, and especially international funds with an emphasis on motivating academic and research staff to submit relevant project applications.
- Emphasis on maintaining the share of funding obtained from the EU framework programme for research and innovations Horizon 2020 (2014–2020) and other international sources.
- Increasing the degree of involvement of young academic employees in research and supporting their career growth.

- Providing the conditions for involvement of doctoral students and talented master's degree students in scientific work.
- Raising the students' awareness about the needs of industrial enterprises and increasing their creativity.
- Raising awareness of the general and professional community, partners, and application entities about scientific, research, developmental and creative activities, latest advancements, and the results of the Faculty departments.
- Systematic development of a broad range of programmes at the Faculty. Initiation and development of multidisciplinary and international cooperation, use of the unique range of disciplines provided by the Faculty.
- Developing multidisciplinary cooperation with domestic and foreign partners in order to achieve internationally competitive research results.
- Supporting short-term and long-term scientific-research internships, involving particularly young researchers.
- Building new and strengthening existing excellent teams in the field of basic and applied research.
- Supporting permanent involvement of the Faculty in large international research infrastructures.

Activities to achieve the objective

- Development of incentives to increase the number of projects obtained by the academic staff and researchers.
- Preparation and implementation of projects from the EU framework programme for research and innovations Horizon 2020 (2014–2020) and other international sources.
- Preparation and implementation of project under the Operational Programme Research, Development and Education (OP RDE).
- Involvement of talented students in scientific and research activities of the Faculty by means of SSPA; supporting their scientific and research activities by means of extraordinary scholarships. Supporting the students' practical training.
- Preparation and implementation of projects supported by grant agencies and ministries of the Czech Republic.
- Project support and administration of project applications.
- Targeted support of the academic staff and researchers to increase their activity in submitting projects supported by grant agencies and ministries and to increase the share of allocation for research, development, innovations from both public and private sources.
- Giving bonus for excellence in science and research by introducing extra rewards for exceptional results.
- Gradual increase in the number of high-quality scientific outcomes and their citations.
- Supporting multidisciplinary cooperation at the Faculty level through systematic approach of investment instruments and devices.
- Organizing seminars, where the academic staff and students will learn about the research activities of partner departments and potential employers.
- Development of the existing infrastructure, improvement of base facilities, reconstruction and modernization of the Faculty premises and equipment, purchase of new instrumentation and technologies.
- Long-term and intensive communication of the results of creative activity to various target groups and partners in the area of practical application of the results of science and research in practice.
- Active use of human resources, application of systematic motivational rules of staff remuneration.
- Continued analysis of the concept and outcomes of scientific work at various departments and in the fields that the Faculty focuses on.
- Definition of main scientific trends and disciplines in which the Faculty achieves high-quality results. Determination of specialized fields of scientific and creative work at the Faculty.
- Providing the conditions for involvement of doctoral students and talented master's degree students in scientific work.
- Popularization of science, disciplines and fields provided by the Faculty including relevant results, and cooperation with external entities through organizing scientific as well as popular

educative events, participation in presentations and exhibitions, and involvement in joint projects.
- Supporting short-term and long-term scientific research internships of the Faculty employees and students in foreign universities and institutes.
- Observing the general career growth principles. Increasing the degree of involvement of young employees in research and supporting their career growth.
- Observing the rules for excellent postdocs and foreign researchers who work at the Faculty.
- Development of employee competences in the area of intellectual property protection.
- Evaluation of the implementation of the 17+ Methodology modules.

Strategic management and development of support processes

Objective: To constantly increase the quality of strategic management with a focus on the evaluation of results in relation to the determined objectives and their application to fine-tune specific tools to achieve the strategic goals.

Strategies
- Evaluation of data on the results of educational activity, research, development, and innovations.
- Implementation of the communication strategy of the Faculty using innovative and modern tools and forms of promotion and communication.
- Coordination and administrative support of the activities relating to the preparation and implementation of projects.
- Application of the internal control system as feedback on the management process.
- Development of professional and language competences of the Faculty employees.

Activities to achieve the objective
- Improving the internal evaluation system.
- Regular collection and evaluation of data and analyses to improve relevant processes, infrastructure, and services.
- Continuous provision of updated and relevant information to the students and employees to facilitate their activities using information systems and modern communication tools.
- Updating the internal regulations of the Faculty to ensure the effectiveness of the relevant processes and activities.
- Increasing the quality of strategic management of all activities of the Faculty. Application of motivational systems of evaluation and financing.

Effective financing

Objective: To obtain sufficient financial resources for the activities and development of the Faculty, to ensure effective spending to allow systematic and continuous development of the Faculty in all areas.

Strategies
- Constant effort to obtain a higher amount of institutional financing by improving quality indicators.
- Continuous use of and search for other sources of financing of the faculty.
- Performing analyses of financial sustainability of investment projects and developmental activities already in the preparation stage.

Activities to achieve the objective
- Activities aimed at increasing the funding from the EU framework programme for research and innovations Horizon 2020 (2014–2020) and operational programmes, and through cooperation with industrial entities by means of projects and contract research, additional activities, and other national or international sources.
- Thorough evaluation of the demands for financial sustainability already in the project preparation stage with an emphasis on projects with a low risk of sanctions arising from the infringement of sustainability criteria.

14. Conclusion

In conclusion, I would like to thank everyone who contributed to making 2019 a special year in the life of the Faculty of Chemical Technology, University of Pardubice. I am aware that this would not have been possible without dedicated work of my closest colleagues in the management, heads of departments and institutes, academic staff, technical and economic employees, and of course the students.

I hope that 2020 will be another successful year in the development of educational, scientific, and research activities of the Faculty, and I wish all employees and students a lot of enthusiasm, good health, professional and academic achievements, and last but not least happiness in their personal life.

Prof. Ing. Petr Kalenda, CSc.
Dean

The Annual Report on the activities of the Faculty of Chemical Technology, University of Pardubice was:

- Discussed and approved at the meeting of the faculty management on 19 May 2020
- Discussed and approved by the Academic Senate of the Faculty of Chemical Technology, University of Pardubice on 29 May 2020

Annexes

Significant academic events and life at the Faculty

Attracting talented students and promotion of the Faculty

On 18 January 2019 a ceremony took place at the occasion of awarding of the honorary doctorate "**doctor honoris causa**."

The laureates are:

Prof. Ing. Marek Liška, DrSc., (FChT)
Prof. Dr. Ing. Günter Löffler,
Prof. Ing. Petr Moos, CSc.

On **21 January 2019** the FCHT Dean election took place

On 15 March 2019 the Dean was appointed for the 2nd term and
on 2 May 2019 the Dean and the Vice-Deans were appointed.

On 14 June 2019 the Faculty of Chemical Technology held a festive academic ceremony — **Graduation of follow-up master's degree students.**

The Diploma was received by 121 new Engineers and Masters.

On 14 June 2019 outstanding students were awarded for their master's diploma thesis and its defence.

The following prizes were awarded:

- Rector's Student Award Class I and II,
- Dean's Award

- Czech Glass Society Award

- Synthesia, a.s. CEO Award
- Award of the Chairman of the Board of JUTA a.s.
- DEVRO, s.r.o. Award

- Lanxess, s.r.o. Award

- S&K LABEL Award s.r.o.

- Precheza Award

- Pfizer Award

At the same occasion, all graduates received a graduation badge.

On 6 September 2019 the Faculty of Chemical Technology held a festive academic ceremony — **Pledge of bachelor's degree graduates.**

The diploma was received by 157 new Bachelors.

On 6 September 2019 outstanding students were awarded for their bachelor's diploma thesis.

The following prizes were awarded:

- Award of the Dean of the Faculty of Chemical Technology,

- Synthesia a.s. CEO Award,

- Pfizer CR, s.r.o. Award

On 28 November 2019 the Faculty of Chemical Technology held a festive academic ceremony — **Matriculation of students in the first year of bachelor's degree**

The novices heard the solemn promise and then made a vow in front of the Vice-Dean of the Faculty of Chemical Technology.

Also this year the achievements of previous and current colleagues and the members of the previous Scientific Board were appreciated.

On 17 On 9 2019, at the beginning of the new academic year, the Faculty management organized a pleasant afternoon for its employees —**"Heart 2019"**

From 22 to 24 January 2019 the Faculty of Chemical Technology was presented at the higher education and lifelong learning exhibition **Gaudeamus** in **Prague** and from **22 to 25 October** also in **Brno.**

On 30 January and **13 February 2019** the Faculty of Chemical Technology held the **Open days** for the public. This event was accompanied by private tours and excursions for students at various dates as requested by secondary schools.

Just as in previous years, future students had the opportunity to take a look into the laboratories and lecture rooms.

On 8 February 2019 the fourth year of the chemical competition for secondary school students **Chemiklání** was held.

On this day, the Faculty was visited by over 60 teams not only from the Czech Republic, but also Slovakia.

In groups of 3 to 5, students competed in theoretical tasks with a time limit.

The winner was the team that completed the highest number of tasks.

Those who were interested in the **Erasmus+** programme had the opportunity to learn more about how to get to know a foreign country in the course of study, **27 February 2019**.

On 13 March 2019 the **KONTAKT** labour fair was held.
Our students were visited by a number of major chemical enterprises.

From 13 to 14 March 2019 the Faculty of Chemical Technology supported the Regional round of the **Festival of science and technology for children and youth in the Pardubice Region — AMAVET**.

The best works of secondary school students in chemistry and biochemistry were awarded.

The awards were also presented by the Dean of the Faculty Prof. Ing. Petr Kalenda, CSc.

On 20 March 2019 the winners of the regional round of **Search for the best young chemist** were announced and awarded.

On **15 April 2019**, the representatives of the Faculty attended the **Gala** at the occasion of the 50th anniversary of the establishment of the **Faculty of Technology, Tomas Bata University in Zlín.**

The long-term cooperation between the faculties was also appreciated by a commemorative medal.

On 16 April 2019 the **Young researchers' night** took place at the ABC Club

On 15 May 2019 our students were introduced a new collection of gift items.

"Life is chemistry" is not just an empty slogan for us…

On 7 June 2019 the Faculty was presented at the **Science Fair** in the modern buildings of PVA EXPO in Prague. This event was organized by the Czech Academy of Sciences.

On 11 June 2019 the Faculty of Chemical Technology held the **7th year of the national finals** of **Search for the best young chemist.**

The contest was held under the patronage of the Dean of FChT Prof. Ing. Petr Kalenda, CSc.

On 13 June 2019 the Faculty participated in the **Science and technology fair.**

From 11 to 19 August 2019 the University of Pardubice had a permanent **Science Point** in the **Sports park** na Špici, where our Faculty was also represented

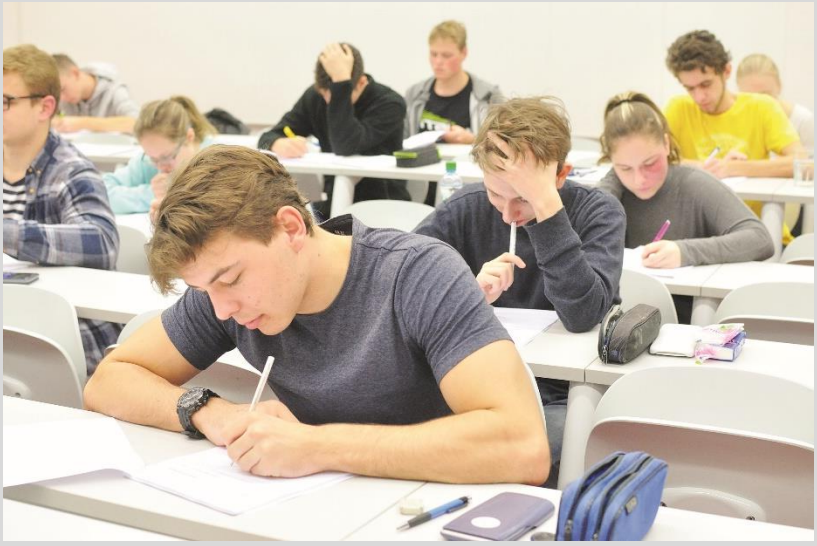
Even during the summer our laboratories were not empty. Our students were replaced by curious young researchers of various ages who took part in several projects such as **Summer School** or **Day Camps**.

In the context of the long-term programme **Science and technology in school yards** we visited several schools including the elementary school in Lanškroun.

On 27 September 2019 the Faculty participated in the European Science Festival — **Researchers' Night**

Between 4 and 10 p.m. the visitors saw a number of experiments.
This year's theme: **Gentle on the planet.**

On **6 December and 4 May 2019**, the regional rounds of the **Chemical Olympiad** were held for the Pardubice Region and Hradec Králové Region.



Category A is intended for students of the final years of grammar school, while category B is for the penultimate years of secondary schools.