Annual Activity Report
Faculty of Chemical Technology
University of Pardubice

2018

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University of Pardubice

2018

Content Page

Introduction

Dear Readers, this publication is the Annual Report for 2018 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)

prof. Ing. Petr Mošner, Dr.
(Vice-Dean for Research)

prof. Ing. Karel Ventura, CSc.
(Vice-Dean for Internal and External Affairs)

Secretary of 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)
Commissioned Head of the Department: prof. Ing. Alexander Čegan, CSc.

Department of Physical Chemistry (KFCh)
Head of Department: prof. Ing. Jiří Málek, DrSc.
prof. Ing. Libor Čapek, Ph.D. *(from 1. 2. 2018)*

Institute of Chemistry and Technology of Macromolecular Materials (ÚChTML)
Commissioned Head of the 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: prof. Ing. Hana Lošťáková, CSc.
Commissioned Head of the Department: Ing. Jan Vávra, Ph.D. *(from 1. 8. 2018)*

Department of Inorganic Technology (KAnT)
Commissioned Head of the 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 (KPF)
Head of Department: prof. Ing. Petr Němec, Ph.D.

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

Center of Materials and Nanotechnologies (CEMNAT)
Head of Center: prof. Ing. Miroslav Vlček, CSc.

Join Laboratory of Solid State Chemistry (SLChPL)
Commissioned Head of the Laboratory: doc. Ing. Eva Černošková, CSc.

Centers

University Ecological Center
Head of Center: prof. Ing. Petr Mikulášek, CSc.

1.3 Academic Senate of FChT

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

Board: doc. Ing. Martin Adam, Ph.D.
Ing. Aleš Eisner, Ph.D.
Ing. Lada Dubnová

Members: doc. Ing. Martin Adam, Ph.D.
prof. Ing. Libor Čapek, Ph.D.
prof. Ing. Čestmír Drašar, Dr.
Ing. Lada Dubnová
Ing. Aleš Eisner, Ph.D.
doc. RNDr. Jana Holubová, Ph.D.
Bc. Jan Hrabovský
prof. Ing. Roman Jambor, Ph.D.
Ing. Patrik Pařík, Ph.D.
Ing. Jan Podlesný *(to 1. 11. 2018)*
Ing. Marek Smolný *(from 1. 1. 2018)*
Ing. Pavel Šimon
Ing. Martina Špryncová *(from 5. 11. 2018)*
Ing. David Veselý, Ph.D.
prof. Ing. Jaromír Vinklárek, Dr.
doc. Ing. Tomáš Weidlich, Ph.D.

1.4 Scientific Board of FChT

Chairman: prof. Ing. Petr Kalenda, CSc., dean of the Fakulty of Chemical-Technology

Intermal 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. Petr Kalenda, CSc.
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.	Technopark Kralupy UCT Prague, Kralupy nad Vltavou
Ing. Jana Bludská, CSc.	Institute of Inorganic Chemistry of the Czech Academy of Sciences
doc. RNDr. Jiří Dostál, CSc.	FLKŘ TomasB Bata University in Zlín
prof. Ing. Jiří Hanika, DrSc.	Institute of Chemical Process Fundamentals of the Czech Academy of Sciences
prof. Ing. Jaromír Havlica, DrSc.	FCH Brno University of Technology
prof. Ing. Aleš Helebrant, CSc.	Vice-dean FCHT UCT Prague
Ing. Josef Liška	director Synthesia, a. s., Pardubice
prof. Ing. Ján Šajbidor, DrSc.	dean FCHPT, Slovak University of Technology in Bratislava
prof. Ing. Václav Švorčík, DrSc.	FCHT UCT Prague
Ing. Josef Tichý, CSc.	director Explosia, a. s., Pardubice

1.5 Study Programme Board

The chairman, the vice-chairman and members were appointed on 26. 4. 2018.

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

Vice-chairman: prof. Ing. Mikulášek Petr, CSc.

Members:
prof. RNDr. Bílková Zuzana, Ph.D.
prof. Ing. Čapek Libor, Ph.D.
prof. Ing. Černošek Zdeněk, CSc.
doc. Ing. Červenka Libor, Ph.D.
doc. Ing. Čičmanec Pavel, Ph.D.
doc. Ing. Fischer Jan, CSc.
doc. RNDr. Holubová Jana, Ph.D.
prof. Ing. Hrdina Radim, CSc.
doc. Ing. Imramovský Aleš, Ph.D.
doc. Ing. Jalový Zdeněk, Ph.D.
prof. Ing. Kalenda Petr, CSc.
prof. Ing. Kalendová Andréa, Dr.
prof. Mgr. Kanďár Roman, Ph.D.
doc. Ing. Krejčová Anna, Ph.D.
prof. Ing. Mošner Petr, Dr.
prof. Ing. Růžička Aleš, Ph.D.
prof. Ing. Sedlák Miloš, DrSc.
prof. Ing. Šulcová Petra, Ph.D.
doc. Ing. Tetřevová Liběna, Ph.D.
Ing. Veselý David, Ph.D.

1.6 Advisory Bodies of the Faculty Management
Advisory Bodies of the Faculty Management

Pedagogical committee

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

Secretary: Ing. David Veselý, Ph.D., commissioned to lead of ÚChTML

Members: doc. Ing. Petra Bajerová, Ph.D., KAlCh
prof. Ing. Alexander Čegan, CSc., commissioned to lead 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 committee

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

Members: prof. Ing. Alexander Čegan, CSc., commissioned head of KBBV
Ing. David Veselý, Ph.D., commissioned to lead of ÚChTML
Lada Dubnová, student
Pavla Palhounová, student
Ing. Jitka Klikarová, student

Investment committee

Chairman: prof. Ing. Petr Mošner, Dr., Vice-Dean for Research

Members: representatives of all departments and institutes

FChT committee for excess and unusable property management and precious metals write-off

Chairman: Ing. Martin Šprync, Faculty secretary

Members: doc. Ing. Petra Bajerová, Ph.D., KAlCh
Ing. David Veselý, Ph.D., commissioned to lead 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 8 bachelor's degree programmes, 6 follow-up master's degree programmes, and 7 doctoral degree programmes; in total, the Faculty has 41 fields of study. In the academic years 2017/2018 and 2018/2019, the following accredited study programmes were available:

Name of study programmes		Name of study branches	Standard length of study (years)			Code KKOV
			Bc.	N-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	Environment 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	Farmacochemistry and Medicinal Materials	Farmacochemistry 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 ane 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

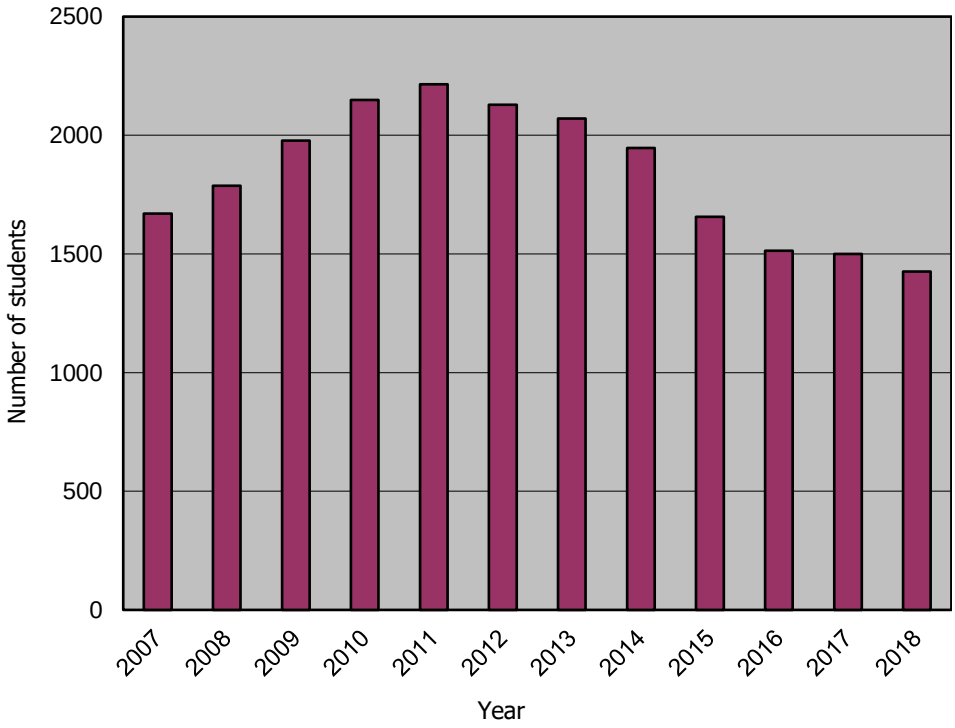
2.2 Numbers of Students in Bachelor's, Master's and Doctoral Degree Programmes

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	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Number of students	1616+54c	1718+69c	1895+83c	2058+91c	2124+91c	2047+82c

Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Number of students	1975+95c	1840+106c	1542+115c	1377+137c	1353+147c	1276+150c



Development of the overall number of students at FChT between 2007 and 2018

Numbers of students by type of study

Form and degree of study	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Students with Czech citizenship	1975	1840	1542	1377	1353	1276
Foreign students	95c	106c	115c	137c	147c	150
Total students	**2070**	**1946**	**1657**	**1514**	**1500**	**1426**
Full-time study Bachelor's programmes Master's programmes	1276+52c 418+13c	1226+62c 381+9c	1040+80c 315+5c	875+95c 326+14c	857+99c 332+22c	841+99c 278+27c
Total Full-time study	**1694+65c**	**1607+71c**	**1355+85c**	**1201+109c**	**1189+121c**	**1189+121c**
Combined studies Bachelor's programmes Master's programmes	69+3c 5	34+1c 0	4+0c 0	2+0c 0	1+0c 0	1+0c 0
Total combined studies	**74+3c**	**34+1c**	**4+0c**	**2+0c**	**1+0c**	**1+0c**
Doktoral programmes	**207+27c**	**199+34c**	**183+30c**	**174+28c**	**163+26c**	**156+24c**

Number of full-time students by study programmes

Study programme	2016/2017		2017/2018		2018/2019	
	Bc*	M*	Bc	M	Bc	M
Chemistry and Chemical Technology	133+6c	-	124+3c	-	116+4c	-
Chemistry and Technology of Foodstuffs	86+9c	42+0c	85+13c	35+0c	104+14c	24+2c
Graphic Arts and Printing Technology	58+6c	16+5c	45+1c	20+9c	44+3c	21+5c
Special Chemical and Biological Programmes	350+34c	73+2c	353+41c	82+6c	360+44c	65+6c
Chemical and Process Engineering	89+4c	-	74+3c	-	64+3c	-
Ecology and Environment Protection	-	-	-	-	-	-
Farmacochemistry and Medicinal Materials	118+35c	-	127+37c	-	96+30c	-
Surface Protection of Building and Construction Materials	8+0c	-	11+0c	-	16+0c	-
Inorganic and Polymeric Materials	33+1c	-	38+1c	-	41+1c	-
Chemical and Process Engineering - N2807	-	41+1c	-	43+1c	-	38+2c
Chemistry and Technology of Materials - N2808	-	84+4c	-	77+5c	-	64+6c
Chemistry - N1407	-	70+2c	-	75+1c	-	66+6c
Total	**1201+109c**		**1189+121c**		**1119+126c**	

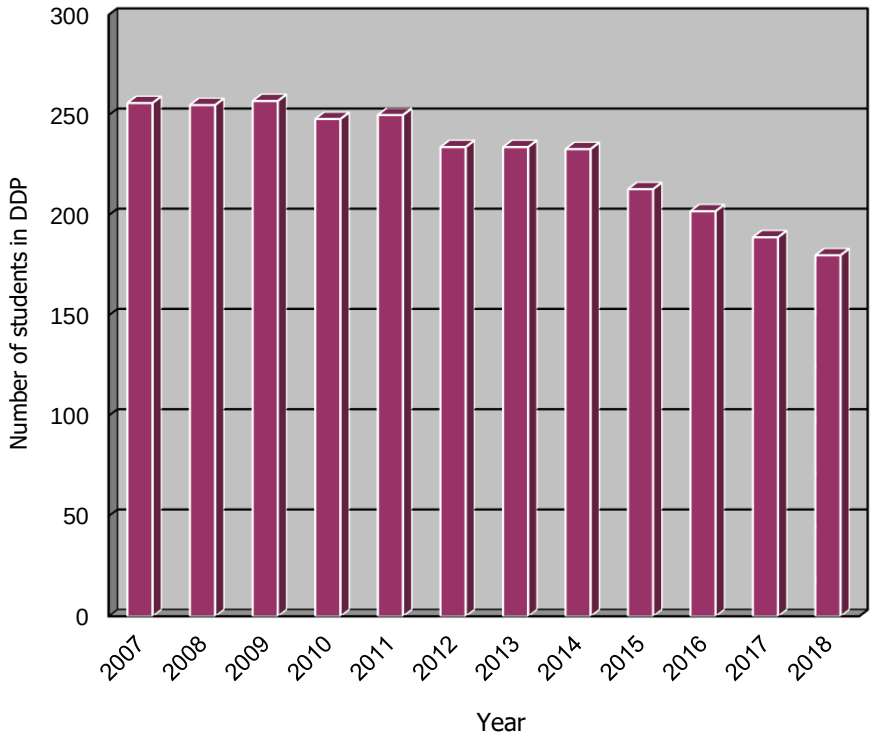
*) Bc – Bacheolor's, M - Master's

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

Year	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Number of students	259	255	260	248	250	234
Number of doctoral (%)	15,5	14,3	13,1	11,5	11,3	11,0

Year	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Number of students	234	233	213	202	189	180
Number of doctoral (%)	11,3	11,9	12,8	13,3	12,6	12,6

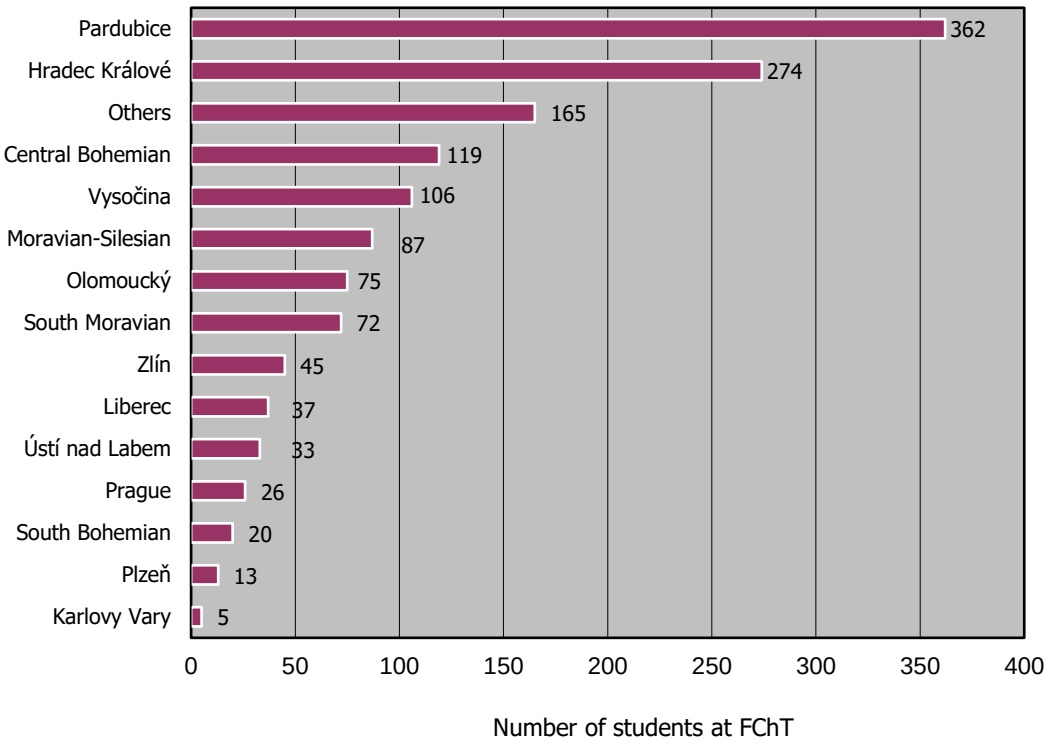
In 2018 the proportion of doctoral degree students was above 10% of the total number of students at FChT. Their current proportion is 12.6%.



Number of students in doctoral degree programmes at FChT between 2007 and *2018*

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 (bar 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 2018)

2.3 Newly Admitted Students

In 2018 the Faculty was active in attracting secondary school students. The Faculty addressed potential applicants at various events, in the radio, press, internet (higher education exhibitions Gaudeamus in Brno and Prague, Akadémia in Bratislava, Open Days, Chemical Olympiad, Science and technology festival AMAVET, Chemical contest Chemiklání, advertisements in press, promotion through the radio, information on web pages and social networks, presentations in secondary schools, etc.)

Open Days

On 10 January 2018, a total of 74 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 proceedings 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 36 students from grammar schools and 38 students from other secondary schools. The second Open Day, which was reserved for students from SPŠCH Pardubice and SPŠPT Pardubice, took place on 11 January 2018 and was attended by 70 students. The third Open Day took place on 7 February 2018. This Open Day was attended by 65 students from grammar schools and 87 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 2018 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 award-winning secondary school students. The district round of the contest took place on 15 February 2018 at the High School of Chemistry Pardubice. The regional round of the contest took place from 8 to 9 March 2018 at the IDEON Exhibition Center 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

Jitka Divíšková
SPŠCH Pardubice

2nd place

Martin Kloz
SPŠCH Pardubice

Miroslav Jirásek
SPŠCH Pardubice

3rd place

Lenka Bauerová
Gymnázium A. Jiráska, Litomyšl

Filip Marek
Gymnázium a Střední odborná škola Přelouč

Lenka Storoženková
SPŠCH Pardubice

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

Adéla Dvořáková, Aneta Dvořáková
Gymnázium Vysoké Mýto

Jakub Nápravník
Elementary school Jindřicha Pravečka Výprachtice

Viktorie Eichlerová, Gabriela Vavřinová
Elementary school Závodu míru, Pardubice

Nikola Šplíchalová, Daniel Klement
Elementary school Litomyšl

Věra Málková, Veronika Kopecká
Elementary school Pardubice - Polabiny, npor. Eliáše 344

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 contest for grammar school students (A, B) and students of chemical vocational schools (E) who in addition to

curricular chemistry want to improve in the field that they want to study after graduation from secondary school. In 2018 the Faculty hosted the regional rounds of the Chemical Olympiad for the Pardubice and Hradec Králové Regions. On 12 May 2018 the contest was held for categories B and E (intended for penultimate years of secondary schools), involving 39 contestants; on 7 December 2018 the contest was held for category A (last years of grammar schools), involving 18 competitors.

In 2018 the Faculty supported the third year of a chemical contest **Chemiklání.** This is a one-day contest for 3 to 5-member teams of secondary school students interested in chemistry. Regarding the huge interest the contest 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 third year of the contest (9 February 2018) involved over 60 teams from secondary schools not only from the Czech Republic but also Slovakia. The winning team was from Gymnázium Budějovická, Praha 4 (#nwm :]), the second team was from Gymnázium Brno, třída Kapitána Jaroše (Fakt silnej pufr) and the third team was from Gymnázium Jírovcova, České Budějovice (Prohibidibádidádijo). 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 get 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 an 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 to 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 2018, the employees of the Faculty visited elementary schools in Lanškroun and Kameničky, Primary school and practical school Svítání, and Children's home in Pardubice.

The staff and students of the Faculty were actively involved in the **Young Researchers' Night** (27 March 2018), which was prepared by the University of Pardubice in cooperation with the East Bohemia Museum Pardubice and 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 directly at the Pardubice Castle 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 center of Pardubice on 14 June 2018. Scientists and university students had their scientific festival including educative and experiential stands and demonstrations at Pernštýnské Square in the historical center 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 27 August to 31 August 2018, a total of twenty children from Pardubice and its surroundings became university students and by means of **Day Camps** participated in 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 (23 October to 26 October 2018) and in Prague (23 January to 25 January 2018). The purpose of the exhibitions 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 various 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 was more than interesting.

The Faculty has regular presentations at the educational exhibition **Akadémia Bratislava**, which took place from 9 to 11 October 2018. The 22nd year of the exhibition presented a total of 66 universities of which 30 were from abroad. Secondary school students showed great interest in the exhibition, which was attended by more than 7,000 visitors. Especially in the morning hours the exhibition grounds were crowded. The representatives of the Faculty provided secondary school students and educational counsellors with information about the Faculty, admission proceedings, accommodation, boarding, and student life in Pardubice. The exhibition also included demonstrations of simple chemical tasks.

In 2018, the Faculty supported the 11th year of **Search for the best young chemist**, and is the traditional sponsor of this event. The awards were presented at a ceremony on 4 April 2018 by the Dean of the Faculty of Chemical Technology Prof. Ing. Petr Kalenda, CSc. As in previous years, the 2018 contest took place in four categories. The best young chemist was the one with the best results in the test part, which consisted of two rounds. The second category was the project part, which was intended for 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 4 April 2018. 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 contest "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 2018, the Faculty of Chemical Technology, University of Pardubice in cooperation with the Association of Chemical Industry of the Czech Republic hosted the jubilee **6th year of the national final of the contest 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 contest. In total, the contest involved more than 15,000 ninth graders. The national round took place on 12 June 2018 at FChT in Pardubice. The guarantors of the contest were the Dean of FChT Prof. Ing. Petr Kalenda, CSc. and Director of SCHP CR Ing. Ivan Souček, Ph.D. 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 contest "Search for the best young chemist of CR"** was presented to competitors in the 1st to 5th place.

1st place

Tomáš Brablec, Elementary school Letovice.

2nd place

Tomáš Bobek, Elementary school Šafaříkova,Valašské Meziříčí.

3rd place

Aneta Piklová, Elementary school J. A. Komenského, Blatná.

4th place

Jana Lelková, Elementary school Pohořská, Odry.

5th place

Vít Pavlík, Elementary school Wolkerova, Havlíčkův Brod

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, Elementary school Letovice, Mgr. Jana Veselá, Elementary school Šafaříkova, Valašské meziříčí, and Mgr. Petra Karešová, Elementary school J. A. Komenského, Blatná.

In 2018, the Faculty was actively involved in popularization of chemistry among the general public in order to support young people's interest in chemistry and its study. Chemistry popularization was also part of the traditional university students' **May Celebration** that took place in Pardubice from 11 to 12 May 2018.

In 2018 the Faculty became the partner of **Children's Super Day** (2 June 2018), whose 17th 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** (5 October 2018) 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 enriched the programme of the Sports Park Pardubice (11-19 August 2018). 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 of the Faculty 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 a student 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 34 students from 12 departments of the Faculty. On 11 June 2018 the papers were publicly presented by means of a short presentation. The presentation also included a scientific debate.

Members of the board who judged the quality of the presentations were satisfied both in terms of content and formal aspects of the presentations. 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 proceedings

The admission proceedings for study in bachelor's degree programmes for the academic year 2018/2019 took place in two rounds. The date for submission of applications for "Chemistry and Technical Chemistry", "Chemistry and technology of foodstuffs", "Graphic Arts", "Inorganic and Polymeric Materials", "Chemical and Process Engineering", "Pharmacochemistry and Medicinal Materials", "Surface Protection of Building and Construction Materials", and "Special Chemical-Biological Disciplines" was 31 March 2018.

Regarding the fact that during the first round of the admission proceedings the capacity of some bachelor's degree programmes was not achieved, the second round was announced with the application submission date 12 August 2018. The second round of the admission proceedings was based on the evaluation of the applicants' academic achievement at secondary school – the applicants were ranked in order and admitted for study according to available capacity of relevant study programmes.

The application submission date for the follow-up master's degree programmes was 31 July 2018. The admission proceedings was performed from 4 September 2018 to 5 September 2018. The admission exam was carried out by means of an oral interview with the applicants. The application submission date for the doctoral degree programmes was 30 April 2018. The admission exam was carried out by means of an oral interview on 12 June 2018. The results of the admission proceedings are summarized in the following table.

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

Study programme	**Number of registered**	**Admitted** I. round	**Admitted** II. round	**Admitted total**	**Enrolled**
Chemistry and Chemical Technology	106	65	15	80	**58**
Chemistry and Technology of Foodstuffs	124	75	18	93	**59**
Special Chemical and Biological Programmes	443	333	-	333	**173**
Graphic Arts and Printing Technology	48	29	6	35	**27**
Chemical and Process Engineering	76	35	17	52	**38**
Farmacochemistry and Medicinal Materials	181	104	36	140	**63**
Surface Protection of Building and Construction Materials	15	8	3	11	**9**
Inorganic and Polymeric Materials	40	24	2	26	**14**
Total	**1 033**	**673**	**97**	**770**	**441**

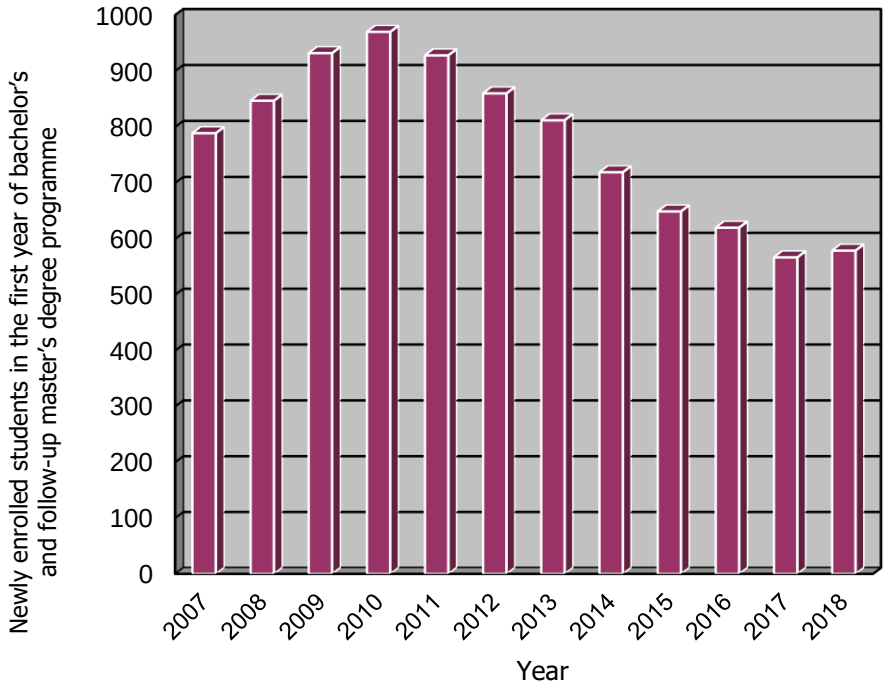
Full-time form of study – master's degree programmes

Study programme	Number of registered	Admitted without entrance exams	Admitted with an entrance exams	Admitted total	Enrolled
Special Chemical and Biological Programmes	71	7	45	52	29
Graphic Arts and Printing Technolog	10		9	9	9
Chemistry	55	18	29	47	37
Chemical and Process Engineering	20		18	18	17
Chemistry and Technology of Materials	45	24	12	36	34
Chemistry and Technology of Foodstuffs	22		16	16	12
Total	**223**	**49**	**129**	**178**	**138**

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

Year	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Registered	1366+29c	1541+32c	1744+57c	1888+58c	1829+50c	1674+66c
Admitted	1221+26c	1304+31c	1489+53c	1174+11c	1284+29c	1245+49c
Newly enrolled	**768+21c**	**829+18c**	**897+35c**	**938+32c**	**910+18c**	**830+30c**

Year	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Registered	1610+72c	1466+91c	1317+121c	1262+164c	1151+132c	1107+149c
Admitted	1176+55c	1115+64c	1005+89c	916+116c	858+89c	838+110c
Newly enrolled	**777+35c**	**682+37c**	**601+48c**	**563+57c**	**516+51c**	**521+58c**



Development of the number of newly enrolled students in the first year of bachelor's and follow-up master's degree programme between 2007 and 2018

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

Study programme	Number of registered	Admitted examination	Admitted total	Enrolled
Inorganic Chemistry	1	1	1	1
Analytical Chemistry	13	12	13	13
Physical Chemistry	3	2	2	2
Organic Chemistry	2	2	2	2
Chemical and Process Engineering	5	5	5	5
Chemistry and Chemical Technology	3	3	3	2
Chemistry and Technology of Materials	12	11	11	10
Total	**39**	**36**	**37**	**35**

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

Study programme	Number of registered	Admitted examination	Admitted total	Enrolled
Inorganic Chemistry	-	-	-	-
Analytical Chemistry	3	3	3	3
Physical Chemistry	-	-	-	-
Organic Chemistry	-	-	-	-
Chemical and Process Engineering	4	4	4	4
Chemistry and Chemical Technology	-	-	-	-
Chemistry and Technology of Materials	4	2	2	2
Total	**11**	**9**	**9**	**9**

770 applicants were admitted in full-time bachelor's degree programmes. 178 applicants (a total of 948) were admitted in follow-up master's degree programmes. A total of 46 students were admitted in both full-time and part-time doctoral degree programmes. **In the academic year 2018/2019, a total of 994 students were admitted, of whom 623 enrolled for 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 together with the Institute of Applied Physics and Mathematics hold the so-called "Introduction in the study" in "General and inorganic chemistry" and "Mathematics". 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, revision of the knowledge of mathematical operations corresponding with secondary school mathematics. The level and difficulty of the course is designed in a way to allow students to cope with the learning content of these two subjects in theoretical as well as practical seminars. In 2018, this course was available for the applicants for study at the Faculty of Chemical Technology.

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	2007	2008	2009	2010	2011	2012
Bc.	209	200	166	191	243	250
Mgr.	38	25	36	35	34	47
Ing.	95	129	139	104	103	106
Ph.D.	34	36	28	41	17	21
Total	**376**	**390**	**369**	**371**	**397**	**424**

Note: Bc. - Bachelor's, Mgr. and Ing - Master's, Ph.D. - Doctoral

Type of study	2013	2014	2015	2016	2017	2018
Bc.	260	223	209	232	208	176
Mgr.	36	30	38	23	24	43
Ing.	114	149	146	116	98	121
Ph.D.	29	29	27	19	26	32
Total	**439**	**431**	**420**	**390**	**356**	**372**

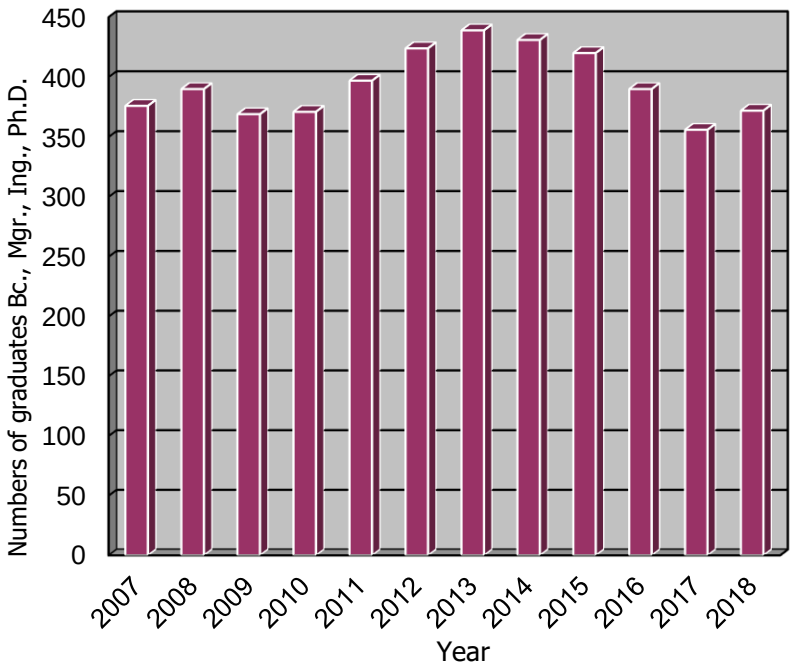
The numbers in the table correspond with Statement V 12-01 for the period from 1 January to 31 December of the relevant year

Numbers of graduates from doctoral degree programmes by year

Graduates Ph.D.	2007	2008	2009	2010	2011	2012
Number	37	35	34	37	22	23

Graduates Ph.D.	2013	2014	2015	2016	2017	2018
Number	26	24	31	20	23	35

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

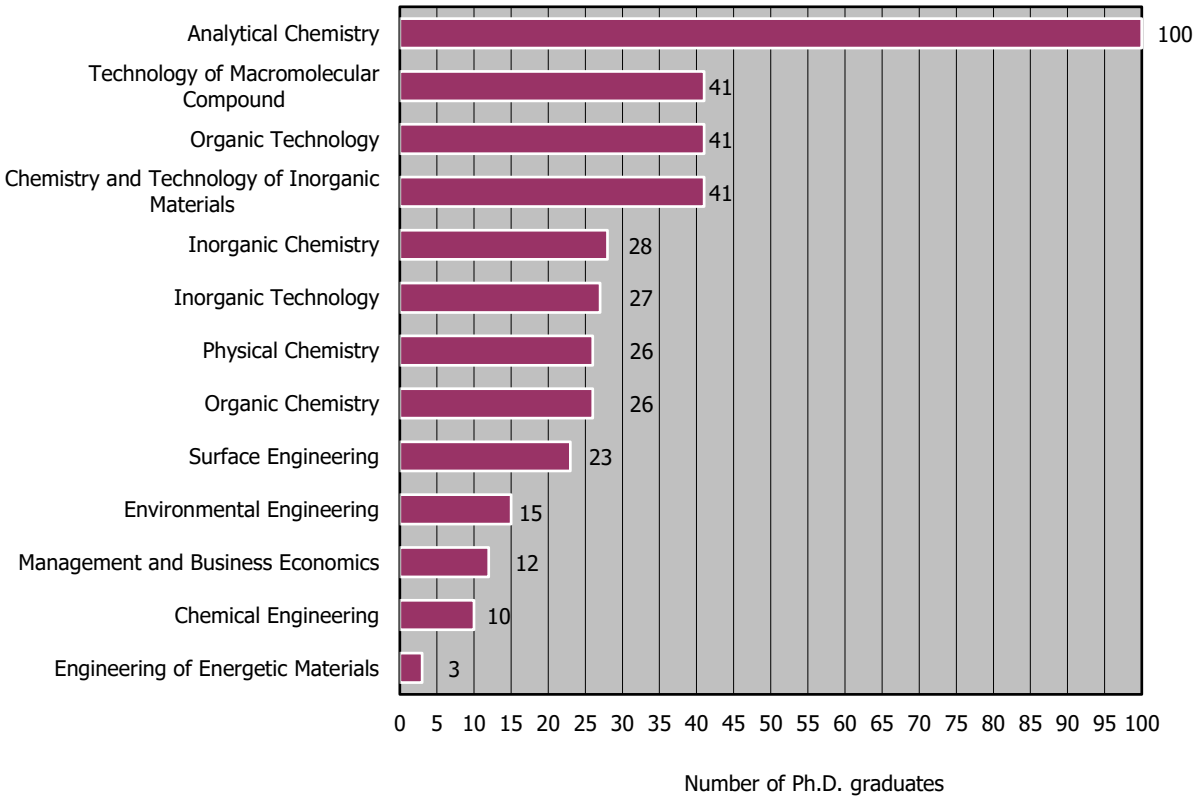


Numbers of graduates Bc., Mgr., Ing. and Ph.D. between 2007 and 2018

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

Study programme	Number of graduates				
	2013/14	2014/15	2015/2016	2016/2017	2017/18
Inorganic Chemistry	3	1	4	3	1
Organic Chemistry	3	1	1	4	2
Analytical Chemistry	3	11	7	5	9
Physical Chemistry	3	-	-	2	1
Chemistry and Chemical Technology	4	4	4	3	-
Chemistry and Technology of Environmental Protection	-	-	-	-	-
Chemical and Process Engineering	5	5	2	1	9
Chemistry and Technology of Materials	3	9	2	5	13
Total	**24**	**31**	**20**	**23**	**35**

The research projects of the departments and institutes also involved a number of postgraduate students, because the topics of their dissertations were based on the 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 2018, a total of 393 postgraduate students defended their dissertations on topics 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 *2018 corresponding with the scientific and research focus of the departments and institutes of FChT*

Award-winning papers of FChT students

In 2018 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 dissertation

Ing. Petr Kalenda, Ph.D.
Study of structure and properties of barium phosphate and borophosphate glasses modified by niobium and molybdenum oxides
Supervisor: prof. Ing. Ladislav Koudelka, DrSc.
Department of General and Inorganic Chemistry

Ing. Stanislav Šlang, Ph.D.
Deposition and characterization of sulfide chalcogenide glass thin films prepared by spin-coating technique
Supervisor: prof. Ing. Miroslav Vlček, CSc.
Department of General and Inorganic Chemistry

Ing. Michaela Štěpánková, Ph.D.
Electrochemical properties of boron-doped diamond electrodes and their application in analysis of bioactive compounds
Supervisor: doc. Ing. Renáta Šelešovská, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Petra Šilarová, Ph.D.
Analysis of antioxidants in natural matrices using liquid
Supervisor: doc. Ing. Lenka Česlová, Ph.D.
Department of Analytical Chemistry

Ing. Simona Žabčíková, Ph.D.
Using of carbon electrodes in analysis of foodstuffs
Supervisor: doc. Ing. Libor Červenka, Ph.D.
Department of Analytical Chemistry

Ing. Martina Říhová, Ph.D.
Bleaching of soda pulp from rapeseed straw
Supervisor: prof. Ing. František Potůček, CSc.
Institute of Chemistry and Technology of Macromolecular Materials

Komerční banka Award for the best scientific-research paper written by a doctoral degree student in the academic year 2017/2018

Ing. Kateřina Nechvílová, Ph.D.
Study of new conductive materials for organic coatings
Supervisor: prof. Ing. Andréa Kalendová, Dr.
Institute of Chemistry and Technology of Macromolecular Materials

Class 1 Rector's Award for master's diploma thesis defended in 2018

Ing. Barbora Řeháková
Analysis of Phenolic Compounds with antioxidant properties in decaffeinated coffee
Supervisor: doc. Ing. Lenka Česlová, Ph.D.
Department of Analytical Chemistry

Class 2 Rector's Award for master's diploma thesis defended in 2018

Mgr. Nikola Voltnerová
Supplements for positive effects on human microbiom
Supervisor: doc. Ing. Marcela Pejchalová, Ph.D.
Department of Biological and Biochemical Sciences

Ing. Barbora Kamenická
Application of cationic surfactants for the separation of chlorinated biocidal acids and their salts from waste water
Supervisor: doc. Ing. Tomáš Weidlich, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Daniel Novotný
Study of properties of nanoparticles in paints intended for car body painting
Supervisor: Ing. David Veselý, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

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

Ing. Vendula Meinhardová
Study of the structural, textural and electronic properties of neodymium modified TiO_2 materials
Supervisor: Ing. Helena Drobná, Ph.D.
Department of Physical Chemistry

Ing. Michaela Lutrová
Differences in financial accounting according to IAS/ IFRS and Czech accounting legislation in the enterprise of chemical industry
Supervisor: Ing. Jana Košťálová, Ph.D.
Department of Economy and Management of Chemical and Food Industry

Ing. Jan Smolík
Photo-induced effects in the glassy $PbO\text{-}Ga_2O_3$
Supervisor: Ing. Petr Knotek, Ph.D.
Department of General and Inorganic Chemistry

Mgr.Pavla Fialová
Study of the influence of plasma fatty acids on the progression of type 2 diabetes
Supervisor: prof. Ing. Alexander Čegan, CSc.
Department of Biological and Biochemical Sciences

Ing. Monika Chládková
Sodium-zinc phosphate glasses with titanium
Supervisor: doc. RNDr. Jana Holubová, 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 2018

1st place

Ing. Václav Branský
Analysis of Aromatic Compounds Present in Green Tea
Supervisor: doc. Ing. Lenka Česlová, Ph.D.
Department of Analytical Chemistry

2nd place

Ing. Marie Herynková
Study of voltammetric behavior of fungicide azoxystrobin and development of method for its determination
Supervisor: doc. Ing. Renáta Šelešovská, Ph.D.
Institute of Environmental and Chemical Engineering

3rd place

Ing. Lenka Kuchařová
Analysis of polyphenolic compounds in superfoods IV
Supervisor: Ing. Blanka Švecová, Ph.D.
Department of Analytical Chemistry

Synthesia, a.s. CEO Award for the most interesting content of master's diploma thesis defended in 2018 *in the area of organic pigments and technologies, processes, materials and technologies with a significant impact on industrial production*

Ing. Barbora Pulkrábková
Analytical and toxicological assessment of red pigment P.R. 177
Supervisor: doc. Ing. Jan Fischer, CSc.
Department of Analytical Chemistry

Ing. Josef Jarkovský
Study of liposome systems of textile dyes
Supervisor: Ing. Michal Černý, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

Precheza, a.s. Award for outstanding master's diploma thesis defended in 2018 *in the area of inorganic pigments, their applications and technologies*

Ing. Martina Novotná
Behavior of coatings in dependence of the metal zinc morphology and of the concentration and type of conductive polymer
Supervisor: prof. Ing. Andréa Kalendová, Dr.
Institute of Chemistry and Technology of Macromolecular Materials

Ing. Martina Šnajdarová
Application options of perovskite compounds based on $SrSnO_3$
Supervisor: 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 2018 in the area of polymeric and textile chemistry

1st place

Ing. Tomáš Janda
Study of biological degradation and weather degradation of polymers based on polylactic acid and LDPE
Supervisor: Ing. Miroslav Večeřa, CSc.
Institute of Chemistry and Technology of Macromolecular Materials

2nd place

Ing. Renáta Kratochvílová
Cationization of cellulosic material and effect
Supervisor: Ing. Petra Bayerová, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

3rd place

Ing. Petra Boháčová
Potential salicylamide based proteasome inhibitors - synthesis and characterization
Supervisor: doc. Ing. Aleš Imramovský, Ph.D.
Institute of Organic Chemistry and Technology

Czech Glass Society Award for the best master's diploma thesis defended in 2018 in the area of glass and amorphous materials

Ing. Jiří Jančálek
Deposition and properties of As-S chalcogenide glass thin films
Supervisor: Ing. Karel Pálka, 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 in the academic year 2017/2018 in the area of graphic arts

Ing. Stanislava Maronová
Printing of the fine line conductive structures
Supervisor: doc. Ing. Tomáš Syrový, Ph.D.
Department of Graphic Arts and Photophysics

Ing. Lucie Matušová
Influence of folding box properties on the blanks flow in packaging line
Supervisor: Ing. Hana Holická, Ph.D.
Department of Graphic Arts and Photophysics

Pfizer, spol. s r.o. Award for the best master's diploma thesis defended in 2018 in the area of pharmacochemistry

Ing. Lucie Kocourová
The synthesis of substituted 4-amino-1-arylpyrazol-3-carboxylates using diazonium salts
Supervisor: doc. Ing. Petr Šimůnek, Ph.D.
Institute of Organic Chemistry and Technology

Ing. Eliška Pilařová
New derivative of Corey lactone as a model intermediate for the synthesis of selected prostaglandins
Supervisor: doc. Ing. Aleš Imramovský, Ph.D.
Institute of Organic Chemistry and Technology

Mgr. Aneta Čápová
Determination of dissociation constants of the antidepressant Vortioxetine and Lesinurade, for the treatment of hyperuricaemia associated with gout
Supervisor: prof. RNDr. Milan Meloun, DrSc.
Department of Graphic Arts and Photophysics

Miroslav Jureček Foundation Award for the best master's diploma thesis in the academic year 2017/18

1st place

Mgr. Eliška Šťovíčková
Phosphorylation of recombinant proteins by soluble and immobilized kinases
Supervisor: prof. RNDr. Zuzana Bílková, Ph.D.
Department of Biological and Biochemical Sciences

2nd place

Ing. Michaela Voleská
Self-crosslinking polymeric dispersions with biocidal effect
Supervisor: Ing. Jana Machotová, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

3rd place

Ing. Aneta Šnajdrová
Dissolution tests of suplements for positive influence of human microbioma
Supervisor: Ing. Jaroslava Kořínková, Dr.
Institute of Environmental and Chemical Engineering

Ing. Michaela Šturmová
Antimicrobial effects of tea infusions and extracts against Arcobacter spp.
Supervisor: Ing. David Šilha, Ph.D.
Department of Biological and Biochemical Sciences

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

Bc. Jiří Kotera
Oxidation of ethanol to acetaldehyde over supported vanadium catalysts
Supervisor: prof. Ing. Roman Bulánek, Ph.D.
Department of Physical Chemistry

Bc. Radka Dvořáková
Psoriasis vulgaris
Supervisor: prof. Ing. Alexander Čegan, CSc.
Department of Biological and Biochemical Sciences

Bc. Andrea Šandová
Ablation of the bulk glass Ge25Se75 UV-pulsed laser
Supervisor: Ing. Petr Knotek, Ph.D.
Department of General and Inorganic Chemistry

Bc. Martin Vrbický
Study of asymmetric α-benzoyloxylation of aldehydes
Supervisor: doc. Ing. Pavel Drabina, Ph.D.
Institute of Organic Chemistry and Technology

Bc. Daniela Hrančíková
Cheese and its antioxidant properties
Supervisor: doc. Ing. Libor Červenka, Ph.D.
Department of Analytical Chemistry

Bc. Jan Pavlík
Up-conversion phenomenon in rare earth ions
Supervisor: prof. Ing. Petr Němec, Ph.D.
Department of Graphic Arts and Photophysics

Bc. Ondřej Košťál
Corrosion resistance of zinc-pigmented coatings depending on the concentration and composition of the fillers
Supervisor: prof. Ing. Andréa Kalendová, Dr.
Institute of Chemistry and Technology of Macromolecular Materials

Bc. Lucie Podškubková
The assessment of service quality in B2B market from the perspective of Fibertex Nonwovens, a. s. and its customers
Supervisor: Ing. Vladimíra Vlčková, Ph.D.
Department of Economy and Management of Chemical and Food Industry

Synthesia Pardubice CEO Award for outstanding bachelor's diploma thesis defended in 2018

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 ČR, spol. s r.o. Award for outstanding bachelor's diploma thesis defended in 2018

Bc. Diana Briestenská
Organoboron compounds as fluorescence bioprobes
Supervisor: doc. Ing. Petr Šimůnek, Ph.D.
Institute of Organic Chemistry and Technology

Bc. Tereza Sedláčková
Study of disintegration of matrix tablets with pentoxifylline in various dissolution media
Supervisor: Ing. Václav Lochař, Ph.D.
Department of Physical Chemistry

Bc. Monika Brožová
Toxicity of aminophenolic compounds
Supervisor: doc. RNDr. Tomáš Roušar, Ph.D.
Department of Biological and Biochemical Sciences

Awarded students other than from FChT in 2018

Ing. Marie Herynková
Study of voltammetric behavior of fungicide azoxystrobin and development of method for its determination
METROHM – YOUNG CHEMIST AWARD – advance to the final among the top 10 with the possibility of presenting the results at the 70th Congress of Chemists.
Supervisor: doc. Ing. Renáta Šelešovská, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Zuzana Hloušková
Pyridine push-pull derivatives as organic photocatalysis.
Price from the committee ProteoMass Scientific Society a Royal Society of Chemistry (RSC) for the best poster at the conference 3rd International Caparica Conference on Chromogenic and Emissive Materials, 3–6 September 2018, Caparica, Portugalsko.
Supervisor: prof. Ing. Filip Bureš, Ph.D.
Institute of Organic Chemistry and Technology

Ahmed Khaled Mohamed Hussein, M.Sc.
The effect of different additives on safety manipulation of cis-1,3,4,6-tetranitrooctahydroimidazo-[4,5-d]imidazole (BCHMX).
The presentation was awarded of the prize "best paper award" at the conference "4th International Conference on Engineering, Applied Sciences and Technology (ICEAST 2018), 4–7 July 2018, Phuket, Thajsko".
Supervisor: prof. Ing. Svatopluk Zeman, DrSc.
Institute of Energetic Materials

Ing. Michaela Chocholoušková
Determination of oxylipins in human plasma samples by UHPLC/MS.
Price for the best poster, MS school, 10−14 September 2018, Špindlerův Mlýn, Czech Republic.
Supervisor: prof. Ing. Michal Holčapek, Ph.D.
Department of Analytical Chemistry

Kateřina Krejčová
Voltammetric determination of insecticide difenoconazole
2nd prize for a lecture on "20.

Kateřina Krejčová
Voltammetric determination of insecticide difenoconazole
2nd prize for a lecture on "20. nationwide student scientific conference with international participation - Chemistry and Technology for Life", 7 November 2018, Bratislava, Slovakia.
Supervisor: doc. Ing. Renáta Šelešovská, Ph.D.
Institute of Environmental and Chemical Engineering

Ing. Jindřich Kučera
On the development of cylinder expansion test fixture.
The poster was awarded as "best poster presentation" of the conference "3rd Conference on Greener and Safer Energetic and Ballistic Systems (GSEBS), 5–9 November 2018, Bretagne, Brest, Francie".
Supervisor: doc. Ing. Jiří Pachman, Ph.D.
Institute of Energetic Materials

Md. Mostafizur Rahman, MSc.
Washing of sulphite spruce pulp.
2nd place for a lecture, 59th International Student Scientific Conference, 10 May 2018, Technical University of Zvolen, Slovakia.
Supervisor: prof. Ing. František Potůček, CSc.
Institute of Chemistry and Technology of Macromolecular Materials

Ing. Marek Smolný
Heterogeneous photocatalysis as a possibility of reducing biological contamination of waters
1st place for presentation at the conference „Innovative Remediation Technologies in Research and Practice X",
17–18 October 2018, Žďár nad Sázavou, Czech Republic.
Supervisor: doc. Ing. Jiří Cakl, CSc.
Institute of Environmental and Chemical Engineering

Ing. Denisa Steinerová
Synthesis and testing of paints with increased corrosion resistance based on water-soluble self-crosslinking acrylate latex containing MgO nanoparticles.
1st place of student poster competition with at the conference „Corrosion and anticorrosion protection of materials" (AKI 2018), 24–26 October 2018, Chodová Planá, Czech Republic.
Supervisor: prof. Ing. Andréa Kalendová, Dr.
Institute of Chemistry and Technology of Macromolecular Materials

Ing. Jiří Škorňok
Latexes as a matrices of heterogeneous ion exchange membranes.
1st place of the best poster at the conference „Membranes and Membrane Processes", 24 October 2018, Česká Lípa, Czech Republic.
Supervisor: Ing. Jana Machotová, Ph.D.
Institute of Chemistry and Technology of Macromolecular Materials

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 **"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 and processing aspects.

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 their 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 **"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 2018

Name of lifelong study programme	Number of participants	Length of study	Form of study	Number of sessions
Commenced in 2018				
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
Ongoing				
Rock disintegration by explosion – organized by ÚEnM	10	4 semesters	Licence	400
Theory and technology of explosives – organized by ÚEnM	11	4 semesters	Licence	345

2.7 University Textbooks Issued at FChT in 2018

An integral part of educational activity is the preparation of study materials – university textbooks. In 2018, the following university textbooks were issued at FChT:

1. Handlíř K., Nádvorník M., Vinklárek J., Vlček M.: Laboratory exercises in general and inorganic chemistry II., 1st ed., 216 copies, 70 pages.
2. Pytela O.: Organic chemistry. Nomenclature and general principles, Bachelor's degree programme, 1st book, 5th ed., 512 copies, 64 pages.
3. Hanusek J.: Organic chemistry. Properties and reactivity of organic compounds, Bachelor's degree programme, 2nd book, 5th ed., 512 copies, 124 pages.
4. Handlíř K., Nádvorník M., Vlček M.: Calculations in general and inorganic chemistry II, 3rd ed., 215 copies, 90 pages.
5. Štěpánková Š., Královcová P., Kanďár R.: Laboratory exercises in general and clinical biochemistry, 2nd ed., 315 copies, 180 pages.
6. Bartoš M., Eisner A., Šrámková J.: Analytical chemistry, 2nd ed., 415 copies, 208 pages.

In total 2,185 copies and 736 pages of text were published.

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 and logically builds on the results achieved in previous years in accordance with the Long-term plan of educational, scientific, research, developmental, artistic and other activities of the Faculty for 2018. The scientific and research activities are performed by working groups established at the Faculty's Departments and Institutes, which are actively involved in projects supported by the Czech Science Foundation, Technology Agency of the Czech Republic, or sectoral 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 2018.

Below is an overview of the scientific and research focus of the departments and institutes of the Faculty and their basic activities in 2018.

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 or toxicological analysis.

In the monitored period, liquid state separations were performed to compare the separation properties of diol and amide columns for the separation of phenolic substances and flavones in double retention systems (HILIC-RP) using a combination of different separation mechanisms on polar and nonpolar columns for the development of new methods in two-dimensional separations. A general retention model on columns with dual RP-HILIC mechanism was designed and verified allowing the prediction of retention in the full range of mobile phases using a simple equation. A two-dimensional LCxLC polar substance separation technique was developed combining RP separation of silica gel monolithic columns and HILIC separation on organic monolithic microcolumns developed at the department. Liquid chromatography of hydrophilic interactions was used to study the predictions of gradient retention data and to assess the effects of ionic additives of mobile phases on separations in connection with mass spectrometry. A HPLC-MS method was designed for the analysis of porphyrin food colourants. In the area of electrophoretic separations, research focused on determining the critical micellar concentration of anionic surfactants of sodium alkyl sulphates and perfluorinated carboxylic acids, and on determining the distribution constants of natural antioxidants in micellar and liposomal systems.

In the area of application outcomes, attention was on the analysis of natural antioxidants in different types of matrices, e.g. in olive oil or coffee. The HPLC/MS conditions were optimized for monitoring the content of phenolic substances contained in buckwheat. A study was completed that focused on the analysis of amino acids and phenolic acids, which were confirmed as suitable markers for the evaluation of the quality of mead. In cooperation with Synthesia, the department performed an analysis of impurities that result from the production of anthraquinone pigment P.R. 177. Selected impurities identified in this pigment were also characterized from a toxicological perspective.

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 samples 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, but this will take several years. Other activities included collection of blood samples from healthy participants taken on a regular basis after several months in order to determine the stability of the lipidomic plasma profile, which should increase the accuracy of screening methods. In order to protect the methodology, two European patent applications were 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 extraction methods group focused on modern microextraction analyses of beers with different types of hopping (traditional method or dry hopping). The aim was to distinguish these two types of beer on the basis of different content of linalool or bitter acids as the main markers. For this purpose, the following two methods were tested: direct microextraction by solid phase with subsequent GC-FID analysis to determine linalool and dispersed liquid extraction in conjunction with HPLC-DAD for the analysis of bitter acids. The research focused on the characterization of natural plant materials. Emphasis was on the kinetics of volatile substances contained in bulb onion using the method of solid phase extraction, and on the antibacterial properties of onion extracts. The research also focused on a comparison of the chemical composition of essential oils obtained by hydrodistillation and steam distillation of true lavender, bay laurel, fennel, and cloves. At the same, tests of antioxidant and antimicrobial activity were performed. The composition of lavender hydrosols was studies using various methods of concentration. A method for the analysis of volatile compounds contained in various samples of wood was developed and tested. Post-explosion residues detected after blasting of improvised charges were analysed by means of GC-MS in the MRM mode (Multiple Reaction Monitoring).

In the area of chemistry and food analysis, products with added nutritional value were produced and tested. This was done by partial substitution of wheat flour by carob powder (*Ceratonia siliqua*) in a bakery product, and monitoring of antioxidant properties and creation of products of non-enzymatic browning depending on the amount of carob powder. In cooperation with UTB in Zlín, the effect of adding grapevine cake (waste product in the production of white wine) into processed cheese was examined. The effect of additions processed by different technologies (conventional drying, lyophilisation) was monitored. In the context of a study focusing on the quantification of polyphenolic substances in foodstuffs, these substances were monitored in selected samples of fruit and vegetables.

In compliance with the requirements of current sustainable chemistry, the atomic spectrometry group focused on the development of environmentally friendly, economical and time-saving analytical procedures for quantitative trace and ultra-trace analyses. New types of reagents were designed that allow in combination with modern microwave decomposition or extraction systems to achieve quantitative results in a subsequent spectral analysis of selected complex samples. Using experiment planning tools, the procedures for the analysis of coal ash, sludge, sediment, pigment, ZrO_2, or TiO_2 were optimized and validated. The methods proposed represent an alternative to the current energy-intensive procedures often using corrosive or toxic agents.

The electroanalytical group continued their systematic development and applications of reagents based on electrode materials, for example a method to determine the amount of Diclofenac in natural waters. The voltammetric method using surfactant-modified carbon paste electrodes was used to determine the berberine alkaloid and selected lipophilic vitamins in cosmetic products. New types of non-ionic surfactants were studied by combining potentiometric titrations with ion-selective electrodes.

In the area of biosensors, the group prepared and tested various configurations based on printed carbon electrodes with chitosan membrane and metal oxides as electron mediators. The model enzyme was glucose oxidase. Focus was also on the study of electrochemical properties of lipophilic

vitamins (A, D, E and K) on various electrode materials and the possibilities of their simultaneous determination. A biosensor was designed for amperometric detection of Paracetamol in the FIA regime.
In cooperation with the University of Łódź a voltammetric method was designed to determine lactofen on silver amalgam film electrode and glass carbon electrode, and the interaction of this herbicide with double-helix DNA was examined. A new electroanalytical method was developed for the determination of K1 vitamin in olive oil and food supplements based on adsorptive accumulation on the surface of glass carbon electrode. The results were comparable with the standardized HPLC method. In cooperation with the Department of Biological and Biochemical Sciences a method was developed for simultaneous determination of protein biomarkers HE4, CA-125 and AFP using electrochemical immunosensors based on printed carbon electrodes with bismuth film for early detection of ovarian cancer. Together with the Department of Radiobiology, Faculty of Military Health Sciences, University of Defence, the group validated a method for electrochemical determination of 8-hydroxyguanine as an indicator of oxidation damage to DNA on printed carbon electrodes modified by carbon nanotubes with bonded carboxyl group.

In the area of isotachophoretic analysis a method was developed for the determination of group B vitamins of a cation and anion nature, and triethanolamine. Research continued on the possibilities of determining amino acids and isotachophoretic determination of ethanol in spirits and selected ions in samples of consumption sugars.

The chemometric group studied protonation balances in selected cytostatics Intepirdine, Lesinurad and Roxadustat and Vortioxetine antidepressant. Analytical and biochemical data were processed by means of a multidimensional statistical analysis, which revealed statistically significant correlations between the concentrations of some fatty acids and the size of inflammatory response or oxidative stress after stent implantation.

Department of General and Inorganic Chemistry (KOAnCh)

The scientific and research activity of the department focuses on two areas – chemistry of organometallic and coordination compounds, non-crystalline oxidic chalcogenide glasses and thin layers, 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 study involved the synthesis and characterization of many oligometallic compounds containing hybrid ligands and multideprotonable ligands. These compounds seem to be very promising in the area of C-H activation, reduction of multiple bonds in different types of organic molecules, or as initiators of various polymerization reactions. The origin of some non-covalent interactions between elements such as gold-gold or iodine-iodine was explained by means of sets of compounds and theoretical methods, while their strength was measured by sophisticated methods in the solid phase and solution. The issue of metallophilic interactions, and chalcogen and pnictogen bonds was studies both practically and theoretically.

Focus was also on the structure and reactivity of compounds containing borane, thiaborane and carborane structures in alkylation, arylation, halogenation and metalation, or their interactions with different bases.

Research also focused on the synthesis of the monomer organogermanate hydrides. Non-conventional compounds containing the terminal bond Ge*H* were prepared and fully characterized. The group also analysed the reactivity of these compounds with organic substrates containing multiple bonds C=O and C=C. In some cases these multiple bonds were reduced without the use of catalysts. Intramolecular coordinated gallaboroxines were prepared and applied in a thin layer on a Si and SiO_2 substrate using the spin coating method. The thin layers were analysed using ellipsometric

measurements, UV-VIS spectroscopy and last but not least, the resistance-temperature dependence was measured in selected layers. Selected compounds were also tested as possible non-flammable materials for use in selected textiles.
New cyclopentadienyl and indenyl complexes of molybdenum and tungsten with a phosphorus atom in the side chain were synthesised. The resulting intramolecular coordination was in compliance with theoretical calculations confirmed also by means of available experimental methods. In selected complexes with good solubility and stability in the physiological environment, the cytotoxic activity was studied using the standard WST-1 test. Furthermore, ferrocenes substituted on the cyclopentadienyl circle by acyl groups were synthesised and characterised. It was revealed that this type of complexes could be used as siccatives of oxopolymer-drying paints.

The mechanism of the origin of ferrocene derivatives of 1,2,3-diaza-phospholes was examined. New polydentate ligands were prepared that are capable of coordinating transition metals, while N,N, N,P and P,P chelates are produced. It was revealed that these compounds behave as N/P hybrid ligands and therefore their application in catalytic processes can be assumed.

Focus was also on interesting reactions of low-valency compounds including 15 group elements with electron deficient alkynes, while unprecedented heterocyclic compounds are produced. A new study began in the new area of organo-tellurium and tellurium compounds which show interesting reactivity, for example activation of the B-H bond in carborane clusters, while a new Te-B bond is produced.

In the area of oxidic non-crystalline materials, sodium-phosphate glasses modified by molybdenum trioxide and tungsten trioxide were prepared, and the changes in the structure of selected physical and chemical properties with an increasing content of transition metals 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 core-level spectroscopy ^{31}P. The study showed a significant effect of basicity of these glasses on their optical properties affected by the development of low-valence oxidizing conditions. The high basicity of glasses prevents the formation of Mo^{5+} and W^{5+} ions that decrease the permeability of these glasses. The group continued in the study of phosphate glasses with oxides of transition metals from the fifth group of the periodic table, and the study of glasses of the Na_2O-TeO_2-P_2O_5 system was finished. These glasses were studied as prospective materials for use in non-linear optics. Cooperation with the Ruđer Bošković Institute in Zagreb continued on materials with ion-polaron conductivity on glasses of the Ag_2O-ZnO-P_2O_5 system containing MoO_3 and WO_3.

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. Focus was also on the structure of $xMoO_3$-50ZnO-$(50-x)P_2O_5$ glasses. In addition to the proposal of the structure, the effect of entropy in the production of glasses was experimentally confirmed. Focus was also on glasses with potential bio-applications. These were quaternary glasses of the Na_2O-ZnO-TiO_2-P_2O_5 system. Their physical and chemical characteristics were determined together with the basic information about the structure of the glass phosphate network using ^{31}P and ^{23}Na MAS NMR, Raman variation, and EPR. Regarding the possible bio-applications, attention was on the link between chemical composition and solubility of glasses both in water and physiological solution. A method for analysing the solubility of native samples was proposed and successfully tested, which allows the determination of the thickness of their surface layer. The preparation of glassy and glass-ceramic layers of glasses on a titanium substrate was successfully tested.

The group continues 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. Cooperation was established with Laboratoire de Spectrochimie Infrarouge et Raman, Université de Lille 1 in the area of 1 and 2D NMR spectroscopy.

Glasses of the *"Heavy metal oxide"* group, specifically the PbO-Ga_2O_3 and PbO-Bi_2O_3-Ga_2O_3 systems, were used for direct laser engraving using radiation of up to 1600 W/cm^2, which led to the development of micro-lenses on the glass surface. The properties of the lenses and intensity of their

development was dependent on the thermal properties of the material, especially the thermal expansion coefficient, difference between the temperatures of crystallization and glass transformation, optical properties of the glass, and penetration depth achieved by the laser radiation applied. The lenses originated as a result of thermal expansion and under laboratory conditions showed time stability of at least 9 months.

The study of chalcogenide materials focused on arsenic, germanium and antimony sulphides, selenides and tellurides as materials for electronic memory, ion conductors, and materials for optics and optoelectronics. Cooperation continued with Dipartimento di Scienze Matematiche e Informatiche, Scienze Fisiche e Scienze della Terra Università degli Studi di Messina, Sicily, Italy and Gifu University, Gifu, Japan on the study and interpretation of electric properties and ion conductivity of silver-doped glasses in a broad frequency range. Attention was also on the study of electric properties, especially of silver and lithium glasses in order to study and describe ion conductivity and phenomena associated with electric activation. New testing memory cells (planar and nano-structured) were prepared and activation functionality was maintained after approximately 10^4 of cycles. The results were published and a PCT patent is in the acceptance procedure. Attention was also on the luminescence properties of glasses (co-)doped with rare-earth elements in combination with transition metals with an emphasis on up-conversion and luminescence properties in the infrared spectrum. QRFS (Quadrature Resolved Frequency Spectroscopy) was used to measure photoluminescence kinetics associated with up-conversion. The study and interpretation of luminescence phenomena was performed in cooperation with the National Institute of Materials Science in Tsukuba, Tokyo Polytechnic University, Japan, Harbin University, Harbin, China and the Institute of Physics of the Czech Academy of Sciences. New thin layers of organometallic precursors containing rare-earth elements were prepared by means of rotary application from solutions. Attention was also on photo-induced changes and luminescence in thin layers prepared by means of PLD and their applications.

The research on thin layers of chalcogenide glasses prepared on a liquid phase basis focused on the preparation of glass layers of the following compositional systems: As-Se and Ge-Sb-S. Focus was also on the study of the effect of tempering, electromagnetic radiation and electron beam exposure on the structure, optical properties and chemical resistance of the prepared thin layers. The results were used for the preparation of micro- and nano-structures in thin layers of chalcogenide glasses of different composition using photolithography and electron lithography. Attention was also on the study of possible preparation of multi-layer thin layers and their doping with nanoparticles of different composition.

The study of thermoelectric materials focused on SnSe single crystals. In cooperation with the Faculty of Mathematics and Physics, Charles University, point defects were analysed by positron annihilation at different temperatures.

The group completed the interpretation of the results characterizing polycrystalline samples of $CuIn_{1+/-x}Te_2$ with different indium stoichiometry. An optimum composition of $CuIn_{1,02}Te$ was identified showing maximum thermoelectric efficiency.

The characterization of single Bi_2Se_3 crystals with a molybdenum addition showed that Mo addition in the crystal structure of Bi_2Se_3 decreases the concentration of natural defects, which leads to an increase in the Seebeck coefficient value. At the same time, the movement ability of free current carriers increases, which leads to an increase in the so-called "Power Factor", i.e. improvement of thermoelectric properties.

In cooperation with the Institute of Physics of the Czech Academy of Sciences, characterization of palladium-doped chalcopyrite samples ($Cu_{1-x}Pd_xFeS_2$) was performed. Despite the relatively low solubility (x=0.013) palladium appears to be an effective donor and increases the order of the concentration of electrons in comparison with the original $CuFeS_2$, which leads to the optimization of the "Power Factor".

Institute of Organic Chemistry and Technology (ÚOChT)

The research and development activities of the employees and students of the institute focused on the following areas: 1. Study of the mechanisms of organic reactions, 2. New catalysts, 3. Biologically efficient compounds, 4. Compounds with defined optical and electronic properties, 5. New technologies of organic intermediate products and organic colourants.

The "click" reaction between sydnone and alkynes was studied. The study also focused on the cyclization reaction of 4-(indol-3-yl)butane acid (plant growth stimulator) that takes place in a strongly acid environment during its voltammetric determination. Focus was also on the physical and chemical properties of new analogues of isothiouronium salts. The strategy of using polarized ethylenes for the synthesis of substituted coumarins was assessed. A series of new nitrogen heterocycles with O–B–N and O–B–O atom arrangement was synthesized and their spectroscopic and electrochemical properties were described. Homogeneous catalysts based on amino acid derivatives and palladium complexes were immobilized on polymeric carriers and their catalytic properties were studied. New heterogeneous enantioselective catalysts intended for nitroaldolization, epoxidation and Michael additions carried out in a batch and flow reactor were prepared. A new strategy of synthesising enantiomer-pure form of Rivaroxaban was proposed and carried out.

In the area of organic electronics, new functionalized aromatic π-systems were synthesised. A systematic study of heterocyclic push-pull derivatives based on different diazines was performed. Pyrimidine derivatives with π-conjugated branches showed to be very promising materials with emission properties. 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 construction of a new tetrapodal electron donor. In the area of photoredox catalysis, a simple synthetic procedure was developed that provides an original catalyst derived from pyrazine-1,3-dicarbonitrile. Focus was also in 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 to atomic depositions of selenium layers.

In the area of manufacture of pharmaceutical specialities, focus was on optimization of laboratory synthesis of enantiomer-pure prostaglandin intermediates. New salicylic acid derivatives were synthesised with a focus on their antiproliferative activities and their ability to inhibit proteasomal activity of cancer cells. A series of new photochromic dyes was synthesized and characterised. The study focused on their photophysical characteristics and application possibilities of dyeing. The team synthesised and characterized new pigments based on polycyclic systems, which are suitable for application in dyeing of plastics while maintaining their antirust and antibacterial properties in the products. The study focused on physical and chemical modifications of hyaluronane, chitin, chitin-chitosan complex and starch in order to prepare microcapsules intended for the transport of biologically active substances in medical and cosmetic applications.

Department of Physical Chemistry (KFCh)

In 2018, research in the area of zeolitic materials and fundamental studies of adsorptions continued by studies on adsorption enthalpies of interactions between hydrocarbons (methane, propane, propene), CO_2 and nitrogen with purely silicate forms of hardly preparable zeolites of IPC-9 and IPC-10 type prepared by means of the ADOR process, and cation forms of MFI and FER zeolites. Enthalpic changes were experimentally determined using the volumetric-calorimetric method. The speed of diffusion of molecules in micropores in the studied materials were determined using the ZLC method. IR spectroscopy was used to identify and for the first time in history describe the bridge type of adsorption complex of propene double bonded with two ions of alkali metals (Na^+ and K^+) in FER type zeolites. The results were compared and discussed with theoretical calculations. Frontal analyses were used to study propane and propene co-adsorption and to determine the efficiency of adsorptive separation of this mixture on FER and ADOR zeolites. It was demonstrated that the presence of bridge complexes in the so-called dual cationic centers significantly increases separation selectivity. Attention

was also on adsorption and separation effects of newly discovered microporous MOF materials based on 12- and 10-vertex carborane complexes with cobalt and zirconium as central metals.

In 2018, part of the group's research activities focused on the study of Brønsted acid centers on zeolitic materials and evaluation of their acidity using appropriate descriptors. The group performed a systematic study of vibration frequencies of O-H bonds and adsorption complexes OH…CO, measured their adsorption enthalpies, and studied the population of intrazeolitic hydrogen bonds on MFI, MWW and PCR zeolites in their 3D and 2D forms. Another experimental approach to the evaluation of Brønsted acid centers was the measurement 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.

The research of catalytic reactions focused on the dependence of the catalytic activity of vanadium complexes anchored on the surface of coordination polymer MIL-101(Cr) (VOx@MIL-101(Cr)) in ODH ethanol to acetaldehyde. It was revealed that this new catalytic material shows a significant activity and more than 95% acetaldehyde selectivity already at 200 °C, which leads to acetaldehyde productivity of as much as 3 kg_{AA} kg_{kat}^{-1} h^{-1}. Focus was also on catalytic activity of potassium modified zeolites of FAU, MFIS and BEA type in aldol condensation of furfural and acetone. Active basic particles in the surface of zeolites were characterized by CO_2-TPD and IR spectroscopy. Two types of basic particles were identified that interact with CO_2 to produce bidentate and monodentate complexes. Monodentate complexes are more stable and show higher catalytic activity in the studied aldol condensation.

Research in the area of basic heterogeneous catalysis focused on Mg-Al, Mg-Fe and Zn-Al mixed oxides. Attention was on in-situ characterization of thermal treatment of Zn-Al hydrotalcites to produce mixed oxides with subsequent rehydration of these materials to the so-called reconstructed double-layer hydroxides. These catalysts were studied in fulfural aldol condensation and in vegetable oil transesterification. Attention was on (a) acid-base properties of catalysts and (b) analysis of the relationship between structure/composition/basicity and activity/selectivity of both chemical reactions mentioned above.

In the area of glass forming systems, the group continued the study of kinetic processes (structural relaxation, viscosity, crystallization, "self-diffusion") that take place in glasses and supercooled melts of chalcogenide volume samples and thin layers. The relationship between the structure and structural relaxation was successfully described in two "pseudo-binary" systems: GeS_2-Sb_2S_3 a $GeSe_2$-Sb_2Se_3. In cooperation with the Institute of Photonic Technology (Jena, Germany), the group extended the measurements of viscosity in chalcogenide materials from the area of glasses and supercooled melts to the area of melted materials, which will significantly simplify the extrapolations of viscosity data for the description of the kinetics of the emergence and growth of crystals in the materials. An important result is the publication of a summarizing paper (review) on viscosity data in chalcogenide glass-forming melts. The kinetics of the emergence and growth of crystals was monitored in volume samples and thin layers in the following systems: Se, As-Se, Ge-Sb-S, Ge-Sb-Se-Te, Ge-Ga-Te and Ge-Sb-Se using a series of experimental techniques (DSC, optical microscopy, SEM, TMA). By combining experimental data from various techniques and viscosity data it was possible to describe the kinetics of nucleation and growth of crystals in a broad range of temperatures. Attention was also on the relationship between viscosity and crystal growth, on the basis of which the nucleation-growth models were adjusted for a more precise description of the crystallization process. The group also started the study of "self-diffusion" (own diffusion of structural units) in thin layers and the surface of volume samples of amorphous Se and $Se_{95}Te_5$, which appears to be a vital piece of information to clarify the deviations from standard nucleation-growth models in the surface of volume samples and thin layers of the materials studied. In 2018, intensive collaboration was established with Zentiva, a.s., which resulted in the development of unique methodology of the prediction of shelf-time/life-time characteristics of amorphous drugs. The possibility of generalized application of this methodology was successfully verified also for nanostructures on the basis of TiO_2 and inorganic materials in the area of catalysis.

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 optical and electron properties of these materials. The description focused on the positive effect of nitrogen doping on the presence of oxygen defects and optical/electron properties of lanthanide doped TiO_2 photocatalysts.

The group continued research on the preparation of esters in homogeneous basic catalysis, where attention was on the use of butanol (i) as a reaction component in transesterification and (ii) as a co-solvent. The advantage of using butanol as a co-solvent is that it also dissolves methanol and oil and produces a single phase, and at the same time works as a reaction component. Attention was also on the use of other types of co-solvents, for example acetone, diethylether, tetrahydrofuran and dioxan. The group also studied the effect of various alcohols (methanol, ethanol, butanol) and ways of reaction stopping resulting in ester losses in the side glycerol phase. The reaction was stopped by catalyst neutralization in two ways: by gaseous carbon dioxide or precise addition of phosphoric acid. Another area of interest was a detailed description of the course of esterification by monitoring pH, conductivity, and viscosity.

In 2018, research in the field of solid drug forms focused on the study of the release of verapamil hydrochloride, pentoxifylline, tramadol hydrochloride and model drug (salicylic acid) from hydrophilic and lipophilic matrix tablets. The direct pressing method was used to prepare matrix tablets containing the drugs mentioned above, various retarding components, and dry binders. The tablets were examined for homogeneity and content uniformity (EDX, SEM) and dissolution tests were performed in an acid gastric medium with pH of 1.2, in simulated gastric juice, and buffer with pH of 6.8. The study also included the effect of alcohol on the speed and mechanism of releasing the active substance from these tablets. Part of the research focused on the study of solubility of active substances depending on the temperature with respect to pH and ionic strength of the environment. The study of dissolution kinetics was supported by photographic monitoring of tablet disintegration, which was used for the clarification of the mechanism of drug release.

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 the application potential of membrane processes. 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. Research experiments focused for example on the study of processes combining photooxidation on the solid phase with membrane micro- and ultrafiltration. The initial catalyst was titanium dioxide. Focus was on the validation of the effectiveness of processes for removing solid impurities, colloidal particles, heavy metals and organic compounds contained in separated systems. 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 concentration of heavy metals (drugs) in solutions, pressure difference above and below the membrane, ion strength of solutions, membrane type, etc., and on 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. These experiments were performed using water-based solutions of ethanol, *n*-propanol, *i*-propanol, butanol, and ethyl acetate. The effect of the concentration of individual substances on the intensity of the permeate flow was tested together with the retention of components depending on the pressure difference applied.

Previous experimental data relating to the transport of phosphoric acid through anion-replaceable membrane Fumasep-FAD (Fumatech, Germany) were processed. Data assessment was performed by means of a rigorous mathematical model allowing not only acid transport but also water transport, which is very important in this case.

The study of the application of electrodialysis in ZLD ("zero liquid discharge") was commenced. In the first stage, a master's diploma thesis was written in cooperation with MEGA, a.s. and Membrain, s.r.o. The thesis examined maximum concentrations of selected salts that can be achieved in the

concentrate. If a grant is obtained from the Ministry of Industry and Trade, the project will continue until the end of 2021.

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 (creep-recovery tests), linear viscoelasticity based on dynamic experiments (oscillatory tests), and adhesive power using tack tests. The results of the tests were used for the description of rheological behaviour of the tested substances. The group also focused on the determination of the gelation points and temperatures of glass transitions of adhesives.

The group of environmental aspects of chemical technologies focused on the issue of removing industrially significant chlorinated 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. The technology of ion exchange using ion liquids to capture chlorinated organic acids was patented (CZ307282 (B6) University of Pardubice). 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". The removal of halogenated derivatives from water was tested using the application of ion liquids 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 functional sample of a quarter-operational sorption column. The procedure allows the concentration of halogenated organic acids and regeneration of the sorption charge using suitable surfactants. Subsequently, a patent-based method of reductive destruction of concentrated halogenated organic acids was developed. 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., Geotest, a.s., and Toray, a.s. The research focused on the issue of decreasing the emissions of organic halogenated derivatives in waste water using the best available economically acceptable techniques such as adsorption, coagulation and flocculation, and subsequent destruction of organic halogenated derivatives by chemical reduction.

The study also focused on the possibilities of using photocatalytic elimination of drugs and dye residues from waste water using economically efficient LED sources of UV radiation and TiO_2 catalyst. In particular, the study focused on the effect of an ion environment on the process. A correlation was analysed between the photocatalytic process, sorption of dye on the catalyst surface and zeta-potential of the catalyst particles.

The group continued their experimental research aimed at the application of electrodialysis and reverse osmosis in processing seepage from municipal waste dump. For the purposes of the research, real water from Svébořice dump was used. To model and evaluate saturation indexes, commercial programmes ROSA (Dow Filmtec) and Design Systems (Toray) were used. The results of the experiments showed that electrodialysis integrated in the system of waste dump seepage effectively decreased its salt content. As a result, subsequent reverse osmosis can be applied at low pressure differences and high conversion ratios around 80%. The course of membrane separation was significantly affected by seepage pre-treatment. An effective method of removing any physical and chemical reversible pollution using alkaline cleaning was proposed and tested.

In the area of dissolution of solid drug forms, research focused on dissolution tests with delayed release. Solubility of the supplement in the form of tablets as the active substance was tested using the Sotax instrument. The effect of rotational speed and tablet surface treatment was tested. An analytical method of high-efficiency liquid chromatography was developed, optimized and validated. Applied research and experimental development was funded by the Technology Agency of the Czech Republic under the Epsilon project "Supplements for a positive effect on the human microbiom".

In the area of photocatalytic efficiency of heterogeneous catalysts, the group compared the efficiency of catalysts based on titanium dioxide using the photocatalysis of methyl orange in a photochemical reactor (powder TiO_2 Degussa P25, crystalline TiO_2, glass microbeads/TiO_2 and $Fe_3O_4/SiO_2/TiO_2$).

Cooperation continued with the Institute of Electronics and Photonics FEI STU Bratislava in order to test and use new electrode materials, especially BDD electrodes. This was the third year of operation of a house waste water treatment unit, for which an electrochemical final cleaning module was prepared. In addition to the electro-oxidation method, the group tested the process of decreasing the outflow concentrations of total phosphorus using sacrificial electrodes. At present, the group works on an optimum structure of sacrificial electrodes in order to minimize waste sludge and to use the system in agriculture (limitation of Al in sediment sludge and increase in Mg content in combination with precipitated P represents a significant source of biogenic elements). 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 using new cathode materials based on Pt, Au or Pd plated titanium. These electrodes are potentially applicable is suppressing AOX produced during electro-oxidation of organic compounds in the chloride ion environment. The following contract research was established with Saint Gobain Adfors CZ, s.r.o. "Laboratory verification of decreasing the concentration of sulphates causing an increase in the RAS parameter in flotation". The substitution of Prefloc flotation agent using a sacrificial steel anode as the source of Fe^{2+} and its oxidation to $Fe^{3+}$was successfully verified.

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 and technical procedures to minimize the impact of forest management on the quality of groundwater as a result of excessive migration of reactive forms of nitrogen and phosphorus". The activity focused on continued monitoring of rainwater, subsurface water and 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 substances in soil for plant nutrition".

Focus was on the development of methodology of preparing samples for analysis 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). These procedures were used in the description of the behaviour of contrast substances on the basis gadolinium complexes and iodine contrast substances used in medical diagnosis. The group studied the abilities of selected biosorbents (active carbon, humic acids, dry algae biomass *Chlorella Keslleri*, ion fluid) to accumulate these substances to help explain their cycle in the environment and find possible mechanisms of their removal from hospital waste water. The ETV-ICP-MS method was developed for determining thallium and gold in suspension samples, which is a significant step to a complex ICP-MS analysis of microsamples at the Institute. The preparation and subsequent ICP-OES analysis of microsamples of living organisms was developed (*Enchytraeus albidus*) for the evaluation of ecotoxicological tests.

In the area of LIBS application, methodology for determining zinc in tissue samples of the white worm was developed. The methodology was used in the evaluation of the test results concerning ecotoxicity of ZnO nanoparticles.

The nanomaterial ecotoxicity group studied the effects of adding model soil constituents (peat, sand) into culture agar on the test results of ecotoxicity of ZnO nanoparticles in the white worm. Low-cost methodology was developed for the determination of oxidative stress biomarkers (malondialdehyde, glutathione) in tissue samples of the white worm.

The group continued their study of the conditions of cathodic electrodeposition of Zn^{2+} from water-based solutions containing 100 mg/L of $ZnSO_4$ on a Ti/Pt-Ti electrode; a total of 11 experiments were performed with conductivity range between 3 and 5 mS/cm; after 5 hours Zn was removed from the solution with maximum efficiency of 85-96%, i.e. by several percent more compared with the previous Pt/Ti electrode. Similar measurements with a Pt/Cu electrode showed efficiency between 73 and 96% after 5 hours and conductivity range of 1 to 5 mS/cm. Similarly to the Ti/Pt-Ti electrode, the best Zn deposition results were achieved at conductivity of 5 mS/cm.

The group started a test of potentiometric indication of the procedure of cleaning power plant waters on the basis of registering the potential response of silver (AgE) and silver amalgam electrode (AgAE) provided with a special interface. The system is applicable in usual technological conditions. The group confirmed the effect of preparation and geometry of the working electrode on the sequence of received signals (for example in AgE in the range of 430 – 460 mV) and on the sensitivity and repeatability (for example between ±2 and 4 mV). The results showed multiple differences in sensitivity between AgE and AgAE.

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 the studies of voltammetric drug behaviour of leucovorin, mesalazine and linuron herbicide on boron doped diamond electrodes (BDDE). Focus was also on voltammetric behaviour of anti-inflammatory drugs of the oxicam group, and the development of methods of their determination using BDDE was initiated. Another group of substances includes azole fungicides. At the same time, research was completed on the characterization of BDDE as an electrode material, especially with respect to different boron content in the diamond film. In the area of development of voltammetric methods for the determination of plant stimulators, focus was on the reaction mechanism of the conversion of the indole-3-butyric acid (IBA) 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 data base of water quality parameter models based on satellite data, and to optimize these models. The group published the first results of the proposed script for atmospheric correction of satellite images together with the first model of chlorophyll A from data taken by Sentinel-2 satellite, and updated models for multiple water quality parameters based on Landsat 7 data.

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.

Scientific activity in the area of organic coatings and paints includes comprehensive research of these materials with an emphasis on binders 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 environmental 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 is 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 the use of 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 with the aim of decreasing the content of this metal using other electrically and electrochemically conductive materials. Research is carried out in the area of synthesis and application of anti-corrosion pigments with various chemical structures and particle morphologies. Pigment modification by conductive polymers is performed to increase 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, 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 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 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 covering made of suitable polymers in order to achieve antiseptic wound covering.

Scientific and research activity in the field of wood, pulp and paper focuses on the theoretical principles of paper production 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 the purposes of intensification of plant activity in agriculture. Explorational activity focuses especially on better characterization of epimolecular structure of lignocellulosic mass and materials, particularly at the hypermolecular level, because this is the key aspect in all molecular-surface, chemical and biochemical processes, as it is the first once 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 of energy materials reactivity.

Research focused on the properties of various coordination compounds containing the cyanide group as an alternative to 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 Sellier-Bellot, a research study was completed on the determination of the structure of selected explosives.

In cooperation with Explosia, a.s., the project entitled Advanced chemical gas generators not only for the automotive industry (MPO FV10332) continued, the purpose of which is 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 focusing on the development and characterization of heterogeneous rocket fuels.

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 risk 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 experiment 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. A project on 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 key 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 of ecological composition, high thermal stability and appropriate optical properties, which 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. 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 the verification 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 defined atmospheres in order to achieve a positive effect on the course of synthesis.

In the area of special agrochemicals, research focused on optimization of the conditions of synthesising hydrogels on the basis of copolymer of acrylic acid and acrylamide grafted konjac glucomannan and 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 synthetic soil improvers that leave undesirable residues. The prepared hydrogels were studied for functional properties such as swelling capacity in water and in nitrogen fertilizer solutions, dependence of swelling capacity on pH, drying speed, solubility in water, nutrient content in hydrogel swollen in urea solutions, ammonium sulphate and calcium nitrate, rate of nutrient release in water and cation exchange capacity. Depending on the composition of the polymerization mixture, the swelling capacity of the prepared superabsorbents achieved 450g to 800g of water per gram of dry gel, hydrogel swollen in urea solution achieved 43% of nitrogen; a significant advantage is also its high cation exchange capacity achieving almost 4 mmol/g of dry matter. 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. The primary objective was to increase measurement accuracy and develop methodology for experiments conducted in an inert atmosphere, and to achieve 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 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-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 (KPF)

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 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 and UV curable systems using UV LED. In the area of hybrid polymerization samples (radical and cation polymerization), FTIR was used to evaluate the degree of conversion, mechanical properties and migration of components from cured layers using gas

chromatography. One of the promising areas in the field 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 on 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 make it possible to print special effects. The future varnish will be cured partially by UV LED and will acquire the final mechanical properties after exposure to a medium-pressure mercury lamp. In the previous period, two functional samples were prepared and the first successful tests were carried out using a commercially supplied varnishing machine in KOMFI spol. s r.o.

In the area of material printing and printed electronics, attention was on Smart Labels for autonomous temperature and relative humidity monitoring. Tests were carried out on production labels of end customers in the food industry, museums, logistics, etc. Current research focuses on the development of a new generation with a printed battery. 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. Production print tests of these sensors were performed and more than 50,000 running meters of sensors produced for an end contractor who tested the sensors in incontinence nappies. The sensor was also successfully tested on a nappy production line with a production capacity of 250 nappies/minute. In the framework of the OrgBat project, research focused on accumulators based on organic compounds. This involved accumulators with electrolytes based on lithium salts as well as sodium salts. A project continued on the development of printed WORM and RRAM memory elements for goods security and personification. In cooperation with industrial partners, a mobile memory reader was developed. This year a research study was started in the area of precision agriculture – SmartField project. As part of project, printed sensors are developed for the detection of soil moisture and temperature in various depths. These sensors are printed on rigid substrates and subsequently are installed in fields, meadows, hillsides, or greenhouses. Data collection from the sensors is performed by means of the IoT module with transition via networks such as LoRa, SigFox, etc.

Another area of research focuses on the issue of preservation and restoration of publications on a paper medium. In cooperation with the National Archives, research focused on the evaluation of ageing and neutralization by metoxy magnesium methyl carbonate of various concentrations on mechanical stability of a layer of printing ink on prepared model samples and real samples of printed materials from 1847-1970.

Under project MPO FV30048 "New additives for multifunction modification of polymeric surfaces", the Department of Graphic Arts and Photophysics performed research on thermochromic behaviour of perylene pigments in polymer matrices. Focus was on testing of selected formulations in paints and plastics. In the area of thermochromic systems based on molecular complexes with charge transfer, research focus was especially on the methodology of monitoring dynamic colour changes.

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 of 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.) The results of this activity are used in practical applications in the polygraphic industry. The other direction focuses on the application of this knowledge by 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.

Qualitative research was performed in selected chemical industry enterprises and focused on the current concept and classification of services provided to customers especially on the B2B market, defining the quality of services, indicators of the quality of services and methods of its evaluation. The results of the survey and a comparison with the results of the review were used to identify the decisive parameters and methods of evaluating the quality of services provided to customers in the B2B market both in terms of customers and suppliers.

A primary quantitative research focused on the reputation of Synthesia, a.s., Explosia, a.s., and Paramo, a.s., in Eastern Bohemia. The evaluation focused on perceived importance of these enterprises for the national economy, their position and the behaviour on relevant markets, their perceived effect on the environment, their attractiveness as employers, and their perceived benefit for the local community. Research focused on the opinions of citizens older than 15 years who lived in the wider area of the enterprises. On the basis of quota selection, a total of 1,545 completed questionnaires were obtained and the data were statistically processed.

A primary qualitative research was conducted in three chemical industry enterprises; focus was on the identification of instruments to develop positive reputation in the eyes of consumers in the area of corporate identity, i.e. corporate philosophy, culture, product design, and marketing communication.

A primary qualitative research was conducted to explore the importance of logistic services in indirect food distribution, and the key attributes of services were identified. An important finding is the low evaluation of the relative importance of services that are essential for partnership cooperation.
A content analysis was performed to compare the intensity and structure of web-based 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.

Controlled interviews with personnel managers in selected chemical enterprises in the Czech Republic were performed to map the degree of implementation of diversity management in these enterprises, and to define alternative benefits, limitations and risks of the implementation of diversity management from the perspective of the chemical enterprises involved.

Department of Biological and Biochemical Sciences (KBBV)

The department has a total of four research groups all of 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 was launched. A project entitled "Strengthening interdisciplinary cooperation in the research of nanomaterials and their impacts on live organisms" allowed to establish long-term cooperation with partners from the Hradec Králové and Pardubice regions, specifically the Faculty of Medicine, Charles University in Hradec Králové and University Hospital Hradec Králové. The project team also includes members from the Center of Materials and Nanotechnologies, FChT. The overall funding of the 4-year project is over 115 million CZK (4,470,360 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 2018. One of them is the already mentioned NanoBio project, where the group focused on surface modification and biofunctionalization of 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 which 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 Center 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, 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. In the framework of the "LOVE FOOD 2 MARKET" project (Horizon 2000), intensive cooperation continues with the Institute of Molecular Biology and Biotechnology FORTH in Greece and other European partners. In cooperation with these partners, a microflow analyser is developed for the capture of potentially pathogenic bacteria in milk products. The role of the team is to develop magnetic carriers for DNA extraction and immunospecific capture of bacteria from a complex sample, specifically pathogenic microorganisms of the Salmonella, Listeria and E. coli genera. 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. This successful research was supported by two GA CR projects. In 2018, work began 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. Cooperation also continues 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.

Research of both general and clinical biochemistry permanently focused 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 collected and analysed samples of patients with cardiovascular disease. The purpose of the study was 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 was devoted to patients after percutaneous coronary intervention. Focus was also on the measurement of the levels of antioxidants and markers of oxidative stress in seminal plasma in a group of infertile men, and the level of selected aminoacids and derived 2-oxoacids in cultivation media where human embryos are incubated prior to implantation. The research was carried out in cooperation with the Center of Assisted Reproduction Sanus in Pardubice. Metabolic activity of cultivated human embryos was compared using the "Time-Lapse Primo Vision" monitoring system. 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. The study also focused on the type of inhibition of these substances and the partition coefficient in the n-octanol/water system, which characterises their lipophilic properties. Several methods were introduced for the determination of cholinesterase activity and the most appropriate reaction conditions were verified. Methods were also introduced for the identification of selected aminoacids, oxoacids and fatty acids in a dry drop of blood, sweat, and breast milk. This year, cooperation 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 small and

large intestine tissue. In these samples, the concentrations of selected aminoacids and fatty acids were determined in order to identify the markers of these diseases.

The staff of the microbiology group focused on several research directions. In the analysis of waste and surface water the group focused 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 were bacteria of *Arcobacter* genus. 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 virulent factors to antibiotics was identified. In cooperation with the Institute of Animal Science in Kostelec nad Orlicí, the group has run long-term research 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, their numbers mostly increase.

In cooperation with the Department of Cardiology of Pardubice Regional Hospital, the physiology and cell biology group studied 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. 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 nephrotoxic and hepatotoxic effects of the substances, but also their possible neurotoxic effects. 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 of intracellular fluorescent probes and immunochemical methods, another important research task was the study of the nephrotoxic effects of cadmium. In this area, a similar research study was started which focused on the mechanisms behind the toxic effects of this heavy metal using molecular and biological methods. In 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 effects 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 effects 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. As far as nanoparticles are concerned, focus is especially on size characterization and classification by nanoparticle size and shape depending on the method of preparation. In the area of polymeric networks, focus is particularly on the study of local arrangement of interpenetrating networks and its correlation with macroscopic and especially mechanical properties. In the area of brush structures, the group focuses on the density and length of wafer surface chains, 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 ALD deposited layers of CdS and subsequent interpretation of long-wave shift of the active area of photovoltaic nanostructures based on TiO_2 nanotubes coated with CdS synthesizer. Ellipsometric characterization and identification of the forbidden energy bands of CdS-CdSe nanoparticles. Development of a holographic system for recording holographic grates. Participation in scatterometric study of rectangular chalcogenide grates prepared by means of electron lithography. Development of tunable monochromatic laser source for diffractometric measurement in the visible spectrum. Formulation of an analytical model of the thickness of layers powdered by pulse laser deposition for KPF. Study of the changes in optical properties of thin layers $As_{35}S_{65}$ induced by exposure to electron beam with different exposure doses using ellipsometric imaging. Measurement and interpretation of ellipsometric spectra of the layers of amorphous $As_{30}Se_{70}$ chalcogenides prepared by spin-coating. Determination of geometrical and optical properties of these layers and their comparison with the properties of layers of the same composition prepared by vacuum deposition. Study of the changes in optical properties of $As_{42}Se_{58}$ layers prepared by vacuum deposition induced by various influences – exposure to light sources (UV, white light), heat treatment, ageing. Measurement of the diffraction efficiency of grates prepared by optical lithography.

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

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 with a changed structure. The number of employees was reduced, which also slightly changed the focus of the department. The scientific and research activity of SLChPL remains divided into three areas – non-crystalline materials, crystalline materials (thermoelectrics), and intercalates. A large part of the activities is based on cooperation with FChT departments and institutes and other workplaces.

As far as non-crystalline materials are concerned, focus was on the wettability of virgin and heat-treated chalcogenide thin films of the As-S system. Surface wettability of these thin layers was also studied in the course of spontaneous ageing and after exposure using various exposure sources. Changes in wettability were correlated with surface roughness and structural misarrangement. Wettability was also analysed on the surface of metal adherends during various pre-treatment stages. The changes identified were correlated with surface roughness, chemical composition and pull-off tests results.

In cooperation with CEMNAT and the Institute of Applied Physics and Mathematics, 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.

In cooperation with the Department of General and Inorganic Chemistry and CEITEC-MUNI, the group studied the ablation of non-stoichiometric volume chalcogenide samples and thin layers of the $GeSe_x$ system, and compared it with the stoichiometric composition of $GeSe_2$. The effect of nanophase separation on material heat convection was confirmed, which also suggests increased ablation efficiency for Se super-stoichiometric samples.

In cooperation with the Institute of Optical Materials and Technologies BAV, Sofia, Bulgaria, variable-angle ellipsometry was applied to study the degree of reaction of a sandwich system consisting of two chalcogenide thin layers after heat treatment and exposure using various exposure sources.

In cooperation with the Institute of Chemistry and Technology of Macromolecular Materials, optical tensiometry to monitor surface properties of latex films based on acrylic copolymers was performed. In the complex framework of latex film development, the effect of several factors was evaluated: (1) Chemical nature of emulsion copolymer determined by the degree of grating and concentrations of fluorine groups in emulsion copolymer; (2) External conditions accompanying the process of paint film curing in terms of relative air humidity and temperature; (3) Content of inorganic nanoparticles (MgO and ZnO) in paint film; (4) Duration of exposure of paint film to water. The results provided key information about latex films in terms of their resistance to water. 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.

As far as crystalline materials are concerned, in cooperation with the Institute of Applied Physics and Mathematics the group monitored the effect of Pd substitution for Cu in a series of samples of the following nominal composition: $Cu_{1-x}Pd_xFeS_2$ (x = 0–0.1). It was revealed that when substituted for Cu, Pd atoms take the donor function. At lower concentrations of excessive Pd this phase makes nanoinclusions, whose presence sufficiently increases the photon dispersion and contributes to a further reduction of grate thermal conductivity. The origination of this phase is accompanied by the origination of antistructure Fe_{Cu}^{2+} defects. In synergy, all of the effects mentioned above contribute to an increase in both *power factor* $\sigma \cdot ^2$ S and thermoelectric efficiency. In this way, materials were prepared with *power* factor achieving $1mW.m^{-1}.K^{-2}$ in a broad spectrum of temperatures (300-550 K).

The study of intercalates continued. In collaboration with colleagues from the Faculty of Mathematics and Physics, Charles University, a detailed structural model of mixed sulphophenylphosphonates-zirconium phosphonates $Zr(HO_3SC_6H_4PO_3)_x(C_6H_5PO_3)_{2-x} \cdot yH_2O$ (x = 0.7; 1.3 and 1.8; y = 0 and 2) was proposed. This model was used for the description of the arrangement of sodium, copper and ferric cations in the inter-layer space of corresponding intercalates.

Borane anions $B_{10}H_{10}^{2-}$ and $B_{12}H_{12}^{2-}$ and mono- and dicarboxy p- and m-carboranes were intercalated into ZnAl layered double hydroxide by ion exchange. In the case of intercalates of both boranes, part of unexchanged original nitrate or carbonate anions stays in the intercalate; in the case of carboxylates the exchange is complete. The arrangement of hosted particles in the inter-layer space and their anchoring to the host layers was proposed.

Center of Materials and Nanotechnologies (CEMNAT)

In 2018 CEMNAT, the youngest 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 their structure and properties. In CEMNAT, there are currently four working groups (headed by Prof. Miroslav Vlček, Prof. Tomáš Wágner, Prof. Petr Němec, and Dr. Jan Macák).

Also in 2018, CEMNAT confirmed its status of excellent infrastructure providing 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 2018 CEMNAT carried out three research projects. In addition to previously launched projects that deal with (i) Preparation and characterization of micro and nanostructures in high-index glasses (supported by GA CR) and (ii) Development of a new solar cell concept combining titanium dioxide nanotubes and suitable inorganic and organic chromophores, which should lead to efficient conversion

of solar energy to electrical energy (supported by the European Research Council, ERC), a project entitled "Sensors with high sensitivity and materials with low density based on polymeric nanocomposites NANOMAT" was launched (supported by the Ministry of Education, OP RDE programme). This project deals with the development of active and passive innovative materials, in particular highly sensitive new sensors on the basis of polymeric nanocomposites, and new materials with low density on the basis of polymeric nanocomposite materials for the space, aircraft and automotive industries. CEMNAT staff were also involved in the following two projects: (i) "Strengthening interdisciplinary collaboration in nanomaterials research and in studying their effects on living organisms (NANOBIO)" (supported by the Ministry of Education, OP RDE programme) and (ii) Selenide 2D nanomaterials with unique properties prepared by atomic layer deposition (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 2D selenide nanomaterials with unique properties by means of atomic layer deposition.

The funding of the projects together with the funding from the developmental project Modernization and upgrade of CEMNAT infrastructure provided an opportunity to open new laboratories, specifically (i) X-ray photoelectron spectroscopy (XPS), (ii) X-ray diffractometry (XRD), (iii) centrifugal (nano)spinning, and (iv) infrared spectroscopy.

In 2018, CEMNAT was involved in a total of 33 original papers published in international impacted journals, 50 active participations (38 lectures, 12 posters) at international conferences, 1 international patent application, organization of 4 scientific seminars and 1 international conference (Solid State Chemistry 2018).

3.2 Involvement in Research and Development Programmes

Funding received in the framework of creative activity

Year	2011	2012	2013	2014	2015	2016	2017	2018
Institutional support for the development of a research organization (THS EUR)	2,770	4,662	4,302	4,343	4,041	4,397	4,730	5,403
Research plans (THS EUR)	692	-	-	-	-	-	-	-
Research centers (THS EUR)	236	-	-	-	-	-	-	-
International grants (THS EUR)	317	330	761	236	336	478	523	390
National grants (THS EUR)	2,456	2,802	2,753	2,690	2,552	2,764	3,590	9,955
Students grants contest (THS EUR)	690	765	737	754	694	701	712	690
Additional activity (THS EUR)	*112	*139	*131	*194	* 103	*170	*214	*217

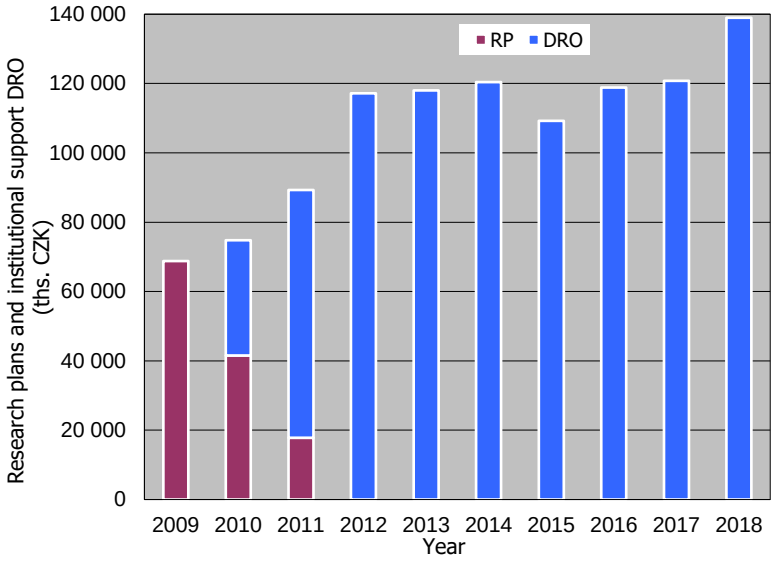
* The amount of additional activity is related to a number of activities in the framework of the main activity.

The amount of 9,955 thousand EUR obtained in the framework of domestic grants and projects in 2018 includes the following:

- National educational grants and projects amounting to 28 thousand EUR (IDC)
- National scientific grants and projects amounting to 2,742 thousand EUR (GA CR 1,491 thousand EUR, TA CR 528 thousand EUR, other projects 722 thousand EUR),
- OP RDE projects 7,185 thousand EUR.

The amount of 216,625 EUR obtained in the framework of additional activity includes the following incomes:

- Service activity 74,697 EUR,
- Printing production 1,715 EUR,
- Contract research above 50 thousand CZK (approx. 1,944 EUR) 115,377 EUR,
- Licences – inventions 24,835 EUR.

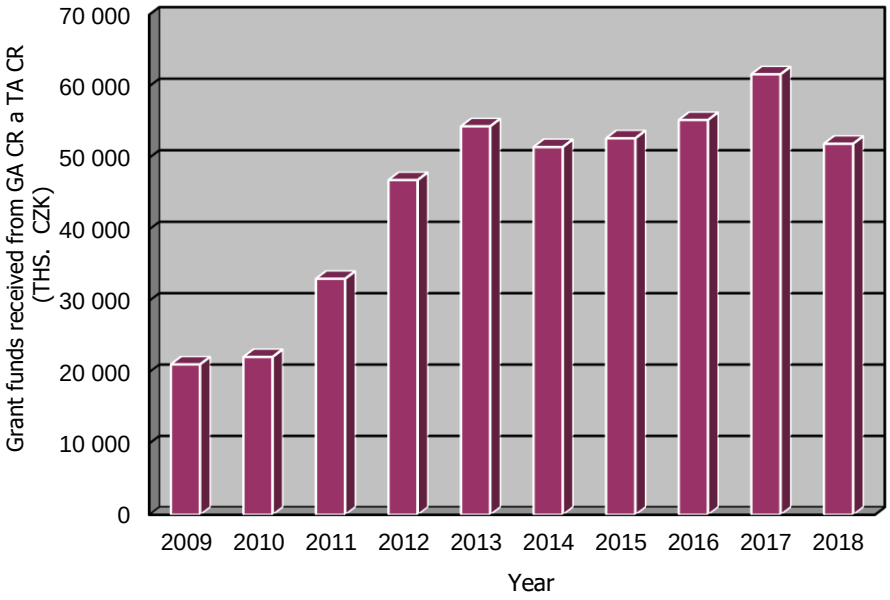


Funding by research plan years and research organization development

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

Supported	2013		2014		2015	
	Number of projects	Funding (THS EUR)	Number of projects	Funding (THS EUR)	Number of projects	Funding (THS EUR)
GA CR	28	**1,530**	24	**1,325**	20	**1,289**
TA CR	14	**454**	16	**532**	14	**662**

Supported	2016		2017		2018	
	Number of projects	Funding (THS EUR)	Number of projects	Funding (THS EUR)	Number of projects	Funding (THS EUR)
GA CR	19	**1,306**	23	**1,466**	24	**1,491**
TA CR	15	**740**	19	**948**	17	**528**
				2018 total	41	**2,019**

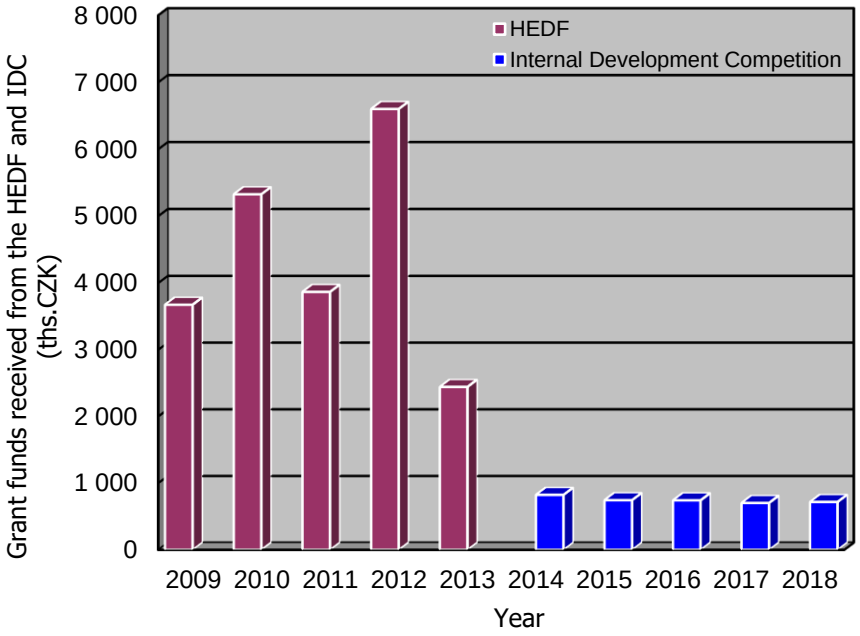


Grant funds received from GA CR and TA CR in between 2009 and 2018

Grant funds received in 2018 from the Internal Development Competition

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

Supported	2018	
	Number of projects	Funding (EUR)
MEYS – Internal Development Competition	9	**27,900**



Funds received from HEDF between 2009 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 2018, the Faculty continued to implement 3 projects supported by the Operational Programme of Research, Development and Education (referred to as OP RDE) launched in the previous year. As part of the Upgrade of CEMNAT infrastructure project, the instrumentation of the Center of Materials and Nanotechnologies (CEMNAT) was improved. State-of-the-art equipment exceeding 41 million CZK (1,593,780 EUR) was purchased. Two other projects continued in the area of increasing the quality and modernization of education, including a greater offer of courses in English. The projects were supported by OP RDE ESF and ERDF for universities.

In 2018, the Faculty launched 3 OP RDE projects under the Pre-application research and Pre-application research for ITI calls. Two of these projects – NANOBIO and NANOMAT – are coordinated by the Faculty. 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 use in practice. The total approved budget of the projects mentioned above (for all partners) is 192.5 million CZK (7,482,993 EUR). The third project coordinated by the University of Chemistry and Technology focuses on the development of energy accumulation technology for power engineering including both traditional and renewable resources. The Faculty is also involved in a global university project International mobility of researchers at the University of Pardubice. As a result of the project, selected research groups are joined by 3 experienced foreign post-docs from prestigious international institutions.

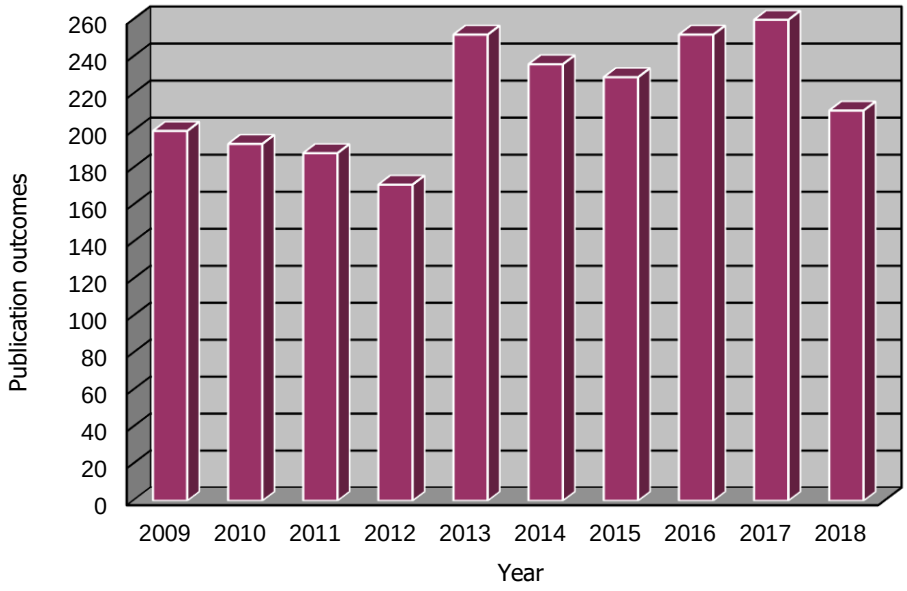
3.3 Publication Activity

The overall data on the publication activity of FChT in impacted journals between 2013 and 2018 and a detailed analysis of all publication activity of the Faculty in 2018 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
Number of publications J_{imp}	252	236	229	252	260	211

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:



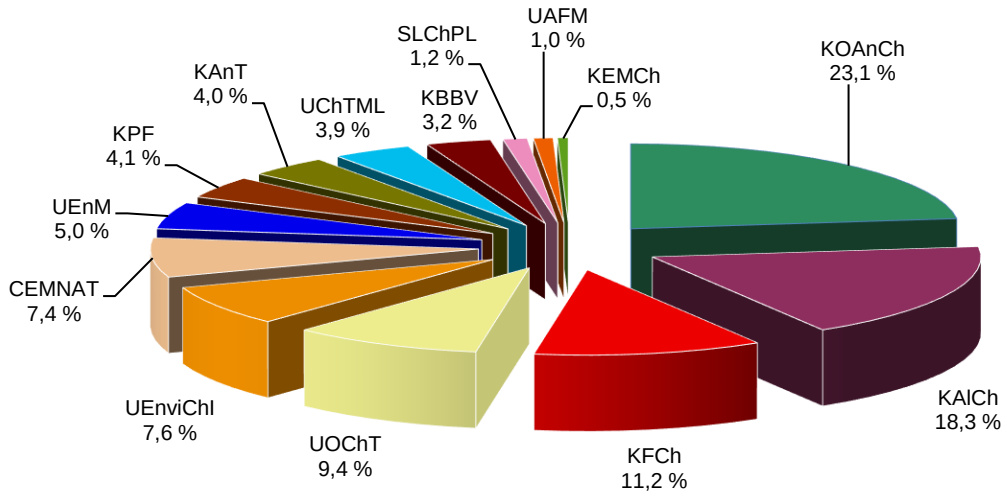
Summary of publication outcomes J_{imp} between 2009 and 2018

Overview of publication and other activity in 2018 by departments/institutes and result groups

Departmenment Institute	A1	A2	A3	A4	B1	B2	C	D	Total number of publications
KOAnCh	57	-	3	2	66	11	1	1	141
ÚOChT	18	1	-	-	47	11	-	2	79
KAlCh	39	4	6	3	62	36	6	-	156
KFCh	35	1	-	-	34	11	1	-	82
ÚEnviChI	17	13	6	4	32	24	-	2	98
ÚAFM	11	-	3	-	15	2	-	-	31
SLChPL	15	-	2	-	17	2	-	-	36
KEMCh	7	1	-	2	10	2	-	-	22
KAnT	8	-	1	-	14	22	-	-	45
ÚChTML	16	7	3	1	18	16	-	4	65
KBBV	17	-	3	3	22	18	1	-	64
KPF	10	-	1	2	21	3	-	-	37
ÚEnM	12	3	-	-	11	3	1	-	30
CEMNAT	23	-	-	1	20	-	-	-	44

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 conference
B2 Papers presented at national scientific conference
C Monographs, selected chapters, learning texts, university textbooks
D Granted patents, utility models, open technologies



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

3.4 Scientific Events and Conferences

14th 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: 7–8 February 2018

6th International Conference on Chemical Technology 2018

The purpose of the conference 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: 16–18 April 2018

21th 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: 18–20 April 2018

20th Monitoring of Extraneous Substances in the Environment

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

Host: Department of Analytical Chemistry
Date: 25–27 April 2018

45th Annual Conference on Industrial Toxicology and Ecotoxicology 2018

The conference focused on new trends in the field of chemical legislation, safety in the chemical industry, ecotoxicology and analysis of pollutants in the environment, toxicology, and methods for the determination of toxic substances.

Host: Institute of Environmental and Chemical Engineering, VÚOS, a.s., Rybitví
Date: 29–31 May 2018

40th International Czech and Slovak Calorimetric Seminar

The annual fortieth seminar focused on the application of calorimetric methods and thermal analysis methods in various fields, both in terms of research and practice. The four-day seminar was divided into the following thematic areas: thermodynamics, biological materials, non-crystalline materials, and thermal analysis. The programme of the calorimetric seminar included two new presentations, the purpose of which was to give a clear overview of various 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, OSChT ČSCh
Date: 28 May – 1 June 2018

5th Pharmacokinetic Seminar

A series of lectures on applied chemical kinetics and pharmacokinetics.

Host: Department of Physical Chemistry
Date: 14 June 2018

13th International Conference on Solid State Chemistry SSC 2018

International conference on new knowledge in the field of chemistry and physics of solid substances and materials research.

Host: Center of Materials and Nanotechnologies, Department of General and Inorganic Chemistry

Date: 16–21 September 2018

20th 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: 19 September 2018

11th 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 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: 5–6 November 2018

51st 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, Chemotex Děčín

Date: 7–9 November 2018

14th Sensing in Electroanalysis

Seminar for partners cooperating in European projects aimed at electroanalysis.

Host: Department of Analytical Chemistry

Date: 14–16 November 2018

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 2018.

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 the 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 2018, 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 2018, 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 2018.

Excursions carried out in 2018

Department/institute	Visited factory, company, institute	Number of students
KOAnCh	CRYTUR, spol. s r. o., Turnov	13
	HELLA AUTOTECHNIK NOVA, s. r. o., Mohelnice	12
	KAVALIERGLASS, a. s., Sázava	16
	NUVIA, a. s., Kralupy nad Vltavou	15
ÚOChT	Cayman Pharma, s. r. o., Neratovice	35
	Contipro, a. s., Dolní Dobrouč	10
KAlCh	Pardubický pivovar, a. s.	31
	ALBA plus, s. r. o., Pardubice	22
	Bioanalytika CZ, s. r. o., Chrudim	8
ÚChTML	Metal Trade Comax, a. s., Velvary	8
	Gabriel Chemie Bohemia, s. r. o., Lázně Bohdaneč	10
	Radka, s. r. o., Rybitví	6
	CZ Plast, a. s., Kostěnice	14

	TONAK, a. s., Nový Jičín	5
	JUTA, a. s., Dvůr Králové nad Labem	7
	Mileta, a. s., (dye house) Dvůr Králové nad Labem	7
	SYNTHESIA, a. s., Pardubice	3
	MILETA, a. s., Hořice	5
	SINTEX, a. s., Česká Třebová	2
ÚEnviChI	Analytika Toxila, VÚOS, a. s., Rybitví	5
	Atmosférická stanice Křešín (Ústav výzkumu globální změny AV ČR, v. v. i.), Pacov	12
	BČOV, Pardubice, Rybitví	7
	Ekotoxikologie, VÚOS, a. s., Rybitví	5
	EMPLA AG, spol. s r. o., Hradec Králové	10
	Pardubický pivovar, a. s.	9
	Synthesia, a. s., Pardubice	7
KEMCh	Synthesia, a. s., Pardubice	9
	Logistické centrum firmy Jusda Europe, s. r. o., Černá za Bory	13
KPF	Tiskárna Hradištko, s. r. o., Hradištko – Praha západ	15
	Koenig & Bauer Sheetfed AG & Co. KG, Radebeul, SRN	33
	HRG, spol. s r. o., Litomyšl	10
	OTK GROUP, a. s., Kolín	7
	Svoboda Press, s. r. o., Praha	7
KAnT	Synthesia, a. s., Pardubice	11
	Saint-Gobain Adfors, s. r. o., Litomyšl	9
ÚEnM	Explosia, a. s., Pardubice	3

4.2 Practical Cooperation in Science and Research

In 2018, 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 focused on increasing the quality of education in master's degree programmes.

The Faculty also cooperated with industrial enterprises, research institutions and hospitals. It would be impossible to list all 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 current problems 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 2018, 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

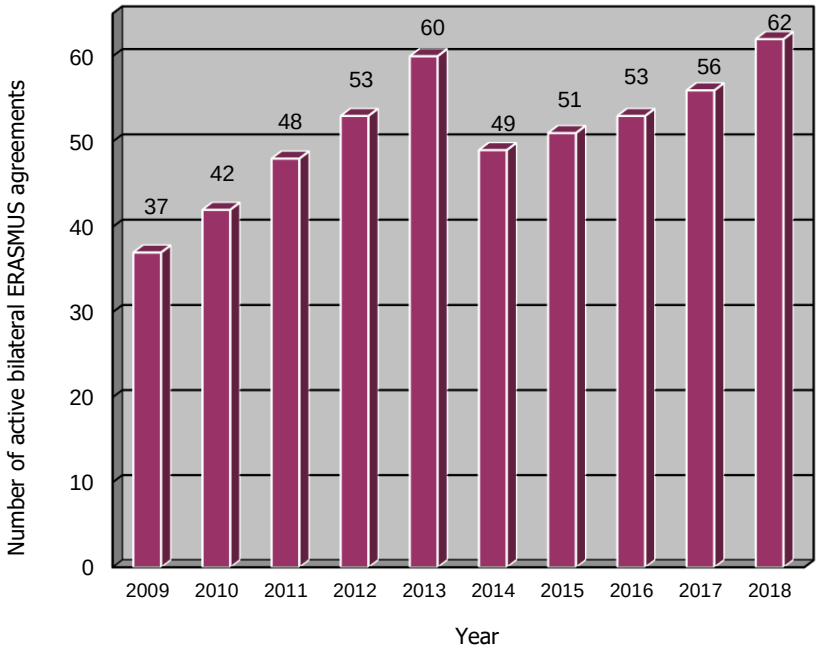
Projects of TA CR cooperating company, institution	**Projects of sectoral provider cooperating company, institution**
Aircraft Industries, a. s., Kunovice	Applycon, s. r. o., Dobřany
ASIO, s. r. o., Brno	Austis, a. s., Praha
Cayman Pharma, s. r. o., Neratovice	Barvy a laky TELURIA, s. r. o., Letovice
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, Praha
The Czech Membrane Platform, z. s., Česká Lípa	Explosia, a. s., Pardubice
Czech Technical University Praha	Explosia, a. s., Pardubice, VÚPCh
Diamo, s. p., Stráž pod Ralskem	University Hospital Olomouc
EPS, s. r. o., Kunovice	GEMA, s. r. o., Pardubice
Explosia, a. s., Pardubice	Graz University of Technology
FOTON, s. r. o., Nová Paka	Holding Contipro, Dolní Dobrouč
GALATEK, a. s., Ledeč nad Sázavou	Masaryk Memorial Cancer Institute Brno
Holzbecher, s. r. o., barevna a bělidlo Zlíč	NOVATISK, a. s., Blansko
Honeywell Aerospace, s. r. o., Olomouc	Regional Hospital Pardubice
INOTEX, s. r. o., Dvůr Králové nad Labem	Poličské strojírny a. s., Polička
Invaz, s. r. o., Trutnov	Department of the Interior Ministry CZ
K2pharm, s. r. o., Opava	SPUR, a. s., Zlín
Ligum, s. r. o., Jablonec nad Nisou	Building Chemistry, a. s., Slaný
KOMFI, spol. s r. o., Lanškroun	Synpo, a. s., Pardubice
Masaryk university Brno	Synthesia, a. s., Pardubice
Membrain, s. r. o., Stráž pod Ralskem	ŠKODA AUTO, a. s., Mladá Boleslav
OTK Group, a. s., Kolín	TOSEDA, s. r. o., Staré Čívice
OPTAGLIO, s. r. o., Husinec-Řež	Institute of Analytical Chemistry Czech Academy of Sciences Brno
PARDAM, s. r. o., Pardubice	Institute of Macromolecular Chemistry, Czech Academy of Sciences, Prague
SOMA, s. r. o., Lanškroun	University of Chemistry and Technology Prague, Faculty of Food and Biochemical Technology
SVÚOM, s. r. o., Praha	University of Technology Brno
Synpo, a. s., Pardubice	VVUÚ, a. s., Ostrava – Radvanice
Synthesia, a. s., Pardubice	Research Institute for Organic Synthesis, a. s., Pardubice
Teramed, s. r. o., Praha	Crop Research institute, v. v. i.
UniCRE, Center for Research and Education, a. s., Ústí nad Labem	Research Institute for Building Materials, a. s., Brno
Tomas Bata University in Zlín	
VITON, s. r. o., Veselí nad Lužnicí	
University of Chemistry and Technology Prague, Faculty of Food and Biochemical Technology	
University of Technology Brno	
Unipetrol Center for Research and Education, a.s., Ústí nad Labem	
Forestry and Game Management Research Institute, v. v. i., Opočno	
Research Institute for Organic Synthesis, a. s., Pardubice	
VZLÚ, a. s., Praha-Letňany	
ZVVZ MACHINERY, a. s., Milevsko	

Contract research projects cooperating company, institution
Austin Detonator, a. s., Vsetín
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., Praha
EKOMOR, s. r. o., Lískovec
Ekotech ochrana ovzduší, s. r. o., Všestary
Explosia, a. s., Pardubice
Fatra, a. s., Napajedla
Glanzstoff Bohemia, s. r. o., Lovosice
GrapheneUP SE, Tuřany u Slaného
HE3DA, s. r. o., Praha
Huhtamaki Česká republika, a. s., Přibyslavice
IQ Structures, s. r. o., Husineč – Řež
KRUŽÍK, s. r. o., Kroměříž
Lučební závody Draslovka, a. s., Kolín
Metrohm, s. r. o., Praha
Mondi Štětí, a. s., Štětí
Nicolet CZ, s. r. o., Praha
Papcel, a. s., Litovel
PARDAM, s. r. o., Pardubice
PRECHEZA, a. s., Přerov
SAINT GOBAIN ADFORS CZ, s. r. o., Litomyšl
Sellier-Bellot, a. s., Vlašim
SINPOL, s. r. o., Starý Kolín
SPM – Security Paper Mill, a. s., Praha
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., Praha

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 2018 was 62. In the framework of ERASMUS+, a total of 11 teachers' mobilities took place (allocated amount 4,250 EUR) and 14 students' mobilities lasting for a total of 48.5 months (allocated amount 24,508 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 2009 and 2018

Involvement in Erasmus+ programme in 2018

Indicator	Erasmus 2016	Erasmus 2017	Erasmus 2018
Number of outgoing students	43	27	14
Number of incoming students	16	34	14
Number of outgoing academic staff	3	7	11
Number of incoming academic staff	5	9	7

Mobilities of students and academic staff including financial costs in 2018

	Students*			Academic staff*		
	Number of outgoing	Number of months	costs in EUR	Number of outgoing	Number of weeks	costs in EUR
Total	14	48,5	24,508	11	11	4,525

*) 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
G	Technological Educational Institute of Athens (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
RO	Universitatea Transilvania din Brasov
RO	Military Technical Academy of Bucharest
S	Umea University
SF	Abo Akademi Turku
SI	Univerza v Ljubljani (2 agreements)
SK	Technická univerzita v Košiciach (2 agreements)
SK	Slovenská technická univerzita v Bratislave (2 agreements)
TR	Ankara University

TR	Canakkale Onsekiz Mart University
TR	Marmara University
TR	Mersin University

In 2018 the Faculty was involved in three networks under the CEEPUS programme ("Central European Exchange Program for University Studies"); mobilities are specified below.

Mobilities of students and academic staff including financial costs in 2018 under the CEEPUS programme

Programme	CEEPUS 2014	CEEPUS 2015	CEEPUS 2016	CEEPUS 2017	CEEPUS 2018
Number of projects	3	3	3	4	3
Number of outgoing students	2	3	2	1	4
Number of incoming students	7*	9	2	13	6
Number of outgoing academic staff	3	6	4	2	16
Number of incoming academic staff	9**	9	6	10	21
Amounts of support (EUR)	11,194***	10,971	5,666	13,465[1]	16,327[2]

*) of whom 2 students as freemovers accepted by FChT
**) 2 academics as freemovers accepted by FChT
***) of which networks (FChT contracts) = 9,859 EUR freemovers (Rector's Office contract) = 1,335 EUR
[1]) of which 12,933 EUR incoming – FChT contract, 532 EUR outgoing – Rector's Office contract
[2]) of which 13,913 EUR incoming – FChT contracts, 2,414 EUR outgoing – Rector's Office contract

In 2018 FChT had a total of three CEEPUS networks:

- CIII-CZ-0212 - Ing. Radovan Metelka, Ph.D.
- CIII-RS-0704 - Ing. Ondřej Panák
- CIII-RO-1111 - Ing. Radovan Metelka, 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 is involved in and applies for projects funded by both domestic providers to promote bilateral cooperation and grants from international providers. Specifically, in 2018 the Faculty was involved in 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 a 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 centers 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 solid cooperation with a number of foreign institutes. This cooperation resulted in 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 2018 amounted to **254,915 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	2012	2013	2014	2015	2016	2017	2018
Costs of international travel (EUR)	317,184	316,061	352,101	243,478	228.090	207,087	254,927

The structure of the sources used to cover international travel in 2018 is shown in the following table.

Sources of financing of international travel in 2018

Source of financing	Funding in EUR
Basic funding (including participation in ZG and KO), development of research organization	109,695
Specific science	31,161
Developmental projects of MEYS	0
Other main activities	1,049
Other science of MEYS	12,718
R+D - GA CR	54,735
R+D - Extra-budgetary grants	11,680
R+D - Foreign grants	18,973
R+D - Other types of scientific cooperation	622
OP RDE	12,837
Licence study	681
Contract research	763
Total	**254,914**

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 (EUR)	Provider/project programme
7AMB17FR058	Němec Petr, prof. Ing., Ph.D.	1,399	MEYS/ Czech-French bilateral cooperation
N62909-16-1-2088	Pachmáň Jiří, Ing. Ph.D.	8,485	ONRG/ Supports the organization of an international seminar
638857	Macák Jan, Dr.-Ing.	303,696	EU/Horizon 2020
687681	Bílková Zuzana, prof. RNDr. Ph.D.	76,040	EU/Horizon 2020

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

University/institution	City	State	End of the agreement
Karl-Franzens Universität	Graz	Austria	1993
Cairo University	Giza	Egypt	1993
South Valley University	Qena, Aswan	Egypt	2001
Martin Luther University	Halle	Germany	1996
Eberhard-Karls-Universität Tübingen	Tübingen	Germany	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	Tuscon	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 BAV	Sofia	Belarus	2017

These agreements resulted in many projects supporting especially teachers' and students' mobility. In addition to agreements concluded by the Faculty, there are university agreements for example with the University of Rennes I, Rennes, France, Belarusian State Technological University, 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, and Uzhhorod National University, Ukraine, 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 Departmental Projects

Department of General and Inorganic Chemistry

Project number	Project name	Provider	Principal investigator
Grants GA CR			
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.
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.
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.
GA16-01618S	Ten-vertex dicarbaborane molecular assemblies via alkylation	GA CR	Růžičková Zdeňka, Ing., Ph.D.
Grants TA CR			
TH02010197	Modern cyclization reactions	TA CR	Jambor Roman, doc. Ing. Ph.D.
GAMA02/011	Non-volatile memory based on resistive switching in thin films of chalcogenides	TA CR	Wágner Tomáš, prof. Ing. DrSc.
TE01020022	Flexible printed microelectronics based on organic or hybrid materials, FLEXPRINT	TA CR	Wágner Tomáš, prof. Ing. DrSc.
GAMA01/001	Progress in lactide esterification – synthesis of lactyllactates with high added value	TA CR	Růžička Aleš, prof. Ing. Ph.D.
GAMA02/005	Modification of technologically important oligo/polyols by sophisticated esterification	TA CR	Růžička Aleš, prof. Ing., Ph.D.
Grant MIT			
FV10240	Catalyzed Aerobic Oxidacion in the Industry	MIT	Jambor Roman, doc. Ing. Ph.D.
Project IDC			
IRS2018/015	Innovations of the student laboratory for the preparation of organometallic compounds	MEYS	Vinklárek Jaromír, prof. Ing., Dr.

Institute of Chemistry and Technology of Macromolecular Materials

Project number	Project name	Provider	Principal investigator
Grants TA CR			
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.
TE02000011	Research center of surface treatment	TA CR	Večeřa Miroslav, Ing. CSc.

Project IDC			
IRS2018/021	Determination of corrosion efficiency by electrochemical methods	MEYS	Kohl Miroslav, Ing.

Department of Economy and Management of Chemical and Food Industry

Project number	Project name	Provider	Principal investigator
Project IDC			
IRS2018/012	Support for Pedagogical Work of Academic Staff of the Department of Economics and Management of Chemical and Food Industry and Innovation of Selected and Preparation of New Economic Courses in English	MEYS	Tetřevová Liběna, doc. Ing., Ph.D.

Institute of Organic Chemistry and Technology

Project number	Project name	Provider	Principal investigator
Grants GA CR			
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 inhibotors	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.
Grant TA CR			
GAMA02/002	Optimazing the strukture and preparation of pyrazine-2,3-dicarbonitrile photoredox catalysts	TA CR	Bureš Filip, prof. Ing., Ph.D.
Project MIT			
FV30048	New additives for multifunctional modification of polymeric surfaces	MIT	Hrdina Radim, prof. Ing., CSc.
Project OP RDE			
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.

Institute of Applied Physics and Mathematics

Project number	Project name	Provider	Principal investigator
Grant GA CR			
16-07711S	Systematic study of the Schottky barrier effect on the energy filtering of electrons in thermoelectric nanocomposites	GA CR	Drašar Čestmír, prof. Ing. Dr.
Project IDC			
IRS2018/018	Elucidation of application aspects of experimental problems solved in Laboratory of Physics I and II across all study programs	MEYS	Sajdlová Světlana, Mgr.

Department of Analytical Chemistry

Project number	Project name	Provider	Principal investigator
Grants GA CR			
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.
Project IDC			
IRS2018/011	Introduction of a hydride generation system coupled to atomic absorption spectrometry in the Advanced instrumental analysis laboratory courses	MEYS	Husáková Lenka, Ing., Ph.D.
Project MIT			
FV10487	Preservatives for writing inks	MIT	Ventura Karel, prof. Ing. CSc.
Grant MI			
VI20152020004	Identification of residues of improvised explosives using physico-chemical analytical methods under real conditions	MoI	Ventura Karel, prof. Ing. CSc.
ERC CZ			
LL1302	Mass Spectrometry in Cancer Research: Lipid Biomarkers for Early Diagnostics	MEYS	Holčapek Michal, prof. Ing. Ph.D.

Department of Inorganic Technology

Project number	Project name	Provider	Principal investigator
Grant GA CR			
16-06697S	Synthesis and characterization of new coloured mixed metal oxides	GA CR	Šulcová Petra, prof. Ing. Ph.D.

Department of Biological and Biochemical Sciences

Project number	Project name	Provider	Principal investigator
Project IDC			
IRS2018/017	Microscopic, bacteriological and immunological examination of stool	MEYS	Brožková Iveta, Ing., Ph.D.
Project OP RDE			
CZ.02.1.01/0.0/0.0/17_048/0007421	NANOBIO- Strenghtening of interdisciplinary cooperation in the research of nanomaterials and their effects on living organisms	MEYS	Bílková Zuzana, prof. RNDr. Ph.D.

Institute of Environmental and Chemical Engineering

Project number	Project name	Provider	Principal investigator
Grant GA CR			
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.
Projects TA CR			

TH02010762	Supplements for the pozitive effect on the human microbiome	TA CR	Kořínková Jaroslava, Ing. Dr.
TH02030823	Development of metodic-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.
GAMA01/007	Effective method for the removal of crucial contaminants from technological wastes and effluents	TA CR	Weidlich Tomáš, doc. Ing. Ph.D.
Projects IDC			
IRS2018/014	Innovation of Equipment for Water Sampling and Analysis	MEYS	Brunclík Tomáš, Ing., Ph.D.
IRS2018/031	Support of practical trainings for students of the ÚEnviChI	MEYS	Slezák Miloslav, Ing., CSc.

Department of Physical Chemistry

Project number	Project name	Provider	Principal investigator
Grants GA CR			
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.
16-10562S	Viscosity and kinetic phenomena in glass-forming systems	GA CR	Málek Jiří, prof. Ing. DrSc.
GBP106/12/G015	Intelligent design of nanoporous adsorbents and catalysts	GA CR	Bulánek Roman, prof. Ing. Ph.D.

Joint Laboratory of Solid State Chemistry

Project number	Project name	Provider	Principal investigator
Grant GA CR			
17-10639S	Nanoparticles of selected layered compounds as precursors for nanocomposites and inorganic-organic hybrid materials	GA CR	Beneš Ludvík, doc. Ing. CSc.
Project TA CR			
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 name	Provider	Principal investigator
Project MIT			
FV10332	Advanced chemical gas generators, not only for the automotive industry	MIT	Jalový Zdeněk, doc. Ing. Ph.D.
Grant TA CR			
TH03020263	Propellants with increased a specific impulse	TA CR	Matyáš Robert, doc. Ing., Ph.D.
International grant			
N62909-18-1-2107	1.Organizing support of the 21 th 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 name	Provider	Principal investigator
Grants GA CR			
16-17921S	Heterostructures based on chalcogenides for nonlinear optics and optical sensors	GA CR	Nazabal Virginie, doc. Dr.
18-03823S	Advanced methods of fabrication of chalcogenide thin films and their modifications	GA CR	Němec Petr, prof. Ing., Ph.D.
Projects TA CR			
TH02010414	Autonomous identification systém 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 a UV curable varnish for digital varnishing machines	TA CR	Vališ Jan, Ing., Ph.D.
Project IDC			
IRS2018/016	Innovation of laboratory equipment for the branch of Graphic Arts (Department of Graphic Arts and Photophysics)	MEYS	Jašúrek Bohumil, Ing., Ph.D.
Projects MIT			
FV10238	Research and development of a CO_2 compensation system in the printing industry	MIT	Němec Petr, prof. Ing. Ph.D.
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 element of industry 4.0	MIT	Němec Petr, prof. Ing., Ph.D.
Grant MA			
QK1810010	SMARTFIELD - Autonomous aquosition of temperature and moisture data of microclima and earth for smart farming based on platform (IoT)	MoA	Syrový Tomáš, doc. Ing. Ph.D.
Project MEYS			
7AMB17FR058	X-ray photoelectron spectroscopy characterization and plasma etching structuration of amorphous chalcogenides	MEYS	Němec Petr, prof. Ing. Ph.D.

Center of Materials and Nanotechnologies

Project number	Project name	Provider	Principal investigator
Grant GA CR			
16-13876S	Fabrication and characterization of micro and nanostructures in high refractive index glasses	GA CR	Vlček Miroslav, prof. Ing. CSc.
Project MEYS			
LM2015082	Large Infrastructure CEMNAT	MEYS	Vlček Miroslav, prof. Ing. CSc.
Project OP RDE			
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 sensitive sensors and low density materials based on polymeric nanocomposites (NANOMAT)	MEYS	Vlček Miroslav, prof. Ing., CSc.

SGC projects solved at FChT in 2018

Project number	Project name	Provider	Principal investigator
SGS FChT 2018			
SGS_2018_001	Modern instrumental methods in analysis of materials, food and biological samples	UPa	Ventura Karel, prof. Ing., CSc.
SGS_2018_002	Advanced organic chemistry and technology of new and perspective compounds - synthesis, characterization, reactivity, utility properties and their safety	UPa	Sedlák Miloš, prof. Ing., DrSc.
SGS_2018_003	Modern Practices in the Fields of Environmental Engineering and Value Management	UPa	Mikulášek Petr, prof. Ing., CSc.
SGS_2018_004	New inorganic materials	UPa	Koudelka Ladislav, prof. Ing., DrSc.
SGS_2018_005	The use of modern analytical, molecular biological, microbiological and cytological methods in biological studies	UPa	Kanďár Roman, prof. Mgr., Ph.D.
SGS_2018_006	Synthesis and study of macromolecular and supramolecular structures of materials	UPa	Bouška Marek, Ing., Ph.D.
SGS_2018_007	Study of advanced materials for chemical technology and other applications	UPa	Košťál Petr, Ing., Ph.D.

Fakulty project

Project number	Project name	Provider	Principal investigator
Project OP RDE			
OP VVV - 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.

6.2 European Research Council (ERC) Project

Center of Materials and Nanotechnologies

Project number	Project name	Provider	Principal investigator
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 EU Framework Project

Department of Biological and Biochemical Sciences

Project number	Project name	Provider	Principal investigator
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 2018. 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 trends of relevant indicators.

Recalculated number of FChT employees from 2014 until the end of 2018 (each year as of 31 December)

Year	Educational staff	Research staff	Other staff				Total
			Technicians, analysts	Administration, TEW	Workers	Total	
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
2014	169,2	45,3	44,0	32,6	6,2	82,8	297,3

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

Educational staff	2014		2015		2016		2017		2018	
	P	R	P	R	P	R	P	R	P	R
Professors	35	30,9	37	32,1	40	33,8	40	34,1	42	36,8
Associate Professors	43	40,8	43	41,1	44	42,5	45	42,3	45	41,9
Assistant Professor	89	85,8	91	87,9	91	89,0	90	87,5	87	84,5
Lecturers	14	11,8	12	9,8	9	6,5	9	6,0	8	5,6
Total	**181**	**169,3**	**183**	**170,9**	**184**	**171,8**	**184**	**169,9**	**182**	**168,8**

Note: P – physical number, R – recalculated number

Age structure of educational staff as of 31 December 2018 (number of persons)

Age	Educational staff				
	Professors	Associate Professors	Assistant Professors	Lecturers	Research Staff
< 29 years	0	0	2	2	12
30 - 34 years	0	0	10	2	20
35 - 39 years	1	7	22	3	10
40 - 44 years	5	10	22	0	6
45 - 49 years	4	8	14	0	2
50 - 54 years	6	6	9	0	1
55 - 59 years	4	1	5	0	2
60 - 64 years	6	7	2	1	1
65 - 69 years	4	2	1	0	0
> 70 years	12	4	0	0	2

Average age in the groups of academic staff in recent years

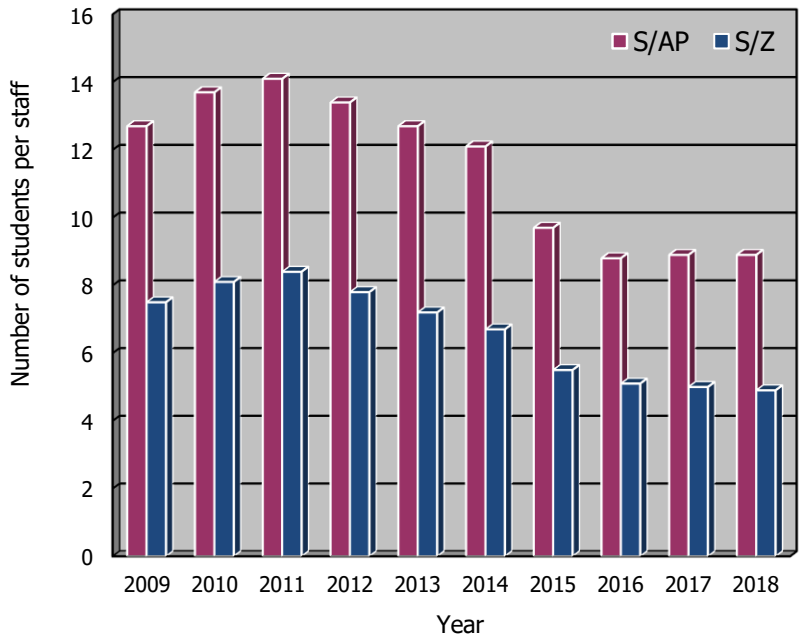
Age	Educational staff				Research Staff
	Professors	Associate Professors	Assistant Professors	Lecturers	
average age 2014	62,8	49,8	41,5	36,1	35,5
average age 2015	62,4	49,9	41,9	38,8	36,4
average age 2016	62,2	50,2	42,0	36,2	36,3
average age 2017	62,2	50,8	42,5	35,6	37,3
average age 2018	60,8	51,8	43,1	35,7	38,3

Average age of academic staff from 2012 until the end of 2018

Year		2012	2013	2014	2015	2016	2017	2018
average age	Educational staff	46,4	46,9	47,0	47,7	48,0	48,7	49,2
	Research staff	35,2	35,4	35,5	36,4	36,3	37,3	38,3

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

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
S/AP	12,7	13,7	14,1	13,4	12,7	12,1	9,7	8,8	8,9	8,9
S/Z	7,5	8,1	8,4	7,8	7,2	6,7	5,5	5,1	5,0	4,9



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

Habilitation proceedings and appointment of professors

List of areas for habilitation and appointment of professors

Branch	Validity period
Analytical Chemistry	up to 1 November 2023
Inorganical Chemistry	up to 1 November 2023
Organic Chemistry	up to 1 November 2023
Physical Chemistry	up to 1 November 2023
Chemical Engineering	up to 1 November 2023
Chemistry and Technology of Inorganic Materials	up to 1 November 2023
Technology of Organic Materials	up to 1 November 2023
Surface Engineering	up to 31 May 2024

Ongoing habilitation proceedings in 2018

Surname, name, title	Faculty	Branch	Status
Krupka Miloslav, Ing., Dr.	FChT	Technology of Organic Materials	in progress
Dohnalová Žaneta, Ing. Ph.D.	FChT	Chemistry and Technology of Inorganic Materials	in progress
Večeřa Miroslav, Ing., CSc.	FChT	Technology of Macromolecular Materials	in progress

Associate professors appointed in 2018

Surname, name, title	Faculty	Branch	Appointment efficiency
Nazabal Virginie, Dr.	FChT	Chemistry and Technology of Inorganic Materials	1 April 2018
Pachman Jiří, Ing. Ph.D.	FChT	Technology of Organic Materials	15 January 2018
Syrový Tomáš, Ing. Ph.D.	FChT	Surface Engineering	1 July 2018
Komersová Alena, Ing. Ph.D.	FChT	Physical Chemistry	1 October 2018

Professors appointed in 2018

Surname, name, title	Faculty	Branch	Appointment efficiency
Hanusek Jiří, doc. Ing. Ph.D.	FChT	Organic Chemistry	25 June 2018
Kandťár Roman, doc. Mgr. Ph.D.	FChT	Analytical Chemistry	25 June 2018

8. Quality and Culture of Academic Life

In 2018 the Dean of the Faculty of Chemical Technology awarded the Silver medal of merit and 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:

Robert Čebiš
For his significant contribution in the field of promotion and popularization of chemistry

Lučební závody Draslovka, a. s., Kolín
For significant contribution in the field of promotion and popularization of chemistry

prof. Ing. Karel Komers, CSc.
For lifelong contribution to the education of students of the University of Chemical Technology in Pardubice and its successor the Faculty of Chemical Technology, University of Pardubice

doc. Ing. Jaromír Kaválek, CSc.
For lifelong contribution to the education of students of the University of Chemical Technology in Pardubice and its successor the Faculty of Chemical Technology, University of Pardubice

prof. Ing. Jaroslav Šesták Jaroslav, DrSc.
On the occasion of a significant life jubilee

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

Mgr. Petra Karešová
For increasing students' interest in the study of chemistry

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

Mgr. Jana Veselá
For increasing students' interest in the study of chemistry

prof. Ing. Aleš Růžička, Ph.D.
Ing. Tomáš Chlupatý, Ph.D.
For publication in a journal with high Article Influence Score (AIS) according to 2017 Evaluation

Academic ceremonies at FChT in 2018

On 15 June 2018, the graduation ceremony of students who completed the follow-up master's degree took place. Between 4 and 8 June all graduates took their final exams and defended their master's diploma thesis. 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 156 graduates.

On 31 August 2018, the ceremonial pledge of graduates from the bachelor's degree programmes was held. The Dean of the Faculty of Chemical Technology presented the bachelor's diploma to a total of 154 graduates who had taken their final exams and defended their bachelor's diploma thesis between 20 and 24 August.

On 30 November 2018, 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 2018

Ing. Miloslav Slezák, CSc.
"Viktor Ettel Award" granted by the Czech Society of Industrial Chemistry for lifelong work in the field of chemical technologies, April 2018

Doc. Ing. Tomáš Weidlich, Ph.D., Ing. Petr Lacina, Ph.D.
1st prize in the "Progressive Idea" contest awarded at the TOP 2018 conference, Štrbské Pleso, Slovakia, 21 September 2018

Dr. Ing. Jan Macák, Prof. Ing. Roman Bulánek, Ph.D.
"Recognition for significant creative achievement" awarded by the Rector of the University of Pardubice for TA CR project TA04011557 "Technology for the production of advanced nanostructure SiO_2 fibres", 16 November 2018

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 issued at FChT in 2018 is provided in Chapter 2.7 of this Annual Report. In 2018, the following proceedings were issued:

1. Scientific Papers of the University of Pardubice, Series A, Faculty of Chemical Technology, Volume 24 (2018), 80 copies.
2. Proceedings of the 21st Seminar on New Trends in Research of Energetic Materials, 50 copies + 300 pcs USB.
3. 40th Calorimetric seminar, 90 copies
4. 20th Conference on Special Inorganic Pigments and Powder Materials, 45 copies
5. Students' scientific activity 2017/18, 115 copies
6. 51st Seminar on Surfactants and Detergents, 75 copies
7. Industrial toxicology and ecotoxicology 2018, 45th year, 114 copies
8. Monitoring of Extraneous Substances in the Environment 20, 65 copies
9. Solid State Chemistry 2018, 170 copies
10. VITATOX 2018, 70 copies
11. 18th International Nutrition & Diagnostics Conference – INDC 2018, 100 pcs USB.

In total, the FChT published 11 titles, 874 copies + 400 pcs USB.

9.2 Service Departments at FChT

In 2018 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):

- Center 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 (KPF)
- 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 university bodies, Council of Higher Education Institutions, Governmental Office for Research, Development and Innovation, National Accreditation Bureau for Higher Education,
- Active involvement of the Faculty representatives in cooperation with scientific and research departments and in various professional boards, including grant commissions, and in cooperation in working groups of relevant advisory bodies,
- Involvement of students and employees in various professional and interest organizations:

American Chemical Society,
Association for Youth, Science and Technology, AMAVET, z. s.,
Association of Chemical Industry of the Czech Republic,
Association of Paint Manufacturers of the Czech Republic,
Association of the Czech Pulp and Paper Industry,
Association of University Educators of Non-Medical Health Professions in the Czech Republic
Associations of the Pulp and Paper Industry (SPPC), Czech Republic, Slovak Republic,
Central European Group for Separation Sciences (CEGSS),
Czech and Slovak Crystallographic Association,
Czech Association of Textile Chemists and Colourists,
Czech Astronomical Society,
Czech Glass Society,
Czech Chemical Society,
Czech Marketing Association,
Czech Membrane Platform (CZEMP),
Czech Packaging Institute SYBA, z. s.,
Czech Physiological Society,
Czech Society for Biochemistry and Molecular Biology,
Czech Society for Forensic Genetics,
Czech Society for New Materials and Technology,
Czech Society for Nutrition,
Czech Society of Clinical Biochemistry,
Czech Society of Cosmetology,
Czech Society of Chemical Engineering,
Czech Society of Industrial Chemistry,
Czech Statistical Society,
Czech Technology Platform for Sustainable Chemistry,
Czechoslovak Association for Crystal Growth,
Czechoslovak Microscopy Society,
Czechoslovak Society for Microbiology,
Department of Human Nutrition and Food Quality CAAS,
Engineering Academy of the Czech Republic,
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 of Associations of Technicians for Industry of Paints in European Countries (FATIPEC),
Filtration Society UK,
Finalists Club of the FameLab Competition, British Council Czech Republic,
Flexographic Expert Group of the Czech Republic and Slovak Republic,
GEM 2 Long Term Strategy Group, European Defence Agency,
International Adsorption Society,
International Association of Research Organizations for the Information, Media and Graphic Arts Industries (IARIGAI),
International Biographical Center 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 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.,
Society for Blasting Techniques and Pyrotechnics Member (STTP),
Society for Imaging Science and Technology,
Society of Applied Spectroscopy,
Spectroscopic Society of J. M. Marci,
SSTVP Slovak company for blasting and drilling work,
Student Board of University of Pardubice,
Students' Professional Activities (SPA)
Sustainable Development of Energy, Water and Environment Systems (SDEWES),
Technical Association of Pulp and Paper Industry (TAPPI), USA,
Technical Committee of Standardization TC142 (ÚNMZ),
Technical Working Group of Ministry of the Environment of Czech republic, Waste Water and Waste Gas Management,
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, Pardubice
Union of Polygraphic Businessmen,
University of Pardubice, Art Ensemble
University of Pardubice, Sports Club,
University of Pardubice, Trade Union.

- 12 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 2018 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 on 1 to 5 October 2018 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 Brno and Akadémia in Bratislava. The stalls of the Faculty were attended by hundreds of secondary school students, their teachers, educational counsellors, and representatives of other universities, a vast amount of information was provided, numerous promotion materials given away, and oral presentations held.

A significant event in the area of publicity is the presentation of the Faculty in selected secondary schools. In 2018, representatives of the Faculty visited many grammar schools and secondary vocational schools:

Gymnázium, SOŠ, SOU, VOŠ Hořice
Gymnázium Letohrad
Gymnázium Litomyšl
Gymnázium a Střední odborná škola Přelouč
Gymnázium Vysoké Mýto
Hořické gymnázium (soukromé)
SPŠCh Brno
SPŠ Hranice na Moravě
SPŠCh Ostrava
SPŠCh Otrokovice
SPŠCh Pardubice
SPŠS Železný Brod
SŠIS Dvůr Králové nad Labem
Střední škola mediální grafiky a tisku, s. r. o., Praha
Střední škola polygrafická, Olomouc
ÚJOP Poděbrady
ÚJOP, Mariánské Lázně
Vyšší odborná škola grafická a Střední průmyslová škola grafická, Praha.

On the other hand, some secondary schools 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 2018 the Faculty was visited by students from grammar schools in Hořice, Chrudim, Ústí nad Orlicí, SPŠCh Pardubice, SŠIS Dvůr Králové nad Labem, SOŠCh Bratislava, and even 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 on cooperation were signed with SPŠCh Pardubice, SŠIS Dvůr Králové nad Labem and SPŠS Železný Brod. These secondary schools will become **Faculty Schools of the Faculty of Chemical Technology, University of Pardubice**.

The publicity of the Faculty was also increased by participation in the labour fair KONTAKT 2018 and the following promotional events: Science and technology in school yards, Young researchers' night, Science exhibition and scientific-technical fair in the city center. 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 occasions: "Search for the best young chemist" contest (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, and exhibitions organized in cooperation with Uskupení Tesla, z.s.

On a regular basis, the Faculty updates the offer of various educational courses, especially the licence study, and data in the national electronic database. The Faculty 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 2018 the Faculty continued to improve the faculty website, including the websites of departments and institutes, and its Facebook and Instagram profile. These activities still continue. The Faculty presents the offer of study programmes on relevant websites, but also uses job opportunity websites (Jobs.cz).

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 2018, the management of the Faculty continued to improve the system of providing information and counselling for students in order to facilitate their 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 representatives of chemical enterprises called KONTAKT 2018. 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 students' orientation on the labour market. Presentations and personal meetings were held in the university auditorium and adjacent areas. Both 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 students' free time. In the academic year 2017/2018, the traditional contest 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 eleven sports (volleyball, basketball, badminton, floorball, futsal, swimming, aerobics, tennis, squash, athletics, rowing) and in 18 sports disciplines involving a total of 948 athletes. The 60th year of the contest for the Flag of the Rector was won by the Faculty of Chemical Technology (81.5 points), followed by the Faculty of Economics and Administration (81 points) and Faculty of Transport Engineering (50.5 points).

The following FChT students were among the best university athletes for 2017/2018:

3rd place CAH 2018 Brno Football Men
Ondřej Kovář

3rd place CAH 2018 Brno Movement Composition
Hana Pavlíčková
Karolína Celbová
Lenka Bubnová

3rd place CAH 2018 Brno Rowing – Men's Coxed Four
Tomáš Halík
Jindřich Mašín
David Slovák

2nd place AMCR 2018 Ostrava – Fire Sport
Markéta Marková, Tomáš Hostinský, Martina Machová, Antonín Sojka, Barbora Punarová

3rd place AMCR in the Extreme Relay Race Litovel 2018
Eva Štěpanovská

3rd place National Floorball League Final 2018 Praha
Jan Hrabovský
Petr Listik

In 2018 the employees of the Faculty were actively involved in the preparation and organization of the 21st 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 2018.

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

Evaluation of the quality of education by students

Between May and September 2018, students evaluated the quality of education using a special module in the IS STAG system. This evaluation covered the whole university.

Dean's Annual Reports

These 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 in 2018 is undoubtedly that by the National Accreditation Bureau for Higher Education as part of the University's application for institutional accreditation. 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 programmes,
a) Educational area of Economy courses; bachelor's, master's and doctoral degree programmes,
a) Educational area of Historical science; bachelor's, master's and doctoral degree programmes,
a) Educational area of Chemistry; bachelor's, master's and doctoral degree programmes,
a) Educational area of Information science; bachelor's, master's and doctoral degree programmes,
a) Educational area of Healthcare courses; bachelor's, master's and master degree programmes.

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 2018, 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.). Member of the Economic Committee of IEB in 2018 was Prof. Ing. Hana Lošťáková, CSc.

Evaluation of educational activity

Following the above, the internal accreditation process of FChT study programmes was performed in 2018 and accreditation was granted to the following study programmes:

Academically focused bachelor's degree programme Chemistry and Technology of Environmental Protection, 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 9 September 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Doc. Ing. Anna Krejčová, Ph.D.

Academically focused bachelor's degree programme Surface Protection of Building and Construction 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 9 September 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Prof. Ing. Andréa Kalendová, Dr.

Academically focused bachelor's degree programme Pharmacochemistry and Medicinal 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 7 October 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Doc. Ing. Aleš Imramovský, Ph.D.

Academically focused bachelor's degree programme Economy and Management of Chemical Industry Enterprises, 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 12 November 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Doc. Ing. Liběna Tetřevová, Ph.D.

Academically focused bachelor's degree programme Analysis of Biological 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 12 November 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Prof. Mgr. Roman Kanďár, Ph.D.

Academically focused follow-up master's degree 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 9 September 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Doc. Ing. Zdeněk Jalový, Ph.D.

Academically focused follow-up master's degree programme Economy and Management of Chemical Industry Enterprises, 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 12 November 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Doc. Ing. Liběna Tetřevová, Ph.D.

Academically focused follow-up master's degree programme Analysis of Biological 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 12 November 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Prof. Mgr. Roman Kanďár, Ph.D.

Professionally focused follow-up master's degree programme Bioanalytical Laboratory Diagnostics in Health Care, 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 areas of education Health Care and Chemistry delivered by the Faculty of Chemical Technology, University of Pardubice, for a period of 10 years, i.e. until 12 November 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Prof. RNDr. Zuzana Bílková, Ph.D.

Doctoral degree programme Organic Technology, 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 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Prof. Ing. Radim Hrdina, CSc.

Doctoral degree programme Organic Technology, 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 2028. The guarantor of the study programme appointed by the Dean of FChT effective from 1 December 2018 for the period of accreditation is Prof. Ing. Radim Hrdina, CSc.

Following Rector's Decree No. 2/2018 on the establishment of study programme boards and their specializations, the Dean of FChT on 26 April 2018 appointed the Board of FChT Study Programmes as the authority supervising the delivery of bachelor's and follow-up master's degree programmes accredited at FChT.

Evaluation of the results of science and research

Since 2004, the Research, Development and Innovation Board (RDIB) has performed an evaluation of R&D results on a yearly basis. The methodology used by RDIB is specified at http://www.vyzkum.cz/.

Regarding the fact that the evaluation of R&D for 2018 was not published, the results of the last known evaluation of the Faculty are provided below.

The evaluation applies only to those result that are directly linked to the activities of the respective research organizations, meet the definition of 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 are translated into a single numerical scale (quantification of results). The evaluation of the results is performed solely on the basis of valid data contained in R&D IS.

If an R&D activity includes multiple entities, the corresponding funding is divided correspondingly, provided that this division is defined in agreements on information resources. If an R&D result includes multiple entities, the points are divided equally. The documents obtained from the RII database are 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 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 thus 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/Faculty of Mathematics and Physics	155 253,6
2.	Charles University/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 Enginnering	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/Fisrt Faculty of Medicine	52 711,9
10.	**University of Pardubice/Faculty of Chemical Technology**	**47 986,1**
11.	Charles University/Faculty of Arts	47 966,9
12.	J. Heyrovský Institute of Physical Chemistry	47 211,6
13.	Biology Center, 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 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, 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

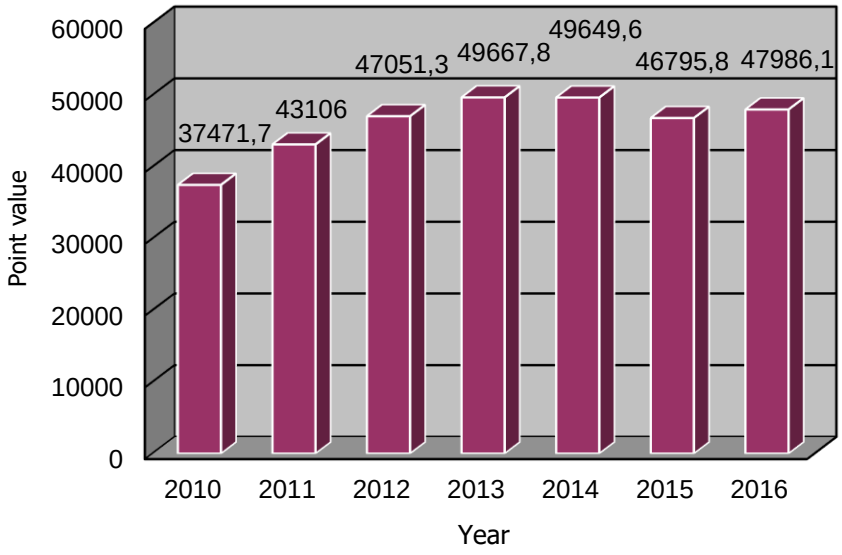
22.	Palacký University Olomouc/Faculty of Medicine and Dentistry	32 872,9
23.	University of South Bohemia in České Budějovice/Faculty of Science	31 619,2
24.	University of West Bohemia/Faculty of Applied Sciences	30 980,3
25.	University of Chemistry and Technology Prague/Faculty of Chemical Engineering	29 461,7

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

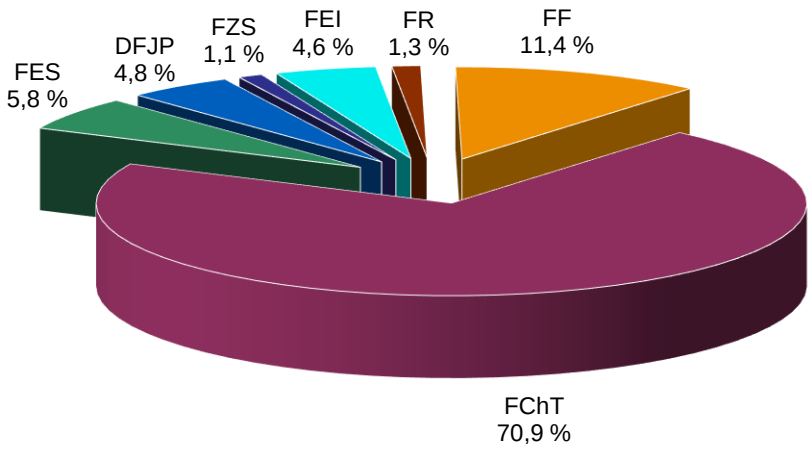
Order of public university faculties with chemical-technological focus by points awarded for R&D results (evaluation for 2016)

Order	Faculty	Number of points
1.	**University of Pardubice/Faculty of Chemical Technology**	**47 986,1**
2.	University of Chemistry and Technology Prague/Faculty of Chemical Technology	43 183,1
3.	University of Chemistry and Technology Prague/Faculty of Chemical Engineering	29 461,7
4.	University of Chemistry and Technology 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 Prague/Faculty of Environmental Technology	8 364,2

The development of the results of FChT for 2010-2016 is shown in the following figure.



Results of FChT, University of Pardubice 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

13. Further Development of the Faculty of Chemical Technology

13.1 Investment Development of FChT

In accordance with the long-term plan, in 2018 the Faculty continued to purchase new and upgrade existing instrumentation in order to strengthen its scientific and research potential in relation to educational activity.

Details on economic management and investment development are included in the Annual Report on Economic Management of FChT for 2018. This document includes only significant investments.

Investments relating to machines, devices, equipment and software (exceeding 200 thousand CZK, aprox. 7,775 EUR) in 2018

Identification of machine, device, equipment or software	Department	Price (thousand CZK / EUR)
Electrophoretic analyser EA 303	KAlCh	1,137 / 44
Capillary electrophoresis with liquid-cooled separation capillaries	KAlCh	755 / 29
Autosampler for liquid chromatography set	KAlCh	359 / 14
Spectrophotometer for measuring colour remission and transmittance	KAnT	547 / 21
Encapsulator of grainy and powder materials	KAnT	1,196 / 46
Differential scanning calorimeter	KAnT	1,797 / 70
Thermomechanical analyser	KAnT	1,898 / 74
Jaw crusher	KAnT	369 / 14
Mass detector for HPLC system (1st instalment)	KBBV	488 / 19
Highly sensitive microplate spectrophotometer/fluorimeter/luminometer	KBBV	2,539 / 99
Z-potential measurement instrument	KBBV	1,235 / 48
Automatic station for detection of proteins by western blot	KBBV	1,153 / 45
Working microscopic station	KBBV	1,349 / 52
Inverted fluorescent microscope	KBBV	
High capacity cell computer	KBBV	1,355 / 53
Cooled high speed centrifuge	KBBV	330 / 13
Laminar biohazard box	KBBV	230 / 9
CO_2 incubator	KBBV	230 / 9
Autoclave for biological waste disposal	KBBV	296 / 12
Corporate information system software	KEMCh	290 / 11
Simultaneous thermal analysis	KFCh	1,891 / 74
Fluorescent spectrophotometer	KFCh	1,058 / 41
Automatic degassing unit	KFCh	603 / 23
CW-EPR modular system	KOAnCh	5,455 / 212
FTIR spectrophotometer	KPF	2,400 / 93
Optical microscope	KPF	604 / 23
Glovebox	KPF	1,549 / 60
Instrument for exposure documents preparation	KPF	2,178 / 85
Large size printer	KPF	510 / 20
Digital printing machine with completion	KPF	1,725 / 67
Profilometer	KPF	2,540 / 99
Instrument for surface tension charge modification	KPF	829 / 32
Printing/depositing instrument for R2R preparation of electrode layers	KPF	2,399 / 93
Oscilloscope	ÚEnM	966 / 38
Kast drop hammer	ÚEnM	586 / 23
Instrument for the determination of sensitivity to friction	ÚEnM	543 / 21
Tensiometer	ÚEnM	295 / 11
Ball mill	ÚEnM	309 / 12
Pulse laser	ÚEnM	998 / 39
Programmable high-voltage blaster	ÚEnM	399 / 16
Ion chromatograph	ÚEnviChI	1,366 / 53

Instrument for microwave sample decomposition	ÚEnviChI	760 / 30
HPLC with fluorescence detection	ÚEnviChI	2,964 / 115
Spectrophotometer UV-VIS dual-beam	ÚEnviChI	587 / 23
Membrane micro/ultrafiltration	ÚEnviChI	240 / 9
Automatic flash chromatograph with integrated UV-VIS and ELSD detection	ÚOChT	1,402 / 54
Mass spectrometer with gas chromatography (GC-MS)	ÚOChT	2,240 / 87
Instrument for preparation of samples for microscopic coating evaluation	ÚChTML	763 / 30
Shock hammer for impact resilience determination	ÚChTML	289 / 11
Universal hardness tester	ÚChTML	842 / 33
Spectrophotometer	ÚChTML	435 / 17
Rheometer	ÚChTML	928 / 36
Laboratory dissolver with extension for basket mill	ÚChTML	555 / 22
Laboratory planetary centrifugal homogeniser	ÚChTML	460 / 18
Instrument for determination of orange peel in paint films	ÚChTML	895 / 35
Instrument for determination of surface treatment abrasion	ÚChTML	248 / 10
Salt chamber	ÚChTML	708 / 28
Grid monochromator	ÚAFM	219 / 9
Glovebox	CEMNAT	1,500 / 58
Helium detector for vacuum system sealing tests	CEMNAT	587 / 23
Precursor containers for atomic layer deposition (ALD) instruments	CEMNAT	357 / 14
Layer thickness check instrument	CEMNAT	582 / 15
Flow reactor for atomic layer deposition	CEMNAT	4,689 / 182
Instrument for measuring Z-potential	CEMNAT	1,235 / 48
Preparation of samples for microscopy (polishing, cutting)	CEMNAT	1,624 / 63
Electrochemical workstation	CEMNAT	617 / 24
Ultracentrifuge for nanomaterial separation from solutions	CEMNAT	973 / 38
Upgrade of SEM/FIB microscope	CEMNAT	4,522 / 176
X-ray photoelectron spectroscope (XPS)	CEMNAT	21,454 / 834
X-ray diffractometer (XRD)	CEMNAT	8,246 / 321
Fibre making machine	CEMNAT	3,433 / 133
Vacuum infrared spectrometer with microscopic attachment	CEMNAT	3,501 / 136
Dual x-ray radiation source	CEMNAT	778 / 33

In cooperation with TO, University of Pardubice, the hardware and control system of FChT was upgraded, the backbone wiring network was strengthened, and a fire alarm system was installed in TP Doubravice. New vegetation was planted around the parking place in front of the HC building as a replacement for felled trees.

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 2019. In 2019, 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 degree programmes, 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

- 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 for talented students in bachelor's and master's degree programmes.
- Emphasis on doctoral degree programmes as an educational priority of the Faculty.
- Sustained development of systematic work with students in 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 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 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 study programmes in cooperation with the application sphere, providing high-quality information about study programmes through various media.
- Continuing analysis of job opportunities for students in all levels of study.
- Evaluation of the process of education by students, graduates and management of the Faculty. Evaluation of study programmes in cooperation with professionals from practice, graduates, and the application sphere.
- Analysis of jobs acquired by 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 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 study by graduates and application of its results.
- Monitoring and evaluation of the reasons for early termination of study in bachelor's degree programmes.
- Systematic actions involving students and employees in order to fight plagiarism.
- Recruitment of 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 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 doctoral students in projects carried out in cooperation with foreign partners.
- Providing adequate conditions and preparation of projects for placement of students in bachelor's and follow-up master's programmes in industrial enterprises and research institutions.

- Systematic promotion of interdisciplinarity and internationalization of 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 academic staff in the area of education.
- Support and development of mobilities of academic staff and students of the Faculty in the context of educational programmes.
- Analysis and maintaining 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 center. 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 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 study and professional career.
- Improving existing specializations of study programmes and maintaining unique fields of study.
- Extending and improving the offer of lifelong learning programmes.
- Introducing 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 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 foreign placements of students of the Faculty of Chemical Technology, University of Pardubice. 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 research performed by 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 language competences of academic and non-academic staff and students of the Faculty.
- Improving the quality of courses taught in English and providing an offer of courses taught in English for Czech students, increasing the number and improving the quality of study materials used in courses taught in English.
- Expanding the opportunities for foreign research internships for academic staff, young researchers, and students in doctoral degree programmes.
- Systematic involvement of 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.
- Searching for new foreign strategic partners and systematic development of cooperation with these partners, both in terms of education and science and research.
- Using the potential of foreign academic staff and students during their long-term and short-term visits at 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 degrees" study programmes.
- Continued analysis of international territories for further partnerships.
- 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. Focus on the quality aspects of this activity by establishing efficient evaluation mechanisms for mapping the contribution of mobility programmes.
- Considering the process of internationalization in the accreditation of study programmes.
- Qualitative analysis of internationalization by establishing efficient evaluation mechanisms for mapping the contribution of mobility programmes.
- Provision of intensive care to foreign students and 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 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 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 a positive image of the Faculty in the eyes of the public.
- Systematic strengthening of the relevance of all study programmes to increase graduates' job opportunities on the labour market.
- Providing information and counselling services to students, and organization of activities to prepare 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 graduates' chances on the labour market.
- Consultations with employers, local stakeholders and other external partners in the process of preparation of study programmes to reflect their requirements and needs concerning graduates' qualification.
- Systematic and contract cooperation with employers and external partners, providing information and counselling services to students, and organization of activities to prepare graduates for the labour market.
- Ensuring the conditions for improving students' language skills.
- Conceptual work with graduates. Use of the system of communication with 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 current and perspective directions of economic development. Specialization of fields of study to reflect the knowledge, skills and competences expected from graduates.
- Provision and exchange of information on good practice examples, educational innovations, creative and other activities of the Faculty between the Faculty and other entities in the application sphere.
- Evaluation of the needs of all groups of 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

- Provide 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 implementing projects aimed at application research and contract research. Increasing the allocation for research, development and innovations from private sources.
- Successful implementation of projects supported by resort, national and especially international funds with an emphasis on motivating academic and research staff to submit relevant project applications.
- Increasing 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 students' awareness about the needs of industrial enterprises and increasing students' 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 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 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 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 reward 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 academic staff and students learn about research activities of partner departments and potential employers.
- Development of 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 staff remuneration rules.
- Analysis of the concept and outcomes of scientific work at various departments and in the fields that the Faculty focuses on.
- Definition of the 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 delivered 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.
- Development of general career growth principles. Increasing the degree of involvement of young employees in research and supporting their career growth.
- Establishment of rules for excellent postdocs and foreign researchers who work at the Faculty.

Strategic management and development of support processes

Objective: To constantly increase the quality of strategic management with a focus on evaluating the results in relation to the 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 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, analyses to improve relevant processes, infrastructure and services.
- Continuous provision of updated and relevant information to all 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 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.
- 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 infringement of sustainability criteria.

14. Conclusion

In conclusion, I would like to thank everyone who contributed to making 2018 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 students.

I hope that 2019 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 29 April 2019
- Discussed and approved by the Academic Senate of the Faculty of Chemical Technology, University of Pardubice on 14 May 2019

Annex

Significant academic events and life at the Faculty

Attracting talented students and promotion of the Faculty

On 15 June 2018 the Faculty of Chemical Technology held a festive academic ceremony – **Graduation of follow-up master's degree students.**

The Diploma was received by 156 new Engineers and Masters.

On 15 June 2018 outstanding students received an award for their master's diploma thesis and its defence.

The following prizes were awarded:

- Class I and II Rector's Student Award
- Dean's Award
- Miroslav Jureček Foundation 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

- Precheza Award

- Pfizer Award and many other awards

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

On 31 August 2018 the Faculty of Chemical Technology held a festive academic ceremony – **Pledge of bachelor's degree graduates.**

The Diploma was received by 154 new Bachelors.

On 31 August 2018 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 ČR, s.r.o. Award

On 30 November 2018 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 took a vow in front of the Vice-Dean of the Faculty of Chemical Technology.

Last but not least, the achievements of previous and current colleagues were appreciated, for example that of Prof. Komers and Doc. Kaválek.

On 10 and 11 January and **7 February 2018** the Faculty of Chemical Technology held **Open days** for future applicants.

Just as in previous years, future applicants had an opportunity to look into the laboratories and lecture rooms.

From 23 to 25 January 2018 the Faculty of Chemical Technology was presented at the higher education and lifelong learning exhibition **Gaudeamus** in **Prague** and from **23 to 26 October** also in **Brno.**

On 9 February 2018 the third year of the chemical contest 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 time-limited tasks.
The winner was the team that completed the highest number of tasks.

On 16 February 2018 our laboratories were visited by small researchers from Staňkova elementary school in Pardubice.

They took part in an entertaining programme annually organized by:

Doc. Ing. Lenka Česlová, Ph.D., and the magician Doc. Ing. Jan Fischer, CSc.

On 8 March 2018 the Faculty held a public debate with Zbigniew Czendlik and Hynek Stejskal on Science and faith.

On 8 and 9 March 2018 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 14 March 2018 the KONTAKT labour fair was held. Our students were visited by a number of major chemical enterprises who introduced themselves.

On 27 March 2018 the **Young Researchers' Night** took place at the Pardubice chateau

On 4 April 2018 the winners of the regional round of the **Search for the best young chemist** were announced and awarded. The Faculty of Chemical Technology supported this contest.

The contest includes 4 categories:

The best young chemist

The best project (whole class)

The best chemistry teacher

The best elementary school

On 2 June 2018 some amazing chemical magic tricks were shown as part of the **Children's Super Day.**

On 12 June 2018 the Faculty of Chemical Technology held the **6th year of the national finals** of the **Search for the best young chemist.**

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

Winners of the contest:

1st place
Tomáš Brablec, Elementary school Letovice.

2nd place
Tomáš Bobek, Elementary school Šafaříkova, Valašské Meziříčí.

3rd place
Aneta Piklová, Elementary school J. A. Komenského, Blatná.

On 14 June 2018 the Faculty participated in the **Science and Technology Fair.**

At the end of **June** and at the beginning of **August** several **alumni reunions** were held. We are pleased that some graduates do not hesitate to fly from remote corners of the world to see their alma mater again.

From 11 to 19 August 2018 the University of Pardubice had a permanent **Science Point** in the **Sports park** na Špici, where our Faculty was also represented

From 27 to 31 August 2018 in cooperation with the **Institute of European Regional Development** a group of 32 children had the opportunity to experience what it is like to be a university student during **daily camps.**

In the context of the long-term programme **Science and technology in school yards** we visited several schools including Children's Houses Pardubice and Svítání.

On 24 September 2018 the acquisition of **Institutional accreditation** was celebrated at the Academic square together will all parts of the University.

On 5 October 2018 the Faculty participated in the European Science Festival – **Researchers' Night**

The famous scientific show was presented by science communicator Dr. Michael Londesborough

Between 4 and 10 p.m. visitors could see a number of experiments.
This year's theme: **100 years of Czech science.**

From 9 to 11 October 2018 the Faculty of Chemical Technology participated in the education exhibition **Akadémia in Bratislava**.

Our lecture rooms and laboratories are open for guided tours of secondary school students.

On 13 November 2018 our faculty was visited by students from Kolmogorov School in Moscow.

On 13 November 2018 the representatives of the Faculty of Chemical Technology regained the challenge cup of the sports contest – **Flag of the Rector of the University of Pardubice.**

By regaining the flag, the year-long effort of our students and employees in many sports disciplines was completed.