VRIJE
UNIVERSITEIT
BRUSSEL

2024 - 2025

Master of Science in

# Chemical and Materials Engineering

120 ECTS

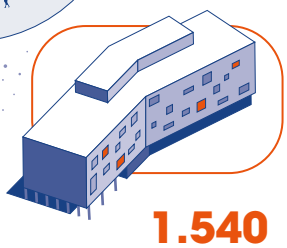
# VUB IN FIGURES

**33**
**BACHELOR'S PROGRAMMES**
including 3 in English

**22.667**
students
**152** nationalities

**60+**
**PREPARATORY PROGRAMMES**

**2.453**
professors, assistants and researchers



**1.540**
student rooms on campus

**8** faculties

**85+**
**MASTER'S PROGRAMMES**
including 31 in English

**€150.000.000**
research budget

**UZ Brussel university hospital, part of VUB**
first high-tech ambulance in Europe

**41**
student associations

**17**
**ADVANCED MASTER'S PROGRAMMES**

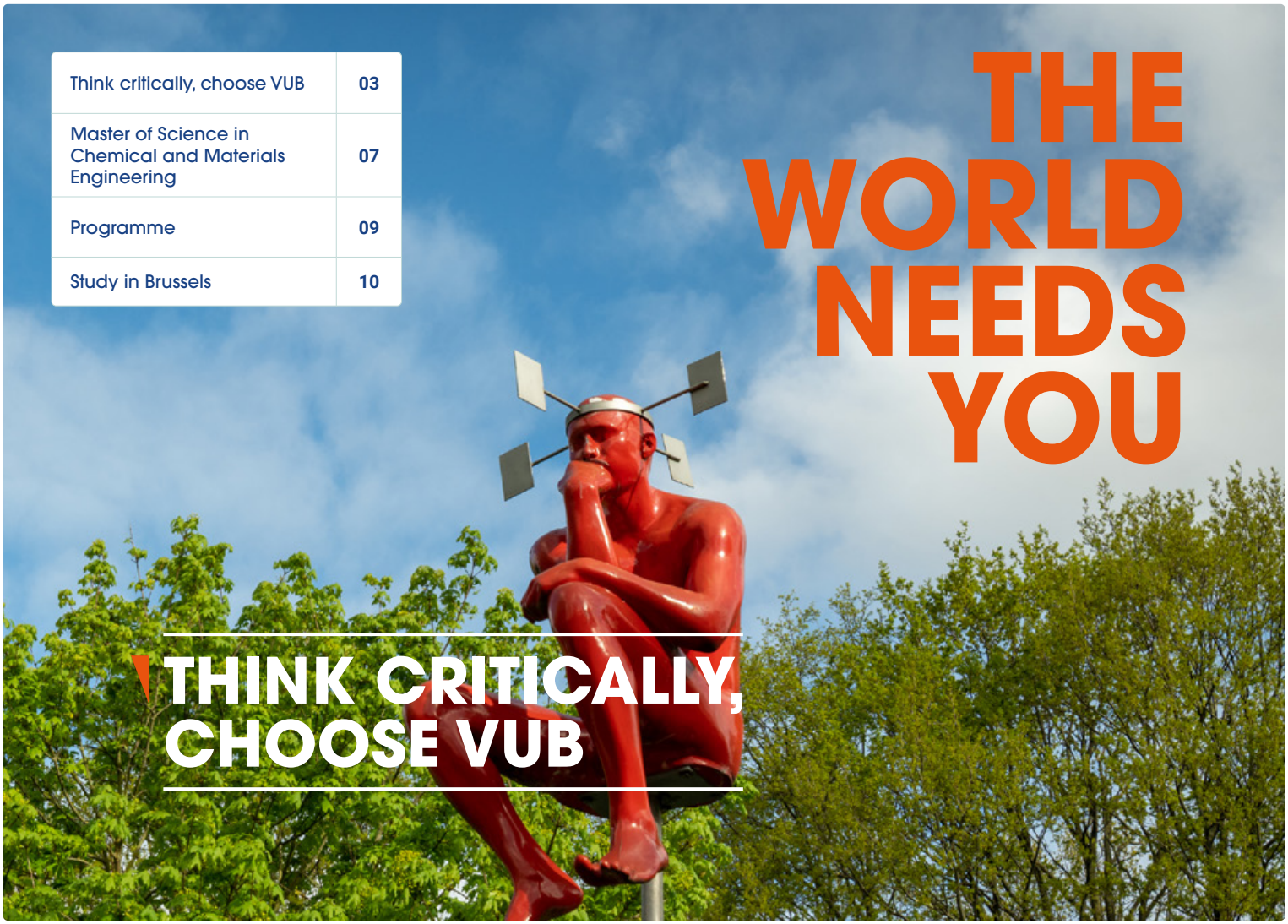
**16**
**POSTGRADUATE PROGRAMMES**

**14**
**CONTINUING EDUCATION COURSES**

**13**
**MICRO-CREDENTIALS**

**8**
**TEACHER TRAINING MASTER'S PROGRAMMES**

**80.000+**
**ALUMNI**
15.000 international




# THINK CRITICALLY, CHOOSE VUB

**Nothing is unthinkable, everything is achievable. Especially if you choose the Vrije Universiteit Brussel: the place for free thinking and sky-high ambition.**

## STRONG TEACHING, PERSONAL APPROACH

At VUB, you have a choice of 30+ academic bachelor's and 85+ master's programmes. So you are sure to find something to your liking. You also get value for your money. If you believe the rankings, we are the best university in Belgium when it comes to teaching.

Our courses build on pioneering research from our 150 research groups. That means you will be on top of the latest developments and technology. What matters to us, as an urban engaged university, is how you, as an engaged global citizen, use your knowledge to make the world a better place.

We mix that social focus and ambition with great study support and a personal approach, the hallmark of the VUB. And you will soon feel at home on campus among your new family of more than 20.000 fellow students. Your professors are leading scientists with an international network, and their doors are always open (when it is not freezing outside, of course).

## CRITICAL MIND, WARM HEART

VUB is a young university with a rich tradition of independent thinking. We do not accept absolute truths. We study the ever-changing reality according to the principles of free enquiry: free from religion, ideology and worldview, built entirely on scientific methods.

At VUB, you will learn how to investigate scientific theses and to ask obvious and less obvious questions. We focus on open-minded research and respectful disagreement. With us, you will not simply reproduce, you will learn to argue your point. You will walk out with your own vision. Critical thinking skills are a vital asset for a brilliant career and an exciting life.

And all these thinkers form a close-knit community. At VUB, you will find yourself in an open and caring environment. Whoever you are, however you think, together we are VUB. That is a special feeling. We embrace every talent in every situation and want to see everyone succeed, both on campus and in life.

## BOUNDLESS AMBITION, CLOSE TIES

Brussels and VUB, founding member of the EUTOPIA alliance, exude a cosmopolitan atmosphere, as every year, students from around 150 countries come to study with us. Your foreign dreams can come true here too. We collaborate daily with higher education institutions at home and abroad, so internship and career opportunities are there for the taking, both in Belgium and further afield.

## SHORT DISTANCES, EASY ACCESS

You will find almost all our faculties on the green VUB Main Campus in Elsene. Only Medicine and Pharmacy are on the VUB Health Campus in Jette, in the shadow of our university hospital. Both are easy to reach by bus and tram connections, and the VUB Main Campus is right next door to Etterbeek train station.

## ENTER BRUSSELS, EXIT BOREDOM

It is all happening in Brussels. Politics, activism, company headquarters, celebrations of sporting heroes, rebellious creativity, the pulse of the world. If you study at VUB, you are studying in the heart of Europe. A Brussels 'ket' is at home in a cultural melting pot, jumps between languages and respects others' customs. That attitude is the key to the door of an international career.

Brussels is also a real student city. Stroll through the streets around the Bourse and you immediately realise that this is a hotspot for culture vultures and food-lovers alike. It is bustling all year round, and yet you will find peace here too. Get to know Brussels and find your own way. You will soon get used to its idiosyncrasies.

Living and studying on our campuses is great. Stroll from your class to the dorms and sports facilities to the restaurant and back again. There is no traffic to dodge, just our inviting lawns. The real advantages of campus life? How quickly and easily you can connect with others, including students from different fields. How you save time very day. And how you immediately feel at home.

Think about it.
And let your adventure begin.

## THE 'V' OF VUB

"Vrijheid" – freedom – is fundamental to the Vrije Universiteit Brussel. And in particular, freedom of thought: the right as humans and scientists to question everything critically, without prejudice. The world still needs that freedom.

Based on this principle, VUB is open to everyone, regardless of their religion or worldview. We support all our students to become truly autonomous, responsible and critically thinking world citizens. Equality, openness and tolerance are at the heart of our humanistic vision.

We consider worldview, including religion, to be a personal choice within the private sphere. We respect it but we do not facilitate it. Our focus is on high-quality education based on free research and first-rate science.

# Tackle environmental challenges and help build a sustainable future

Engineers in chemistry and materials science play a unique role in sustainable development. They manage resources, energy and the environment to develop and produce novel materials and chemical commodities. This master's programme prepares you to face the demands of the modern technological employment field. With English as the working language, you are ready to start an international career and help shape the future.

# MASTER OF SCIENCE IN CHEMICAL AND MATERIALS ENGINEERING

## INTEGRATION OF PROCESS TECHNOLOGY AND MATERIALS

This master's programme aims to train students to become engineers who shape the transition towards a sustainable society, in fields such as the petrochemical and materials industry, pharmaceutical industry, food industry, biotechnology, advanced materials processing, and the recycling industry. The master's programme encompasses two distinct profiles: 'Process Technology' and 'Materials'. In the 'Process Technology' profile, the student is trained in the sustainable design and operation of productions units and the unit operations involved, for jobs in chemical industry, consultant engineering firms, and the environmental sector. The 'Materials' profile prepares its graduates for designing, analysing and selecting novel and sustainable materials and their processing methods, for jobs in research and development, material processing, or application environments. The master's programme has a common core of 56 ECTS, ensuring strong mutual interaction and integration between both profiles. The development of environmentally friendly and safe production processes for sustainable materials, the shaping and processing of materials into intermediate or finished products, and the optimal integration of materials in other disciplines are strongly related to the optimisation of environmentally friendly chemical processes in general.

## COMBINE SCIENTIFIC AND TECHNOLOGICAL SKILLS

Scientific and technological efficiency is key in the Master of Science in Chemical and Materials Engineering. It is an academic programme, which implies a close link with scientific research in the related fields. The programme offers a balance between scientific and technological knowledge, skills that are useful for both industrial and scientific careers. And the programme provides you with plenty of other skills, from management techniques, to communication and social skills. In all situations, we foster independence, creativity, inventiveness and critical thinking. These skills will help you shape the technology of tomorrow.

## EXPERTS FROM BOTH WORLDS

The programme of 'Chemical and Materials Engineering' is a Bruface collaboration between the two largest education institutes of engineering in Brussels: the Vrije Universiteit Brussel and the Université libre de Bruxelles. Together, we offer you the best of both worlds: a worlds: a high-level education in a fully English-taught master programme, by highly qualified academic staff with a large international network, state-of-the-art research facilities, and all of this in an internationally oriented city. And on top of that, you will receive a joint diploma from VUB and ULB.

## INTERNSHIP

The programme offers the opportunity to put these skills into practice through a two- or three-month internship at the beginning of the second year. The internship gives you a good opportunity to be actively involved in the professional world and gain engineering competences in real-life situations. You can take on an internship in a company in or outside Belgium, or in a laboratory or research institute outside Belgium. And what's more, your master's thesis can be carried out with the company, lab or research institute you are working at.

## ENTREPRENEURSHIP

You can take up entrepreneurship-related courses, which are complementary to your education. During these courses, you will be introduced to business and economics, frameworks and tools for general management, human resource management, communication and teambuilding, marketing, and accounting. In short, everything a student with a nose for business initiatives needs.

## STUDY ABROAD: MOBILITY WINDOW

Fancy an international career? This mobility window offers extra freedom and flexibility to tune the content of your curriculum with additional courses and research projects without delaying your study. It also gives you the chance to work with experts from other universities for your thesis research. Our collaboration with T.I.M.E. (Top Industrial Managers for Europe), a network of engineering schools and universities in Europe, gives you the opportunity to study abroad. There are possible destinations inside and outside Europe, including Japan, China and Australia. Broaden your horizons personally as well as professionally, and graduate with a degree from both VUB and ULB, and the hosting institution.

# PROGRAMME

| Master year 1 | ECTS |
|---|---|
| **Common core I: 41 ECTS** | |
| Molecular structural characterization and analysis | 5 |
| Electrochemistry | 4 |
| Parameter Estimation and Modelling | 5 |
| Microstructural design and characterization of inorganic materials | 6 |
| Surface treatment: Processing and Analysis | 4 |
| Organic Chemistry: Reactions and Mechanisms | 4 |
| Polymer Materials | 6 |
| Unit operations | 7 |
| **Project: 5 ECTS** | |
| **Profile Materials I: 14 ECTS** | |
| Ceramics | 4 |
| Mechanics of Materials | 3 |
| Production of Metals | 3 |
| Advanced Materials | 4 |
| **Profile Process Technology I: 14 ECTS** | |
| Sustainable Chemical Processes | 4 |
| Modelling and Design of Multiphase Systems and Reactors | 6 |
| Heterogeneous Catalysis | 4 |
| **Total** | **60** |

## Materials

The 'Materials' profile thoroughly prepares you for a job in the materials technology sector of metals, polymers, ceramics and composites. You will be trained to become a creative engineer, capable of designing sustainable and multi-functional materials for future and high-tech applications in civil, mechanical, and biomedical engineering fields. You will also develop skills to engineer intermediate or finished products with these materials, using environmentally friendly and safe production processes.

| Master year 2 | ECTS |
|---|---|
| **Common core II: 10 ECTS** | |
| Environmental Technology | 3 |
| Biotechnology | 3 |
| Reliability and risk analysis of industrial installations | 4 |
| **Profile Materials II: 13 ECTS** | |
| Forming of Metals | 4 |
| Polymers: Rheology and Processing | 4 |
| Sustainability of Materials | 5 |
| **Profile Process Technology II: 13 ECTS** | |
| Design of Chemical Plants | 5 |
| Simulation and Design Tools | 4 |
| (Bio)Chemical Process Design and Control | 4 |
| **Profile Process Technology II: elective course of 3 ECTS** | |
| **Options: 10 ECTS** | |
| Option 1: Internship | |
| Option 2: Elective courses | |
| Option 3: Entrepreneurship | |
| **Master's thesis: 24 ECTS** | |
| **Total** | **60** |

Students must select one profile: Profile 'Materials', Profile 'Process Technology' and one option.

The programme is subject to change. Check **www.vub.be/en/chemical-and-materials-engineering** for the latest information about the programme.

## Process Technology

The 'Process Technology' profile prepares you to become an engineer who can be employed to design and manage production units (operation and optimisation of production facilities) in chemical and environmental industries. Alternatively, you could work in an engineering group, where you would develop new sustainable production processes that meet performance specifications. The profile mainly focuses on the chemical industry, but also connects with biotechnology and the food industry. You will be trained in identifying opportunities and finding solutions for making processes more sustainable and for preventing environmental problems.

**ECTS** - ECTS is the standardised method for transferring study credits in Europe. At the Vrije Universiteit Brussel, each ECTS credit equals one study point (SP). One ECTS credit represents approximately 25 to 30 hours of educational, learning, and evaluation activities.

# STUDY IN BRUSSELS

## STUDY AT THE HEART OF THE EU

Brussels appeals to a lot of international students, and each year about 70.000 students seek higher education here. This should not come as a surprise.

Belgian education is internationally renowned for its high standard, and Brussels is a multicultural cosmopolitan city. It is a hub for cultural activities with numerous international institutions, companies and embassies. Brussels is the sixth leading European business city, according to property consultants 'Cushman & Wakefield'. This means studying Chemical and Materials Engineering at VUB opens up a world of opportunities for your career.

The short travel times by high-speed train to cities like Amsterdam (2h) or London (2h) or Paris (1h30) place Brussels at the heart of Europe. There is no better location for you to study and start your career.

## BRUFACE: BEST OF BOTH INSTITUTIONS

Bruface, short for Brussels Faculty of Engineering, is a cooperation of the Vrije Universiteit Brussel (VUB) and Université libre de Bruxelles (ULB). The two universities in the city of Brussels join forces to offer English-taught programmes in the field of engineering.

Bruface offers you the opportunity to study in an international context and to make use of the best facilities of both universities. But most of all, this cooperation allows for expertise of both universities to be at your disposal.

High-level education is within reach, at a reasonable tuition fee. At the end of the programme, you even take home a joint degree from VUB and ULB.

For more information, please visit **www.bruface.eu**.

## NUMEROUS FIELDS OF EXPERTISE

Expertise from VUB and ULB is gathered to offer you the best education and research possibilities. Therefore, a broad variety of fields of research is at your feet. Our research groups boast a large portfolio with Belgian, European and international projects.

On the materials side, our research groups work on, among others, sustainable materials like biobased and self-healing polymers or non-traditional cements; solid-state batteries for renewable energy storage; novel processing methods like the additive manufacturing of metals, polymers and even concrete; materials' degradation monitoring as well as prediction and corrosion protection; and least but not least on high technology glasses and ceramics.

On the processing technology side, topics range from research on transport processes in cell membranes and fundamental studies on the behaviour of fluids, over the development of highly advanced (bio)analytical separation methods, microfluidics and microreactor technology; to the development of sustainable chemical processes for the production of renewable chemicals or $CO_2$ capture and conversion, or for the food processing industry.

In both fields, the research is supported by a strong activity in numerical modelling, going from the level of molecular interactions, to the simulation of large-scale reactors and processes.

These research topics are closely related to the needs of the industry such as automotive and aerospace, 'green' energy and chemical process industry and biomedical materials or devices, answering the call for a sustainable engineering future with a high societal, environmental and economic impact on a global scale.

## SOME RECENT SUCCESS STORIES THAT STARTED IN OUR LABORATORIES

### SPIN-OFF COMPANY: PHARMAFLUIDICS

PharmaFluidics is a spin-off of the Chemical Engineering Department developing a novel technology to perform liquid chromatography separations, an analytical separation technology with an annual multi-billion dollar turnover. After decades of incremental improvement, this technology is reaching its limits. PharmaFluidics' pillar array chromatography introduces a paradigm shift by fundamentally rethinking the type of stationary phase used to achieve separations by introducing perfect order.

### SPIN-OFF COMPANY: ZENSOR

Having a background in combining material science and advanced sensing techniques, Zensor offers end-to-end monitoring solutions for the state-of-health of industrial production assets and large civil infrastructure. By including advanced data science in the mix of its products, Zensor helps asset owners to predict when preventive maintenance is needed and to estimate the remaining operational life.

30 students in master year 1

Fully English-taught programme

Joint degree from 2 universities

## ADMISSION CRITERIA AND LANGUAGE REQUIREMENTS

Applicants for our master's programmes must meet certain academic requirements and demonstrate personal motivation. Specific requirements can be found on each programme's page. For more information on general requirements, please visit our website: www.vub.be/en/admission-language-requirements.

## APPLICATION DEADLINE

We strongly encourage candidates to register early, even if they do not yet meet certain admission requirements, such as obtaining a particular diploma. Please see our website for the exact deadlines: www.vub.be/en/application-deadline.

## TUITION FEES

VUB offers subsidised tuition fees for most master's programmes. Fees for non-EEA students may be higher. For the exact amounts and to calculate your tuition fees, see our website: www.vub.be/en/study-costs.

## MORE INFORMATION

Scan the QR code below for more details about this specific programme. For further inquiries, please contact us via secretariaat.ingenieurswetenschappen@vub.be or www.vub.be/contact.

www.vub.be/en/chemical-and-materials-engineering

## JOINT PROGRAMME WITH

ULB

VUB VRIJE UNIVERSITEIT BRUSSEL

9 780201 380088