The chemical industry plays an important economic role in Belgium, representing more than 20% of the gross national product. High-level scientific research in conventional and frontier areas of chemical and biochemical engineering as well as in-depth education and training of chemical engineers are required in order to maintain this capacity and to introduce the necessary innovations in a changing socioeconomic context. The Department of Chemical Engineering guarantees the highest quality for both of these points.

To this end, numerous industrial collaborations exist and an industrial advisory board, consisting of CEOs of leading chemical companies, provides valuable feedback on the department’s strategic decisions.

The international dimension of the department is strengthened by a multitude of longstanding international collaborations, by the English-language Chemical Engineering master program and by a very international staff. The latter not only attracts international scholars, but also enables exchanges and even dual degrees with prestigious universities in Europe (e.g. Nancy, Aachen) and North America (e.g. Delaware, Montréal).

http://onderwijsaanbod.kuleuven.be/opleidingen/e/CQ_51370025.htm

In order to meet changing industrial demands and to follow major new developments in the field of process and occupational safety, the advanced academic program on Safety Engineering was conceived. This master is a joint initiative of the KU Leuven (with the Chemical Engineering department taking the lead) and essenscia (the Belgian umbrella organization of companies that are active in the field of chemistry and life sciences).

http://onderwijsaanbod.kuleuven.be/opleidingen/e/CQ_5026684.htm

Research Profile

In general terms, chemical technology deals with the transformation of matter. It delivers a major contribution to the quality of life at various levels. The Chemical Engineering Department has chosen to develop strong research groups in trending areas that have a large potential for impacting the future of (bio)chemical engineering and technology.

Safe (bio)chemical reactor engineering and human health.
In its (bio)reactor engineering research, the department gets the best out of nature by focussing on three main application areas, i.e., biological wastewater treatment, industrial biotechnology and chemical engineering for human health. Indeed, micro-organisms are exploited to convert waste(water) into high value molecules and building blocks are extracted to create new products for health care. These production processes are optimized, preferably model based, and with their safety always in mind.

Chemical product design of soft matter
Creation of added value lies in the final stages of product design. Chemical engineers are well equipped to rationally design products that are more stable and have well-controlled properties and functionalities, for example, in the area of nanomaterials and renewables, food, pharmaceuticals, etc.

Sustainability and innovation in chemical process engineering
Improvement of conventional processes is achieved by using hybrid or multifunctional technologies, miniaturized continuous-flow equipment, and novel energy sources leading to devices and flow sheets with reduced raw material and energy consumption. These improvements
aim to increase more resource efficiency, intrinsic safety, and process intensification.

**Keywords**

**Process engineering**
- (bio)reactor (process) engineering and model-based control
- process identification and estimation
- transport phenomena
- membrane & other separation technologies
- ultrasound, light, microwaves and plasma
- microstructured reactors
- electrochemistry
- safety, risk analysis, loss prevention
- industrial biotechnology
- process intensification
- biological wastewater treatment
- resource recovery and recycling
- biopharmaceuticals
- tissue engineering
- cell factories
- bioactive substances

**Product engineering**
- chemical product design
- (bio)polymer technology
- polymer processing and recycling
- nanotechnology
- interface design
- colloid technology
- coating technology
- rheology and tribology
- nanoparticle self-assembly and structures
- renewable materials design
- 3D printing
- biomaterials
- biosensors
- biofabrication

**Divisions**

The above mentioned research lines are covered by the five divisions of the department.
- (Bio)Chemical Reactor Engineering and Safety (CREaS)
- Soft Matter, Rheology and Technology (SMaRT)
- Process Engineering for Sustainable Systems (ProcESS)
- Renewable Materials and Nanotechnology Research Group, Campus Kulak Kortrijk
- Sustainable Chemical Process Technology Cluster

**Unique Infrastructure**

**Process engineering**
- parallel (membrane) bioreactor and activated sludge systems (aerobic and anaerobic)
- filterability and respirometry set-ups
- ultrafiltration – nanofiltration – reverse osmosis – pervaporation
- (s)electrodialysis – membrane distillation and membrane crystallization equipment
- sono-, photo- microwave and plasma reactors
- micro- and millistructured flow reactors
- autoclave reactors for solid-liquid processes
- galvanic line
- chemical analysis for inorganic (ICP-MS and -OES, IC, (MP-)AES) and organic (GC-MS, FID, -ECD and -NTD), HPLC, TOC-TN, LC-MS, AOX, FTIR) compounds including wastewater analysis
- inverted fluorescence microscopy equipped with camera and tailor made image analysis software
- high-speed imaging, particle image velocimetry (PIV), laser-induced fluorescence (LIF)
- solids analysis: BET, laser diffraction analysis (LDA)
- public and other modeling software: multiphysics modeling software (COMSOL Multiphysics® Modeling), geochemical models, chemical process optimization software (Aspen Plus)

**Product engineering**
- rotational, elongational and capillary rheological devices to characterize flow behavior of structural liquids from water-like to highly viscous materials
- 2D rheological devices to study interfacial dynamics
- rheo-optical equipment to characterize micro-structures during flow using confocal and traditional microscopy, birefringence, dichroism and SALS
- polymer, dispersion and nanomaterial processing equipment
- special devices: rheo-DSC, electrosprinning, counter rotating and microgap rheometers, tribo-rheometry, isotothermal titration calorimetry and rheo-dielectrics
- elementary analysis
- dynamic light scattering and zeta potential measurements
- coupled GPC and multi-angle light static light scattering (MALS)

**Industrial Collaborations**


**Figures**

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
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<td>Professors</td>
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(figures October 2017)