NTNU

Knowledge for a better world

Department of Chemical Engineering

- Sustainable Process Solutions

Department’s Vision and Strategy

Illustration by Ida Kristine Kure

- A national premise provider and scientific supporter of the development of energy efficient and sustainable process technology
- A national leader within Chemical Engineering - our best researchers are internationally leading in their fields of expertise
- Primary responsibility for research-based education of master candidates in Chemical Engineering in Norway
- Characterized by a generous and inclusive organizational culture

Department of Chemical Engineering

- Located at the Gløshaugen campus at NTNU in Trondheim
- Approximately 150 employees
- Educating Master students and PhDs within research-based chemical engineering for the Norwegian and international industry and academia
- Performing fundamental and applied research from the atomic/molecular level to the process systems level

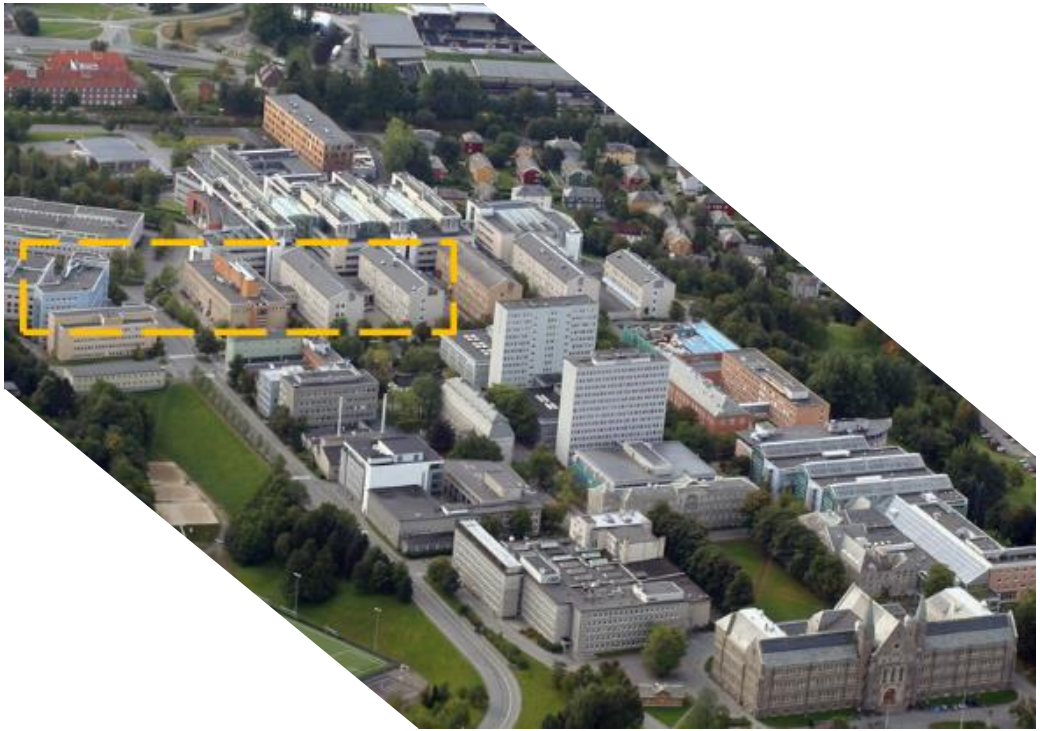
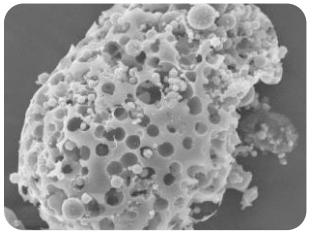


Photo: Lars Strømmen

From Lab Scale to Industrial Production

Molecules



Particles

Process Units

Process Plants

We contribute to development of sustainable process solutions that ensure good utilization of resources and protect the environment

Department Organization

Head of Department
Professor Jens-Petter Andreassen

Technical Coordinator
Gøril Flatberg

Head of Administration
Tom Helmersen

Deputy of Education
Professor Hanna Knuutila

Deputy of Research
Professor Jana Jakobsen

Catalysis (KinCat)
Professor Edd Anders Blekkan

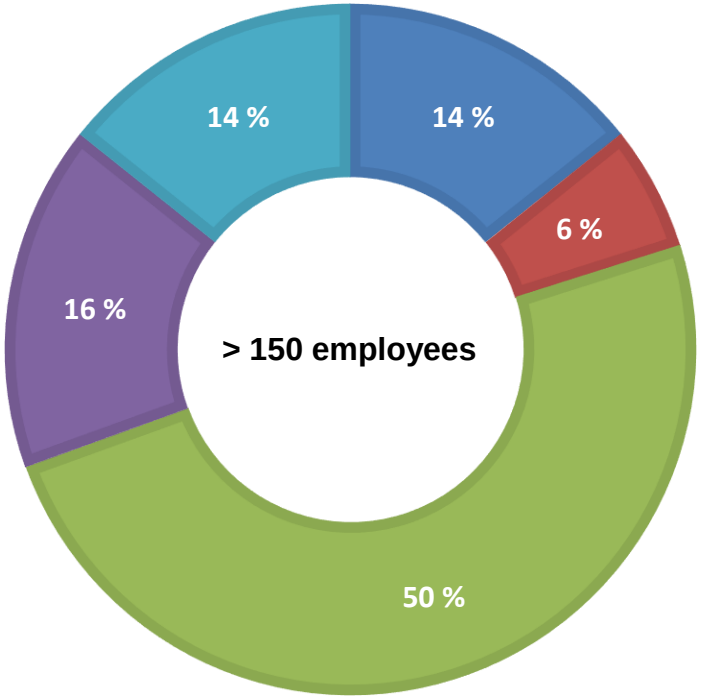
Colloid and Polymer Chemistry (Ugelstad Lab)
Professor Gisle Øye

Environmental Engineering and Reactor Technology
Professor Hugo Jakobsen

Process Systems Engineering
Professor Johannes Jäschke


> 150 employees from all over the world

Employee Overview



Education

The Department of Chemical Engineering graduate students with specialization in Chemical Engineering:

5-years master

MSc in Chemical Engineering and Biotechnology (MTKJ)
- specialization from 3rd year

2-years master

MSc in Sustainable Chemical and Biochemical Engineering (MSCHEMBI)

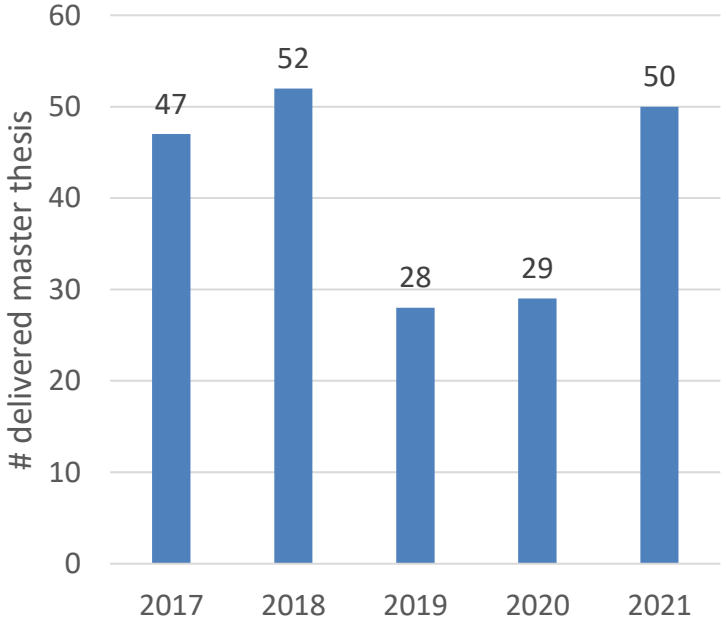
The department also teaches courses in the bachelor programs in Chemistry, Biotechnology and Material Sciences and a master program in Nano Technology

Photo: Per Henning

Number of Delivered Master Thesis

The Department of Chemical Engineering attracts well-qualified students, and our educated graduates are highly attractive in the job market.

Photo: Kim Ramberghaug



Master students from the Department of Chemical Engineering are highly attractive in the job market

Department of Chemical Engineering

- A national premise provider for the development of energy efficient and sustainable process technology

CO_2-CAPTURE

- Solvent-based absorption
- Membranes
- Adsorption

CLEAN HYDROGEN AND AMMONIA

- Blue and green hydrogen and ammonia production

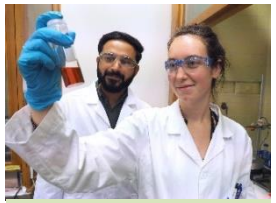
CIRCULAR CHEMICAL ENGINEERING

- Recirculation of batteries and plastics
- Conversion of waste
- Water treatment

BIOBASED PROCESS INDUSTRY

- Industrial biotechnology
- Bio-fuel production
- Bio-reactors

MEDICINE AND FOOD



- Nanomedicine
- System biology
- RAS systems
- Fertilizers

DIGITALIZATION AND OPTIMIZATION

- Energy efficiency
- Process optimization
- Digital twins and machine learning

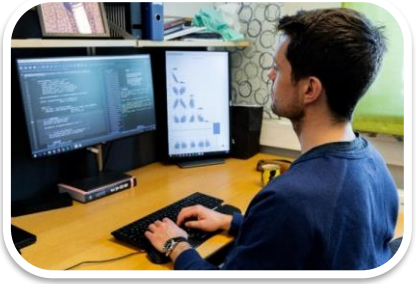
Our Research Groups

The Department of Chemical Engineering offers a wide variety of research.
Our strength lies in high international expertise, both in experiential and computational knowledge.

Catalysis

Colloid and
Polymer Chemistry
(Ugelstad Laboratory)

Environmental Engineering
and Reactor Technology



Process Systems
Engineering

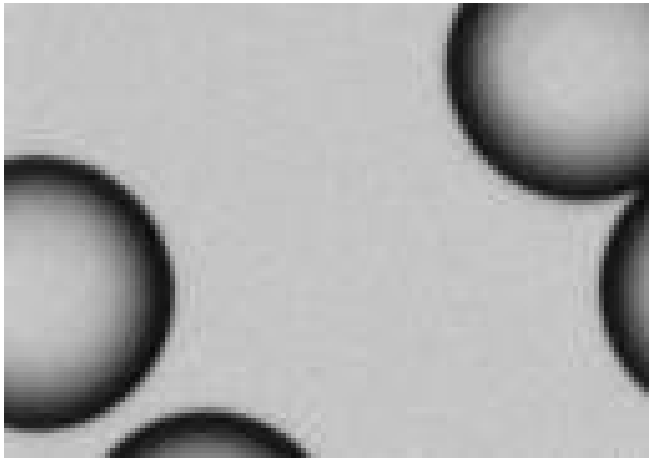
Catalysis (KinCat)

Photo: Per Henning

- Group leader: Professor Edd A. Blekkan
- The Catalysis group is focused on research on catalysis, reaction kinetics and related subjects
- Research areas:
  - Industrial Catalysis
  - Environmental Catalysis
  - Biofuels
  - Gas Cleaning
  - Materials Development
  - Fundamental Studies in Heterogeneous Catalysis
  - Micro-structured Reactors and Membrane Reactors
  - Production and Application of Carbon Nanomaterials, Carbon Nanofibers, Nanotubes and Graphene
  - Photocatalysis
  - Refinery Operations and Natural Gas Conversion

Colloid and Polymer Chemistry - Ugelstad Lab

- Group leader: Professor Gisle Øye
- The Ugelstad Laboratory carry out research in the field of surface, colloid and polymer chemistry – combined with chemical engineering
- Areas of expertise:
  - Interfacial engineering;
    - Complex interfaces and dispersion stability
    - Complex interfaces and flow in porous media
  - Microfluidics
  - Rheology



Coalescence of two oil droplets filmed in Microfluidic setup
Video: Marcin Dudek

Environmental Engineering and Reactor Technology

Photo: Geir Mogen

- Group leader: Professor Hugo A. Jakobsen
- The Environmental Engineering and Reactor Technology Group works with:
  - experimental and theoretical analysis of separator and reactor performance
  - heat and mass transfer
  - modelling of physical processes
  - numerical methods and statistics
  - bubble, drop and particle size distributions
  - particle design and crystallization
  - thermodynamics and transport phenomena
  - techno-economical evaluations
- These concepts are used for design of process units, as well as total chemical and bio-chemical process plants

Process Systems Engineering

- Group leader: Professor Johannes Jäschke
- The Process Systems Engineering group focuses on overall process system behavior and how to combine individual process units to achieve optimal overall performance
- Important research topics:
  - process operation and control
  - multi-scale process modelling
  - process design and simulation
  - statistics and optimization
  - systems biology and bioinformatics

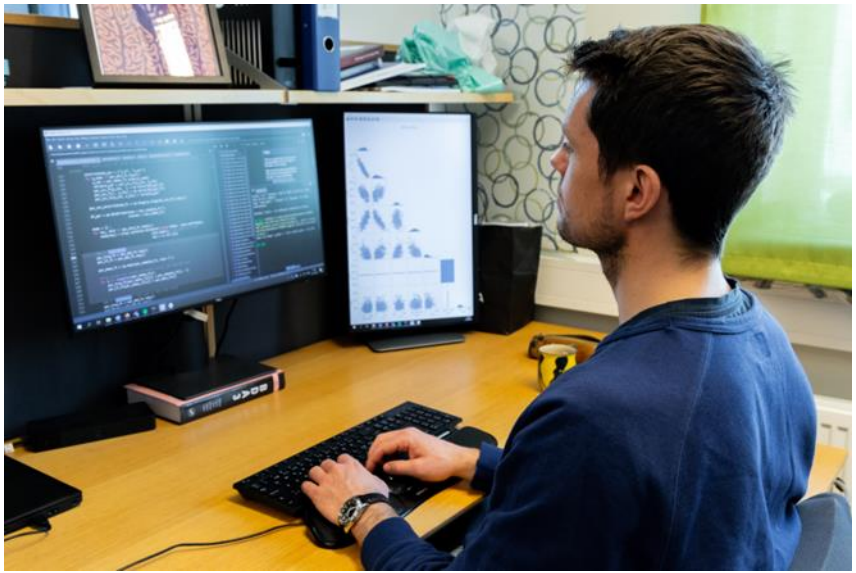


Photo: Jun Xing Li

Centers for Environment-Friendly Energy Research

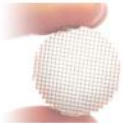
The Department of Chemical Engineering is partner in four Centers for Environment-friendly Energy Research / Senter for Miljøvennlig Energi (FME):

Bio4Fuels	HighEFF	HYDROGENi	NCCS
•Bio4fuels develops innovative technology to convert biomass and organic residues to sustainable fuels and energy	•HighEff will make Norwegian industry the world's greenest through development and demonstration of technologies that may improve energy efficiency and reduce emissions from the industry	•HYDROGENi is dedicated to the research and innovations within hydrogen and ammonia needed to meet the 2030 and 2050 goals of the Norwegian hydrogen road map	•NCCS will enable fast-track CCS deployment through industry-driven science-based innovation, addressing the major barriers identified within demonstration and industry projects

Centers for Research-based Innovation

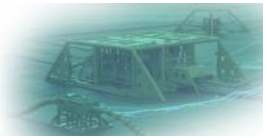
Centre for Research-based Innovation
The Research Council of Norway

The Department of Chemical Engineering is host for two Centers for Research-based Innovation / Senter for Forskningsdrevet Innovasjon (SFI) and is partner in one:



iCSI

SUBPRO



SFI
Industriell bioteknologi
Industrial biotechnology

iCSI industrial Catalysis Science and Innovation	SUBPRO Subsea Production and Processing	Industrial Biotechnology
•The main objective of iCSI is to boost industrial innovation and competitiveness within industrial catalysis science, as well as to provide efficient, low-emission process technology	•The primary objective of SUBPRO is to be an international leading subsea research center that provides top quality candidates, knowledge and technology innovation	•The center will contribute to increased competitiveness of Norwegian Biotech based industry and new innovations with national and international market potential

Ongoing H2020 Projects

IKP is coordinating two Horizon 2020 projects:

- **iFermenter**: recover high value compounds from sugar residuals, and to turn fermentation processes converting these residual to antimicrobials cost effective
- **MESOSI-CO2**: design a Ni-based mesoporous silica resistant to sintering

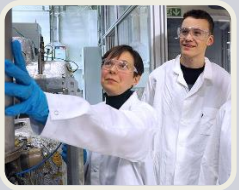
https://ec.europa.eu/programmes/horizon2020/en

IKP is a partner in several Horizon 2020 projects:

- **BIKE**: research and training network for the next generation of bimetallic catalysts for energy management.
- **ECCSELERATE** / ECCSEL ERIC: accelerating user access, growing the membership and positioning internationally to ensure long-term sustainability
- **GEOPRO**: produce a set of integrated knowledge-based design and operation tools for the geothermal industry
- **MARKETPLACE**: central-hub for materials modelling related activities in Europe
- **REALISE**: demonstrating a Refinery-Adapted Cluster-Integrated Strategy to enable Full-Chain CCUS Implementation
- **ALBATROSS**: advanced light-weight battery systems optimized for fast charging, safety, and second-life applications
- **EHLCATHOL**: chemical transformation of enzymatic hydrolysis lignin (EHL) with catalytic solvolysis to fuel commodities under mild conditions
- **OPTIMAL**: smart and CO2 neutral olefin production by artificial intelligence and machine learning
- **VIPCOAT**: Virtual Open Innovation Platform for Active Protective Coatings Guided by Modelling and Optimization

Gemini Centers and Other Strategic Initiatives

The Department of Chemical Engineering is partner in three Gemini Centers:



CO_2 Impact

CO_2 capture with absorption

HyPros

Hydro-chemical process technology in the circular economy

KinCat

Kinetics and catalysis

The Department of Chemical Engineering has established several strategic initiatives:

Innovation Hub for Chemical Conversion of Waste

Particle Engineering Centre

Particle Engineering Core Facility

NTNU Energy

NTNU Energy is one of the four strategic research areas at NTNU.

The Dept. of Chemical Engineering is heading one of NTNU's Energy Teams and are involved in two:

Photo: Per Henning

- Team Carbon Capture, Utilisation and Storage
- Team Hydrogen
- Team Battery

Close Cooperation with the Industry

At the Department of Chemical Engineering, we work closely with the Norwegian and international process industry, and research organizations such as SINTEF and RISE PFI

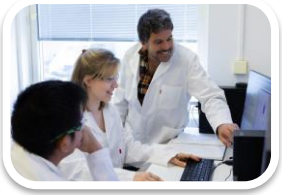
Laboratory Infrastructure

The Department of Chemical Engineering has a modern and well-run laboratory infrastructure, supported by a group of highly competent and dedicated technical staff. Some examples:


Nanoparticles


Microfluidic


Membranes


Bio-reactors


Catalysis


CO2 Pilot

FROM LAB BENCH TO INDUSTRIAL PILOTS

HSE at IKP

- Well organized and on the frontline of HSE-work
- Focus on safety and risk assessment
- Standardized HSE education for all employees and guests
- HSE training and laboratory access are intertwined

Photo: Per Henning

The Department of Chemical Engineering contributes to innovation and development of sustainable process solutions, that protect the environment and assures sound use of resources, in line with UN’s Sustainability Development Goals

NTNU

Knowledge for a better world

Thank you!

Our webpage: