

Overview of activities at Chalmers

Teodora Retegan Vollmer, Christophe Demaziere and Mattias Thuvander

SKC Meeting, October 13, 2026, Uppsala

Overview of research groups at Chalmers

- Activities of interest to SKC carried out at three units at Chalmers:
 - The **Nuclear Chemistry group**, Division of Energy and Materials (Department of Chemistry and Chemical Engineering)
 - The **Division of Microstructure Physics** (Department of Physics and Astronomy)
 - The **Division of Subatomic, High Energy, and Plasma Physics** (Department of Physics and Astronomy)



Nuclear Chemistry and Industrial Materials Recycling

Teodora Retegan Vollmer, Christian Ekberg

tretegan@chalmers.se

che@chalmers.se

Nuclear Chemistry today

- 2 Professors
- 1 Senior Researcher
- 6 PhD students + 2 more on the way

Membership

SAINT (Swedish Competence Center)

ANITA (Swedish Competence Center)

ENEN (founding member, Chalmers)

FALCON Consortium (ALFRED demonstrator)

SNETP ...

Teaching

- Nuclear Chemistry (1 lecture BSc)
- Nuclear Chemistry course 7.5 p (MSc)
- Applied Nuclear Chemistry 7.5 (PhD)
- Actinide, Lanthanide and Superheavy Elements 7.5 p (PhD)
- Solvent Extraction 7.5 p (PhD)
- Radiopharmacy 7.5 p (PhD)

Laboratories

Alpha, gamma and low active laboratories

Nuclear Fuel research Laboratory

Chemistry laboratories



Nuclear Chemistry Research

Generation IV and II

Safety

Fuel manufacturing

Separation for
transmutation

Fuel/coolant/cladding
interactions

Accidents

Iodine
chemistry

Ruthenium
chemistry

Other scenarios

Repositories

Used fuel
leaching

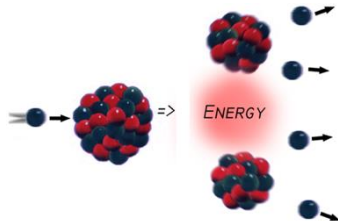
Sorption

Ra chemistry

Medicine

Cancer therapy

Implant-body
interactions



Leaching

Separation

Organic synthesis

Chemistry of
complexes

Thermodynamics

Material analysis

On-going Projects and Research funding

- Majority of projects EURATOM/EU funded; 2 VR projects ; Energimyndigheten; SSF; SSM; SKB; SKC; AoA CHALMERS

The newest projects:

- MÅSTE (EM, coordinates)
- TRANSPARANT (EU)
- SOCRATES (EU)
- FREDMANS (EU, coordinates)
- ANiTA projects
- ✓ LESTO Project (EU)
- ✓ SKILLS4NUCLEAR (EU, coordinates)
- ✓ ENEN2+ (EU)

Teaching/Training Nuclear Chemistry - at EU Level



SKILLS4NUCLEAR: <https://www.skills4nuclear.eu/>



- ✓ The Skills4Nuclear projects will develop a long-term collaborative framework to address skills and workforce shortages across the nuclear sector, both fission & fusion.
- ✓ It will bring together partners from industry and research as well as education & training (E&T) organisations. Over three years (March 2025 - March 2028) S4N will create a European Forum for Nuclear Workforce and Skills to monitor workforce needs
- ✓ Ensure alignment between E&T and the needs of the industry (including the latest technology developments)
- ✓ Develop a Nuclear Skills Strategy to attract, retain, reskill and upskill workers in nuclear field.

info@skills4nuclear.eu

Nuclear Materials

Nuclear Materials Research

- Division of Microstructure Physics (Department of Physics and Astronomy)
- Staff: Prof. Mattias Thuvander
4 PhD Students + 1 Post-Doc
- Areas
 - Cladding tubes
 - Coatings for ATF
 - Additive manufacturing
 - Gen-IV materials
- Topics
 - Irradiation damage
 - Corrosion
 - Thermal aging
- Methods
 - APT
 - Electron microscopy

Ongoing NM Projects

- MÅSTE (led by Christian Ekberg, Chalmers) – Energy Agency
 - Materials for Gen-IV reactors – 1 PhD student
- AMTVINE (led by Caroline Pettersson, RISE) – Energy Agency
 - Additive manufacturing + coated claddings – 1 PhD student
- FurCoat (led by Magnus Odén, Linköping) – Energy Agency
 - Coated Zr claddings – 1 PhD student
- Coated Claddings – SKC
 - Coated Zr claddings – 1 PhD student
- NuMaP (led by Pär Olsson, KTH) – Energy Agency
 - Irradiation of materials – 1 Post-doc
- ANITA (led by Sophie Grape, UU) - Energy Agency
 - AM/Cladding - 1 PhD student to be recruited
- SURF (led by Kristina Lindgren, RISE) - SSM
 - Stress corrosion crack initiation in AM316L
- DIWER - NKS
 - Dissimilar welds

RESEARCH AND TEACHING ACTIVITIES IN REACTOR PHYSICS, MODELLING AND SAFETY

Prof. Christophe Demazière
demaz@chalmers.se

Division of Subatomic, High Energy and Plasma Physics
Department of Physics and Astronomy



**TASK FORCE ON
DETERMINISTIC REACTOR MODELLING**

Staff

- **Safeguards and core diagnostics:**

- Assoc. Prof Paolo Vinai, Em. Prof. Imre Pázsit, 1 new PhD student under recruitment
- Financing: SSM

- **Computational nuclear reactor physics (aka DREAM):**

- Prof. Christophe Demazière, Assoc. Prof. Paolo Vinai, 4 PhD students, 1 new Post-Doc under recruitment
- Financing: EU, SSM, SKC, VR, Energimyndigheten, Chalmers Energy Area Of Advance

On-going research projects

- **XEROM** – Reduced order modelling for the analysis of xenon oscillations in PWRs (SSM/SKC financing – 1 PhD student)
- **NOISE-SMR** – Neutron noise-based core monitoring for Small Modular Reactors (Energimyndigheten financing via ANItA – 1 PhD student)
- **NOISE-EQUI** – Equivalence for neutron noise calculations (SSM financing – 1 PhD)
- **NOISE-Gen-IV** – Neutron noise-based core monitoring in fast Gen-IV systems (Energimyndigheten financing – 1 PhD student)

On-going research projects

- **ENEN2+** – EU project on nuclear education and training (EU financing)
- **GRE@T-PIONEER Alliance** – Advanced courses in computational and experimental reactor physics and safety (SSM financing + Chalmers Energy Area Of Advance financing + ERASMUS+ Blended Intensive Programs)

New research projects

- **Neutron noise monitoring in SMRs** – project on the extension of the ANItA1 project on core monitoring to industrial applications (Energimyndigheten financing via ANItA2 – 1 Post-Doc student to be recruited)
- **Safeguards** – project on the detection of missing fuel pins via Machine Learning (SSM financing – 1 PhD student to be recruited)

Education

Commissioned
education

Advanced education

MSc education

Open Educational
Resources (OER)

- Courses on “Deterministic modelling of nuclear reactor multi-physics” (3 parts)

- 9 courses as part of **GRE@T-
PIONEER** 

- Course on “Computational continuum physics”
- Guest lectures on nuclear energy in other courses
- TRACKS courses on “Nuclear reactor technology – Past, present and future) and “Nuclear power safety”

- Course “Introduction to nuclear engineering” on Chalmers web and Learnify

Education

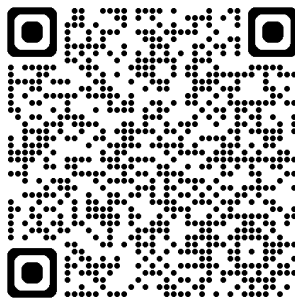
- TRACKS course “**Nuclear reactor technology – Past, present and future**”:
 - **New course** of **7.5 ECTS** launched in the academic year 24/25
 - **Flipped course** that can be attended entirely online (all activities developed for **hybrid learning**)
 - **In the academic year 26/27, 18 students**: 1 Chalmers BSc student, 8 Chalmers MSc students + 1 Chalmers MSc student (remote), 1 Chalmers PhD student, 6 Chalmers Alumna, 1 MSc student from Lund (remote)
 - **Interactive sessions of 4 hours** offered every week between September and December (complemented by **online self-paced studies**)
 - A few highlights:
 - **Field trip** to Änggårdsbergen
 - Use of **CASMO-4/SIMULATE-3** for reactor physics-based calculations
 - **Hybrid laboratory exercises** on the **VR-1 Training Reactor at the Czech Technical University**, Prague, Czech Republic
 - Interactive workshop on **nuclear power safety** with **AFRY**
 - Interactive workshop on the **integration of nuclear power in future energy scenarios** with **Vattenfall**

Education

- Course “Nuclear Power Safety”
- Advanced level – 7.5 hp
- Open to MSc Chalmers students, Chalmers employees, Chalmers Alumni and professionals in Sweden
- Onsite course only
- Given over two lecturing periods (spring) – started in the academic year 2024/2025

Education

- Course “**Introduction to nuclear engineering**” on Chalmers web and Learnify:
 - **Free of charge**
 - **Self-paced**
 - Targeting **professionals/individuals** looking for a basic course in **nuclear engineering**
 - **Certificate** of completion issued
 - Course advertised on <https://learning4professionals.se>
 - Since launch in October 2024:
 - 1325 persons registered
 - 156 persons obtained a certificate
 - Participants’ overall impression: 4.6 (1 = very bad – 5 = very good)



CHALMERS
Open Online Courses for Professionals

Login

Search

Refine

Browse Listings



Elbilar - Introduktionskurs för kommuner

Skall du börja använda elbil? Eller kanske jobbar du med att välja fordon och planera för hur de skall användas? Då är den här kursen för dig! Syftet med denna kurs är underlätta för dig som berörs av övergången till elfordon.

CHALMERS

Self-paced



Emissions from transportation

This online course will boost your ability to take an active role in discussions that involve emissions, the effects on climate and health and ways to bring about changes for a better future.

CHALMERS

Self-paced
FREE



Introduction to nuclear engineering

Do you want to know more about nuclear power and technology? Are you new to this area or do you want to refresh your knowledge in this field? Follow this self-paced course giving you an introduction to nuclear...

CHALMERS

Self-paced
FREE



Policies for Climate Action and Circular Economy

This online course introduces a portfolio of environmental policy instruments that you can strategically implement in your own practice. Topics in focus: climate change, circular economy, and the energy crisis.

CHALMERS

Started Dec 19, 2022
FREE

Education

Graduate Education Alliance for Teaching the Physics and Safety of Nuclear Reactors (funded by EU 2020-2024, SSM 2025-2028)

- 18 university teachers from 8 different universities in 6 different countries
- Advanced level – 1.5 - 3.0 hp/course
- Open to MSc, PhD, Post-Doc students in nuclear engineering and nuclear engineers
- Flipped hybrid course
- Given on 5 weeks (4 weeks self-paced + 1 interactive)
- 9 courses:
 - Nuclear cross-sections for neutron transport
 - Core modelling for transients
 - Hands-on exercises on the AKR-2/CROCUS/BME training reactor
 - Neutron transport at the fuel cell and assembly levels
 - Reactor transients, nuclear safety and uncertainty and sensitivity analysis
 - Radiation protection in nuclear environment
 - Core modelling for core design
- Course delivered via the Learning Management System SOUL from Westinghouse
- Since start in academic year 2022/2023: 657 certificates of successful completion issued

Education

- Fifth edition of the course “Deterministic modelling of nuclear reactor multi-physics”
- Offered via Chalmers Upskilling Academy as 3 separate modules
- Also part of the governmental initiative on “short courses for professionals in nuclear engineering”
- Course also offered to MSc/PhD/Post-Doc students
- 155 applicants to the course – 68 accepted applicants
- Course can be attended fully online, or as a combination of online and onsite activities
- Worldwide attendance
- Course running from beginning of October to beginning of February

Education



Energy & Sustainability, Physics & Nanotechnology

Part I – Deterministic modelling of nuclear fuel assemblies

Master nuclear fuel modeling: learn deterministic lattice methods, algorithms, assumptions, and limits through a flexible, expert-led 6-week course.

Duration 80 Hours

Location Online

[Read more & register](#)



Energy & Sustainability, Physics & Nanotechnology

Part II – Deterministic modelling of nuclear reactor cores

Master nuclear core calculations: learn deterministic core physics methods, algorithms, assumptions, and limits through a flexible, expert-led 6-week course.

Duration 80 Hours

Location Online

[Read more & register](#)



Energy & Sustainability, Physics & Nanotechnology

Part III – Deterministic multiphysics modelling hands-on

Nuclear reactor modelling spans complex physics and scales. Through this course, you will develop simulation solvers and algorithms for reactor systems via hands-on programming.

Duration 40 Hours

Location Hybrid

[Read more & register](#)

Education

- **Completely new offering of MSc programs to be launched in the fall of 2027**
- A **“radiation science and nuclear technology”** track will be offered in the following master programs
 - **Physics**
 - **(Chemistry and materials)**
- **Core courses:**
 - 22.5 hp {
 - Nuclear chemistry (SP2 – year 1)
 - Nuclear reactor technology – Past, present and future (SP3 – year 1)
 - Radiation safety (SP4 – year 1)
 - + master thesis project (30 hp)
 - + other elective courses in SP1+2 – year 2
- Course “Nuclear reactor technology – Past, present and future” also part of the specialization “Energy carriers engineering” within the Master program Energy Systems



CHALMERS
UNIVERSITY OF TECHNOLOGY