Overview of activities at Chalmers

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)
  - The **Division of Subatomic, High Energy, and Plasma Physics** (Department of Physics)

Nuclear Chemistry and Industrial Materials Recycling

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Nuclear Chemistry today

- ✓ 2 Professors
- ✓ 3 Assoc. Prof.
- ✓ 2 Adj Prof.
- ✓ 1 Senior Researcher
- ✓ 2 Post Doc(s) on the way
- ✓ 9 PhD students + 2 more on the way

Membership

SAINT (Swedish Competence Center)

ANITA (Swedish Competence Center)

ENEN (founder 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

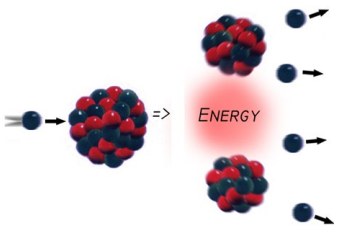
Sorption

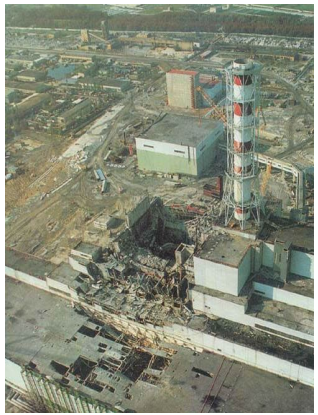
Ra chemistry

Medicine*

Cancer therapy

Implant-body interactions





Leaching

Separation

Organic synthesis

Chemistry of complexes

Thermodynamics

Material analysis

Teaching/Training Nuclear Chemistry - at EU Level

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

- ✓The SkillsNuclear 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 the next three years 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@skills4nucler.eu

Nuclear materials

Nuclear Materials Research

- Division of Microstructure Physics (Department of Physics)
  - Led by Mattias Thuvander (4 PhD students + 1 post-doc)
- Areas
  - Cladding tubes
  - Coatings for ATF
  - Reactor Pressure Vessel steels
  - Additive manufacturing
  - Gen-IV materials
- Topics
  - Irradiation damage
  - Corrosion
  - Thermal aging

RESEARCH AND TEACHING ACTIVITIES IN REACTOR PHYSICS, MODELLING AND SAFETY AT CHALMERS

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Division of Subatomic, High Energy and Plasma Physics at Chalmers
Department of Physics
Chalmers University of Technology

DREAM

TASK FORCE ON DETERMINISTIC REACTOR MODELLING

Staff

- **Safeguards and core diagnostics**:
  - Assoc. Prof Paolo Vinai, Em. Prof. Imre Pázsit, 1 Post-Doc student
  - Financing: SSM

- **Computational nuclear reactor physics (aka DREAM)**:
  - Prof. Christophe Demazière, Assoc. Prof. Paolo Vinai, 3 PhD students, 1 Post-Doc + 1 new PhD student starting in October
  - Financing: EU, SSM, SKC, VR, Energimyndigheten, Chalmers Energy Area Of Advance

Education

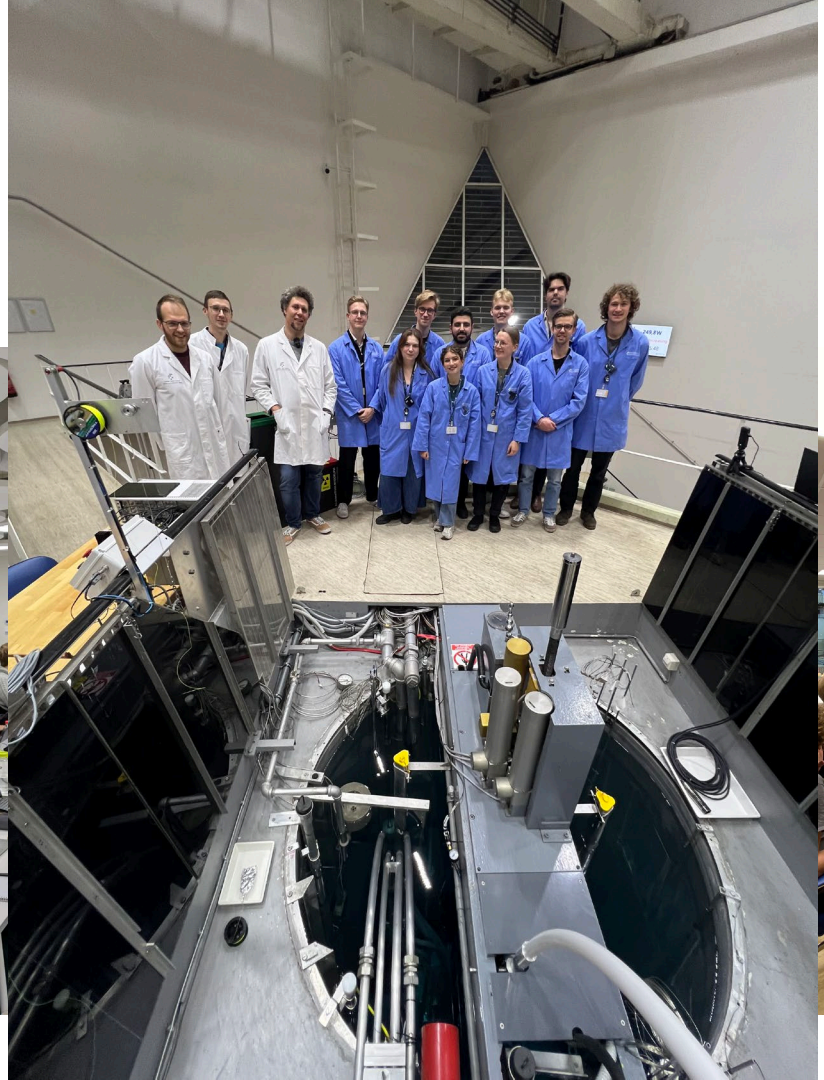
- Commissioned education
  - Course on “Modelling of nuclear reactor multi-physics”
- Advanced education
  - 9 courses as part of GRE@T-PIONEER
  - Course on “Computational continuum physics”
  - Guest lectures on nuclear energy in other courses
  - TRACKS courses on “Nuclear reactor technology – Past, present and future) and “Nuclear power safety”
- MSc education
  - TRACKS course on “Modern energy technologies and systems”
- BSc education
  - TRACKS courses
- Cross-disciplinary education
  - Course “Introduction to nuclear engineering” on Chalmers web and Learnify
- Open Educational Resources (OER)

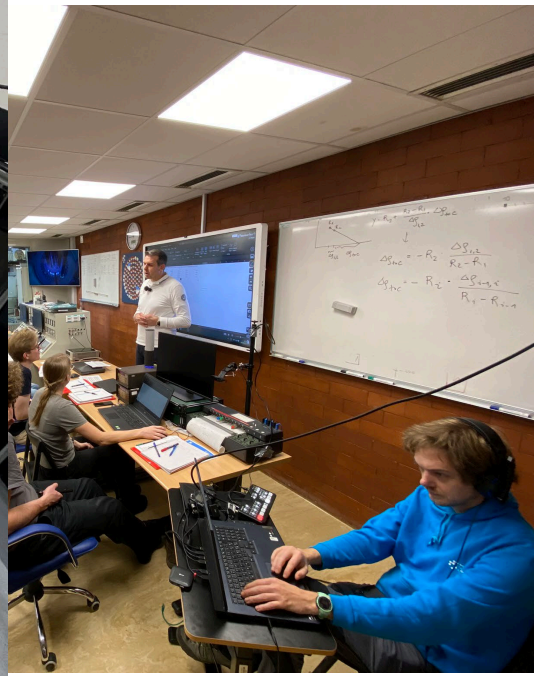
Education

- 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 25/26, 18 students**: 13 Chalmers MSc/(PhD) students, 1 Chalmers Alumna (remote), 2 students from Lund (remote), 1 student from Chalmers (remote), 1 professional from Norway (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 **Jožef Stefan Institute TRIGA reactor**, Ljubljana, Slovenia
    - Interactive workshop on **nuclear power safety** with **Afry**
    - Interactive workshop on the **integration of nuclear power in future energy scenarios** with **Vattenfall**

Education

Education

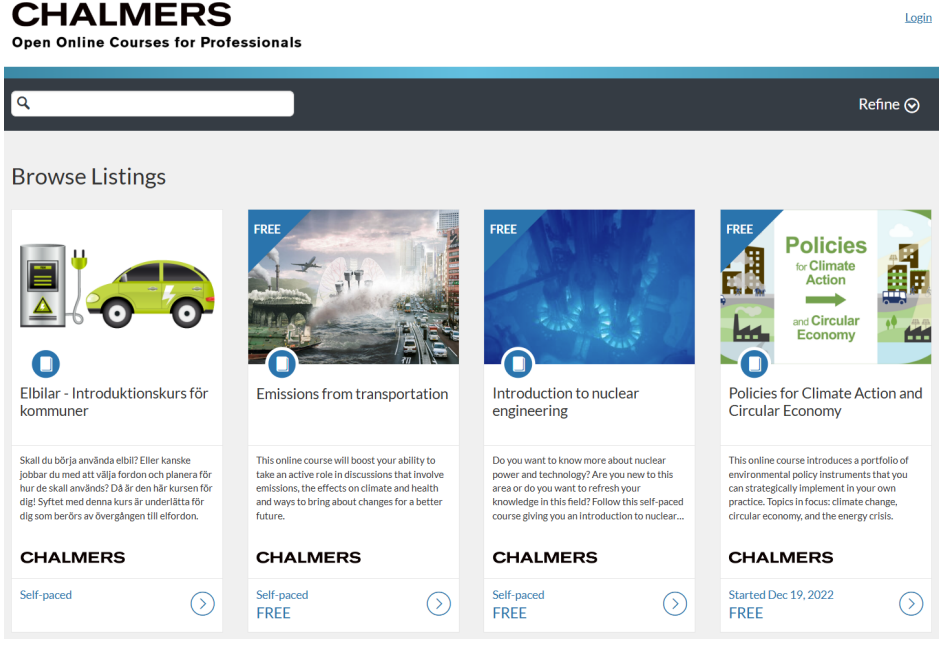




Education

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:
    - 411 persons registered
    - 67 persons obtained a certificate
    - Participants’ overall impression: 4.7 (1 = very bad – 5 = very good)



Cross-disciplinary education – TRACKS

- 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) – starting in the academic year 2024/2025
- Course delivered via the Learning Management System Canvas

Advanced education

- 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
  - Neutron transport at the fuel cell and assembly levels
  - Core modelling for core design
  - Core modelling for transients
  - Reactor transients, nuclear safety and uncertainty and sensitivity analysis
  - Radiation protection in nuclear environment
  - Hands-on exercises on the AKR-2/CROCUS/BME training reactor
- Course delivered via the Learning Management System SOUL from Westinghouse
- Since start in academic year 2022/2023: 438 certificates of successful completion issued

On-going discussions

- **Completely new offering of MSc programs at Chalmers being prepared**
- **Launch** of new MSc programs in the **fall of 2027**
- A ”**radiation science and nuclear technology**” track will be offered in the following master programs
  - **Physics**
  - **Materials chemistry and molecular engineering**
- Courses in **nuclear engineering** will be offered in the master program ”**energy systems**”

Education

- Despite no official Master program in nuclear engineering, **complete portfolio of courses** tackling all levels in Chalmers and outside of Chalmers
- **Increased visibility** with the new master programs at Chalmers to be launched in the fall of 2027
- **State-of-the-art pedagogical methods** combined with **innovative flexibility** in the **attendance** (self-paced studies combined with hybrid attendance)
- TRACKS courses, GRE@T-PIONEeR/A-CINCH courses and course on “Modelling of nuclear reactor multi-physics” can be attended by **external students** and **professionals**

➢What are you waiting for to register?

CHALMERS

UNIVERSITY OF TECHNOLOGY