

NOMATEN Hybrid Seminar

Location: NOMATEN seminar room

Time: 1 PM

gotomeeting room (for online): <https://meet.goto.com/NCBJmeetings/nomaten-seminar>

Seminar date: December 19th, 2023

Title: Atom Probe Tomography Studies of Nuclear Materials

Speaker name: Prof. Mattias Thuvander

Speaker affiliation: Chalmers University of Technology, Gothenburg, Sweden

Abstract: Atom probe tomography (APT) is a unique analysis technique providing chemical analysis with near atomic resolution in 3D. Here, recent APT research on nuclear materials performed at Chalmers University will be presented. Zirconium alloys are used as fuel claddings in nuclear reactors and undergo degradation due to corrosion, hydrogen pick-up and irradiation damage. Using APT, the understanding of the underlying mechanisms can be increased. In particular, segregation of alloying elements to irradiation induced dislocation loops has been identified. An important development regarding fuel claddings is the application of protective coatings, contributing to so called accident tolerant fuel (ATF). The reactor pressure vessel (RPV) steel weldments are affected by neutron irradiation, resulting in hardening and embrittlement by the formation of nanometer-sized clusters of Fe, Mn and Si. We have investigated RPV welds irradiated in a test reactor, surveillance samples and samples from a decommissioned boiling water reactor. Also, thermal aging is an issue for welds, and here we have analyzed weld metal from a pressurizer after long term operation. Finally, thermal aging and the effect of irradiation of stainless steels have been studied. In welds and castings the ferrite phase becomes hard and brittle by spinodal decomposition and the formation of G-phase precipitates. The examples presented hopefully convey the usefulness of APT for the studies of nuclear materials.

Bio: Associate professor Mattias Thuvander is currently head of the Division of Microstructure Physics at Chalmers University of Technology in Gothenburg, Sweden. He obtained his doctoral degree at Chalmers in 1998, with a thesis on atom probe studies of grain boundaries in nickel base alloys. After a post-doc at Oxford University, he spent about ten years in industry, mainly working on welding metallurgy at the company ESAB. In 2009, he returned to Chalmers, where a new atom probe tomography (APT) instrument (LEAP 3000) had been installed. Since 2017 he is responsible for the atom probe research and received a grant in 2021 to purchase a new instrument (LEAP 6000) which was installed in 2022. His recent research focuses mainly on APT of nuclear materials, zirconium alloys and steels.