



Thermal neutron flux density mapping

TU Wien, Exercise TUW-10



Main topic: Reactor Physics

Keywords: β -detector, activity, thermal neutron flux, neutron activation, neutron detector

Purpose: The measurement of the thermal neutron flux density distribution in the core is of significant importance. The measured flux density values are applied for calibration of nuclear channels, assessment of absolute power, power distribution in the core, identification of hot spots and calculation of fuel burn up. It is also important to know the thermal flux density at irradiation sites from the reactor user's points of view.

The purpose of this experiment is to provide all participants an overview of the neutron flux distribution in the reactor core. The students will become familiar with neutron activation and get experienced in handling irradiated samples and short-lived radioisotopes. They will also learn how to deal with an appropriate counter system to measure the produced activity of radioactive isotopes.

Level of exercise: Basic Advanced Complex

Level of education: BSc MSc PhD

What you will learn:

During this experiment the participants will gain the principal knowledge of reactor power calibration.

Important information:

- Minimal size of student group: 4
- Maximal size of student group: 8
- Overall duration of the experiment (in wall clock hours): 3





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Possibility to perform experiment on demand: Yes No

Frequency of occurrence: Once a year

Examination modalities: Participation in the experiment, protocol and final written test

Teaching languages: English/German

Pre-knowledge required: understanding in nuclear and reactor physics; radiation physics and protection.

Instruments required for exercise:

- Reactor I&C system.;
- A 2π counter to measure the foil activity;
- A contamination monitor.

Execution:

- For this experiment two identical Au foils are activated, one foil covered with the Cd and the other Au foil uncovered.
- The sample holders, which contain two samples each, are inserted into the reactor core.
- The foil activation is carried out at low reactor power of 10 W and the sample holders are lowered by string into the irradiation tubes at different radial positions. The resultant flux profile could then be determined from the results and plotted at the different radial positions.
- After an irradiation and proper cooling down time, the sample holders are removed from the reactor core and taken to the laboratory, where the samples are placed, in turn, into the 2π β -detector. The activity of Au is measured.

Limitations:

This experiment will be conducted in a controlled radiation area. Hence, controlled radiation area limitations apply.

