Measurement of the diffusion length and the Fermi age of neutrons

Slovak University of Technology in Bratislava, Exercise STU-02

Main topic: Neutron-physical parameters of moderators

Keywords: Diffusion length, Fermi age, moderator, activation analyses, gamma and neutron measurement, neutron detectors, neutron radionuclide source

Purpose: The experiment demonstrates the fundamentals of neutron moderation and parasitic absorption in one of the most frequently used moderators. Diffusion length and Fermi age are parameters, which are used to categorize moderator materials in terms of their application. Within the measurement of neutron flux distribution in water or graphite the students apply fundamentals of the neutron slowing down and diffusion theory. At the end, students will be able to quantitatively characterize the main parameter of neutron moderators.

Level of exercise:	☐Basic	☒Advanced	☒Complex
Level of education:	☒BSc	☒MSc	☒PhD

What you will learn:
The students will learn how to measure neutron flux and, based on theoretical knowledge, and to determine the basic parameters of neutron moderators.

Important information:
- Minimal size of student group: 2
- Maximal size of student group: 4
- Overall duration of the experiment (in wall clock hours): 6

Measurement of the diffusion length and the Fermi age of neutrons

Slovak University of Technology in Bratislava, Exercise STU-02

Possibility to perform experiment on demand: ☒ Yes ☐ No
Frequency of occurrence: 2-3 times per year
Examination modalities: report
Teaching languages: English, Slovak

Pre-knowledge required: Basic in neutron diffusion and slowing down theory, radioactive decay, types, sources and interaction of radiation with matter, detection principles and data processing

Instruments required for exercise:

- AmBe/PuBe neutron source
- Graphic prism or water tank
- Activation and neutron detectors

Execution:

- The neutron radionuclide source is placed in a specific position of a water tank or graphite prism
- The neutron flux is measured via boron, helium detector or activation detector in different distance from the neutron source
- To determine thermal, fast and resonance neutron flux, cadmium and indium filters are used
- Based on the linear regression method and on the ratio of integrals, the diffusion length and the Fermi age are processed from the prepared functions

Limitations:

Pregnant and breastfeeding women are not allowed to enter the controlled radiation area. Legal age (18) is required. Fore more information please visit http://www.ujfi.fei.stuba.sk/kontakt.php