

Neutron activation analysis in practice

Czech Technical University in Prague, Experiment CTU13

Main topic: Neutron applications, neutron physics

Keywords: VR-1 reactor, neutron applications, neutron activation analysis

Purpose: Neutron activation analysis (NAA) is an analytical technique based on the measurement of characteristic radiation from radionuclides formed directly or indirectly by neutron irradiation of a material. This qualitative and quantitative technique is widely used for determination of the composition of materials, determination of impurities or trace elements in various samples. NAA is widely used in archaeology, geology, biomedicine, earth sciences, industry, nutrition projects, health projects, forensic science, etc.

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

What you will learn:

Learning objective of the experiment is to understand the NAA and its use in different fields of human activities. NAA experiments are also suitable for students studying various fields of human activities such as archaeology, geology, biomedicine, earth sciences or forensic science as their major curriculum where the use of nuclear analytical techniques in master and doctoral study programmes is foreseen.

Important information:

- Minimal size of student group: 3
- Maximal size of student group: 6
- Overall duration of the experiment (in wall clock hours): 4



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Possibility to perform experiment on demand: Yes No
 Frequency of occurrence: On demand, ca 30 times/year
 Examination modalities: Protocol, evaluation, discussion
 Teaching languages: English, Czech

Pre-knowledge required: The student should have basic ideas about the structure of atoms, nucleus and atomic/nuclear interactions.

Instruments required for exercise:

- The VR-1 reactor
- Apparatus for gamma ray spectrometry

Execution:

When a sample of the studied material is loaded into a research reactor, stable nuclides in the sample interact with the neutrons in the core and unstable radionuclides can be produced. After removing the irradiated sample from the core, it is measured in a gamma ray spectrometry system. By determination of the energy and area of the gamma lines, qualitative and quantitative analysis, respectively, of the irradiated unstable isotopes present in the sample can be performed. Knowing them, the occurrence of the original stable isotopes in the sample can be consequently determined.

Limitations:

No particular limitation for this experiment, only general requirements for entry to research nuclear installation according to the Czech nuclear legislation should be fulfilled.

