

ADONIS – ADvanced ON-site Investigation using alpha Spectrometry

ADONIS is a novel approach intended to measure alpha spectra of good energy resolution from smooth surfaces at ambient air pressure. The source can be a radiochemically processed sample, an air filter, a swipe, a thick object or any flat and smooth surface. Feasibility studies have been performed, and the concept is shown to be promising. Portable equipment could be used in a laboratory or in the field – with no vacuum pump. Full reachback capability is envisaged to ensure that the results will be readily available for the specialists analyzing the spectra as well as the measurement teams operating in the field.

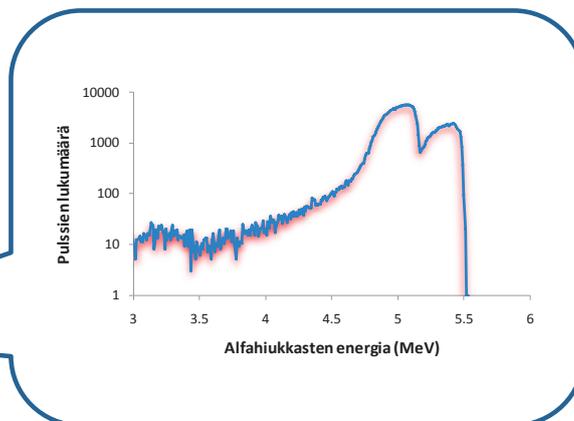


Fig. 1. Measuring alpha-particle energy spectrum using a prototype equipment of ADONIS.

Features

- Equipped with a semiconductor alpha/beta detector (1200 mm²)
- No need to a vacuum pump
- Good energy resolution
- Data acquisition with α -Vasikka software (compatibility with Linssi database)
- Spectrum unfolding using ADAM or AASIFIT software
- Calibration for activity per unit area (thin sources)

Applications

Measurement of thin sources at ambient air

ADONIS can be used for radiochemically processed sources or other thin source at ambient air pressure, i.e. no vacuum pump is needed. The energy resolution is superior compared to any other commercial equipment operating at ambient air pressure (Fig. 2).

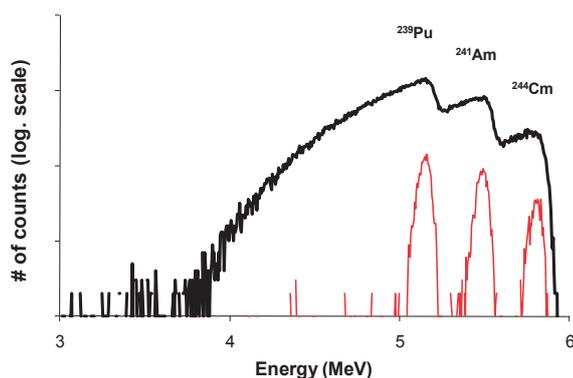


Fig. 2. Alpha particle energy spectra measured from a radiochemically processed source in air pressure. The source contained ^{239}Pu , ^{241}Am , and ^{244}Cm . Red spectrum is from ADONIS whereas black spectrum was measured using standard equipment.

Monitoring radioactive particles from surfaces

Reference particles with diameter of approximately $1\ \mu\text{m}$ and composed of Pu have been measured using ADONIS. The particles were on a flat surface. The peaks of Pu isotopes can be easily identified (Fig. 3).

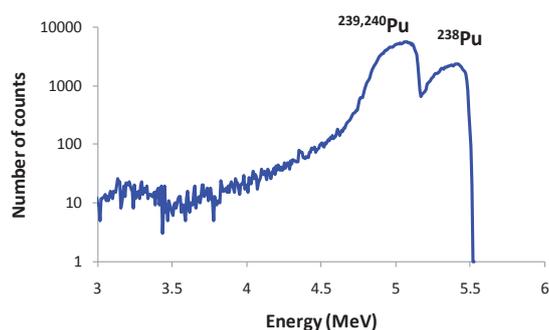


Fig. 3. Alpha spectrum from a sample containing artificially produced Pu-particles (^{238}Pu , $^{239,240}\text{Pu}$).

Technology readiness

Prototype equipment of ADONIS has been constructed. The present version uses NIM electronics for data acquisition. Plans for fully portable in-field device have been made, including remote expert support (reachback) with SNITCH software.

Nuclide identification from thick objects

Measurement of an alpha spectrum using ADONIS from a thick object with smooth surfaces gives a possibility to identify radionuclides (Fig. 4). Activity ratios can also be estimated which is important for example in safeguards.

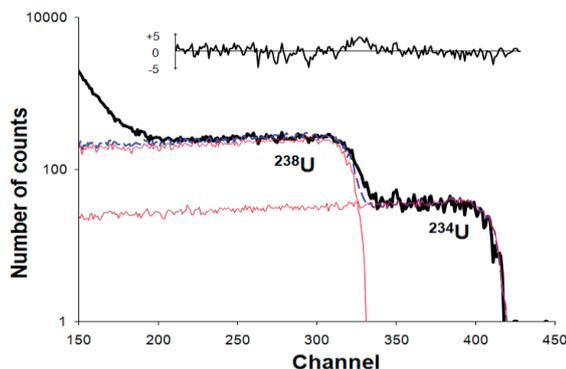


Fig. 4. Unfolding an alpha spectrum (AASIFIT program) from a DU penetrator.

Radionuclide identification from goods

ADONIS can be applied for radiation measurements from goods (Fig. 5).

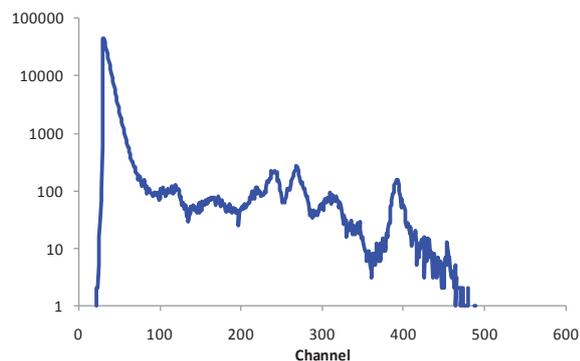


Fig. 5. Alpha spectrum from a polished table top (granite) containing U- and Th-series radionuclides.

Technology Readiness Level 4

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