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Determination of uranium content in samples coming from the nuclear fuel cycle by L-absorption edge spectrometry

Détermination de l'uranium dans les solutions du cycle du combustible nucléaire par absorption de rayons X à la discontinuité L

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Foreword

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radio protection*, Subcommittee SC 5, *Analytical methodology in the nuclear fuel cycle*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Determination of uranium content in samples coming from the nuclear fuel cycle by L-absorption edge spectrometry

1 Scope

This document specifies a method for the determination of uranium concentrations in nitric acid or TBP-DILUANT (for example TBP-kerosene) solutions coming from the nuclear fuel cycle.

The method is applicable

— for process control of solutions, free of suspension, which contain between 10 g/l to 300 g/l uranium, and

— for high accuracy purposes (Safeguards) to nitric acid solutions, free of suspension, which contain between 100 g/l and 220 g/l uranium.

Having

— the content of neptunium and plutonium impurities in the solution less than 1 % of the uranium content.

— the content of neutron poisons (gadolinium, erbium) less than 1 % of the uranium content to ensure the absence of significant interferences at the level of required precision, for high accuracy purposes.

The method is applicable to solid samples as well, provided that they can be fully dissolved in nitric acid.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

A highly collimated X-ray beam passes through a uranium solution with well-defined path length. The transmission spectrum is recorded with a solid-state detector. A sharp jump of the photon transmission, which is related to the concentration of uranium, occurs at the L-edge energy of uranium (E_{LIII} = 17,17 keV). Uranium concentration is determined from the size of the jump using calibration and spectrum processing algorithms.

The proposed spectrum processing algorithms require the acquisition of reference spectrum to cancel out the influence of the matrix.

For high accuracy measurement, the isotopic composition of uranium and the temperature shall be known and corrections may apply.