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Characterization of uranium bearing material using HPGe gamma detector for nuclear forensics purposes

Nuclear forensics is a method that uses nuclear material to uncover information. The nature of the method of manufacturing is expressed in the material's elemental and isotopic structure as well as its microscopic and macroscopic appearance. Notwithstanding the presence of national nuclear security frameworks, there keeps on being instances of material out of regulatory control, regardless of whether accidentally, for example, through misfortune, or purposefully because of a criminal intension, for example, robbery and theft. Every nation which is a Member State of the IAEA must build up the capacity to forestall, distinguish, and react to any event that includes trafficking of radioactive material that has nuclear security concerns. Thus, nuclear forensics, as a Tool for Nuclear Security has proven relevant in the identification of the products, how, when, and where the materials were produced and how they were designed to be used legally. Non-destructive analytical techniques are used to characterize and identify specimens as part of the verification of nuclear materials and the detection of undeclared nuclear materials in national and international safeguards. At the first two stages, gamma spectrometry serves a dual purpose: quick in-field categorization of radiological or nuclear material to identify the safety risk to first responders and the general public, and more thorough characterization of the material in the laboratory to accurately determine the isotopic composition. One of the challenges in this field is to clarify distinctions between origins, detect clusters and patterns, and eventually attribute samples to or differentiate from known sources using isotope ratios in uranium-bearing material samples with appropriate accuracy and measurement errors. The objective of this study was to investigate the use of the radiometric spectrometry technique to accurately characterize the uranium-bearing materials, using direct detection of high purity gamma spectrometry (HPGe) for gamma-rays from 235U and 238U. . Isotopic composition and total U-content of UOC and uranium ore were determined. The results show that U & UOC isotopic ratios and activity of these nuclear materials from two uranium mines differed significantly with no correlation at all.

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